The University of Nottingham
School of Mechanical, Materials, Manufacturing Engineering
and Management

A Networking Model Supporting Small and Medium Enterprises to Develop New Processes and Products

by

Stephen John Harding, MSc

April 2002

Thesis submitted to The University of Nottingham
for the degree of Doctor of Philosophy.

ABSTRACT

Small and Medium Enterprises (SMEs) are a key part of manufacturing economies. However, the move towards globalisation of supply can potentially be harmful to SMEs, which, because of their size and lack of internal resources, often lack the capability to add value to their products and differentiate themselves in the marketplace. Networks are seen as a key method by which SMEs can acquire "know how" on the external environment as well as in collaborating to supply customers to overcome these constraints.

However, there is a lack of clarity in the literature on the appropriate type of network to support specific outcomes in SMEs. Nor is there an understanding of the specific characteristics, which define a network's internal dynamic. Without an understanding of network typologies and characteristics it is difficult to effectively support existing networks or seek to develop new ones. This research therefore, focuses on providing an understanding of network typologies and network processes to inform SME network policy and to provide practical help to facilitators of networks in forming and then supporting SMEs in meeting their network objectives.

The research takes a longitudinal approach, examining two SME manufacturing networks in the West Midlands region of the UK over a two-year period as well as a Control Group of non-networking firms for comparison. The networks are from the Vertical Supply Chain and Industrial District traditions. The emphasis is on seeking to establish the impact of networking on new processes and new products in the SMEs as well as the external facilitation process.

A Case Study approach was undertaken tracking SME activity and obtaining rich insights into the way SMEs behave in networks. A Questionnaire was administered at three stages (start, middle and end) to establish Performance Indicators and to then register changes in performance in the SMEs to reflect on network activity.
A version of the Questionnaire was then utilised within a regional sample of SMEs for comparison.

The results show that networks support SMEs in learning from others, in sharing ideas, in gaining information on trends, in benchmarking and in assisting in process improvements. The research describes a typology for assessing networks and describes two new distinct network types, a Closed Strategic Network of SMEs from the Supply Chain tradition and an Open Social Network from the Industrial District tradition. A series of "Characteristics" including, Purpose, Trust, Compatibility, Equity and Entrepreneurial and Collaborative Behaviour have been identified. The Typologies, Characteristics and Performance Indicators can be used to *systematically* help in support of existing networks and in developing new ones. These Typologies, Characteristics and Performance Indicators, have been incorporated into a Three-Stage Networking Model. The research defines the types of facilitation needed at distinct stages of development in the Model and also identifies how SMEs then make partnership arrangements (in dyadic relationships) to transfer to a business relationship external to the network.

CONTENTS

TABLE OF FIGURES

LIST OF TABLES

GLOSSARY

Abbreviation	Description
ACCELERATE	Regional automotive support programme funded through the EU and Central Government
ADAPT	An EU programme to support the adoption of new technology for SME employees and managers
AWM	Advantage West Midlands, the Development Agency for the region
BCC	Birmingham City Council
BCM	Birmingham Centre for Manufacturing
CG	The Control Group of 4 SMEs
CSN	Closed Strategic Network
DTI	Department for Trade and Industry (UK)
EU	European Union
ICPG	Inter Company Productivity Group
ICT	Information and Computer Technology
NPD	New Product Development
OSN	Open Social Network
PI	Performance Indicator
QCD	Quality, Cost and Delivery
RDA	Regional Development Agency (UK)
SME	Small and Medium Enterprise
TOR	Terms of Reference for the Networks
UCE	University of Central England (UK)
WCM	World Class Manufacturing
WM	The West Midlands

PAPERS AND ARTICLES

Conference Papers

Harding, S.J., and Hogan. J., (1997) Manufacturing SMEs as Learning Organisations: Insights for practitioners on effective intervention strategies, 4th International Conference, European Consortium for the learning Organisation, Sophia Antipolis, France (Unpublished Proceedings).

Harding, S.J., (1998) The development of a model to describe how small firms innovate within supply chains. "MIM 98" Managing Innovative Manufacturing, University of Nottingham. Pp103 – 108. ISBN 09533 - 720 –0-6.

Broadley, S.A., Hardcastle, M., Harding, S.J., and Taylor, B., (1999) Learning and competitiveness in Small and Medium Enterprises –A response within two ADAPT Programmes in the West Midlands. SMESME, Stimulating Manufacturing Excellence in SMEs, University of Plymouth. Pp. 355 – 361.
ISBN 1- 8- 72677 - 29 – 0.

Harding, S.J. and Hogan, J., (1999) A study of providing innovation services to SMEs in the automotive supply chain in the West Midlands: 4th International Symposium on Logistics, Florence, pp 227 – 234. ISBN 88-86281-37-4.

Harding, S.J., (1999) Innovative SMEs in the automotive supply chain: Issues for concurrent engineering: 5th International Conference on Concurrent Enterprising "ICE 99": The Concurrent Enterprise in Operation, The Hague, The Netherlands, 15th-17th March 1999, pp 243 – 250. ISBN 0 – 951 975 - 9 8 6.

Harding, S.J. and Hogan, J., (2000) Networks and networking for small manufacturing firms: Proceedings of the 5th International Symposium on Logistics, Iwate, Japan. Pp 175 – 182. ISBN 4 – 901 195 – 03 – 4.

Harding, S.J., (2000) The development of a model to describe the influence of networking on an SMEs' ability to implement new processes: Proceedings of The Logistics Research Network, 5th Annual Conference, Cardiff University, September 7-8th 2000. Pp. 247 – 254. ISBN 0 9537982 1 6.

Harding, S.J., (2001) Knowledge transfer in small firm networks: Small Business and Enterprise Development Conference, University of Leicester, 29th-30th March. Conference Proceedings, European Research Press Ltd., Shipley. Pp. 150 – 157. ISBN 1 – 872677 – 34 -7

Harding, S.J. and Broadley, S.A., (2001) Learning Support for Small Businesses. 8th International Conference, European Consortium for the Learning Organisation, May15- 18th 2001, Lisbon (Unpublished Proceedings).

Harding, S.J. and Broadley, S.A, (2001) The development of the 4Sight Network. Conference proceedings, What Really Matters in Operations Management, EUROMA, 8th Annual Conference, Bath, June 3-5th 2001 Volume 1. ISBN 1- 85790-088 – x.

Harding, S.J. and Pawar, K.S., (2001) Know how share and transfer in SME Networks, a contingent approach: ICE 2001, Proceedings of the 7th International Conference on Concurrent Enterprising, Engineering the knowledge economy through co-operation, Bremen, 27-29th June 2001 pp 261 – 271. ISBN 0 85358 098 7

Harding, S.J. and Broadley, S.A., (2001) The development of models for e-Business in manufacturing networks: Proceedings of the 6th International Symposium on Logistics, Salzburg, pp 101 – 109. ISBN 0 85358 099 5.

Journal Articles

Harding, S.J. and Pawar, K.S., (2002) Know how share and transfer in SME networks, a contingent approach, submitted to International Journal of Production and Operations Management, January 2002.

ACKNOWLEDGEMENTS

I would like to thank the following people who have helped and supported me throughout the duration of this PhD.

Firstly the Managing Directors and Employees in the Small and Medium Enterprises who have worked with me over the two years of the research.

I would like to thank my Supervisor, Professor Kulwant Pawar who inspired me at the start and has supported me throughout. Special thanks to Alison Parrett for her support in pulling the thesis together and Kul's Research Team for help and guidance when needed.

I need to also thank the Dean of UCE Business School, Professor Upkar Pardesi for the time and space to think and carry out the research. Birmingham City Council supported the circulation of the questionnaire to SME's which, was an essential part of my research.

A special thanks to Ajit Nair for his assistance in supporting me in data collection.

Sadly two great supporters, Professor Joe Hogan and Tony Thomas, who inspired me during the research have now passed away before they could see the fruits of this analysis.

Especial thanks to Mum, Betty (1928 – 1996) and Dad, Brian.

Finally, a very special thanks to my family, Anita, Alex and Sebastian without whose support this would not have been possible.

1.0 RESEARCH OBJECTIVES, QUESTIONS AND HYPOTHESES

1.1 INTRODUCTION

The need to understand the impact of networking on Small Firm competitiveness in traditional sectors is of considerable importance as a research topic and as a policy issue within regional economies. Networking models for high technology firms, for companies in a locality and for those linked to a World-Class customer are all well documented. However, in the West Midlands region there is little evidence in the literature of networks in support of Small and Medium Enterprises (SMEs) in *manufacturing* to develop in terms of both existing and new supply chains.

The Vertical Supply Chain tradition has seen some successful local partnerships, but for many small firms access to a World Class customer able to support the SME within a partnership perspective is difficult to record. There is also very little to no evidence of SME to SME groups working together in supply chains to supply customer needs.

Many SMEs are having to consider their role in the manufacturing process itself. The sustainability of many "commodity" based firms is questionable in the medium term given the range of economic factors against them (changes in technology, the global nature of supply chains and competing with low cost based competitors). Increasingly, small firms need to either compete directly in global markets or to find strategies to maintain market share locally to sustain their business from new entrants from overseas.

The need to collaborate to be able to compete seems imperative, but there are few examples of this particularly for manufacturing firms, which come from an automotive tradition. The networks that do exist have a "horizontal" focus, that is, they support information, social interaction and benchmarking within groups of local SMEs. How these firms can then develop beyond the network is unclear. In terms of the agenda for creating jobs in the European Union, the need for supporting clusters of SMEs in distinct geographical areas remains a key policy objective. How this aspiration then meets the needs of "traditional" sectors needs to be understood.

What, then, are the processes which can lead to successful networking and how can firms move from informal "horizontal" and social contexts towards a model where business is supported through networking?

The West Midlands region has had a long history of support for process development improvements and this would seem to be an appropriate place to begin to look for the impact of networking. The need for diversification into new sectors is also apparent, many firms have poorly differentiated products and services, how can networking support New Product Development? Significantly, there is the aspect of facilitation in support of networking – how can small firms best be supported as they move from sub-contract, perhaps adversarial relationships, into collaborative working?

The thesis therefore, will focus on the West Midlands Region as the key automotive and manufacturing region in the UK (DTI, 1998, AWM, 1999 and 2001). This thesis, therefore, sets out to describe hypotheses, methodology, research activity and analysis, which seeks to understand the impact of networking on the competitiveness of small firms in manufacturing by developing a model for SME Networking.

1.2 BACKGROUND AND CONTEXT

1.2.1 Introduction

This Chapter details the importance of the small manufacturing firm in the context of the West Midlands economy. It notes the potential threat of globalisation and questions how small firms with little history of working together can collaborate to compete. It introduces the notion of networking and the two traditions of the Vertical Supply Chain approach and that of the Industrial District approach. It notes the lack of practical examples on the ground of either of these network forms and suggests that research is needed to examine the reasons for this and to determine a framework for network development within small firms engaged in manufacturing.

A number of research questions are then detailed which contribute to three hypotheses on networks and new processes, networks and facilitation and networks and a propensity for New Product Development. The research field is next described and the initial contacts and rationale for engaging with groups of local small firms engaged in networking to test out the hypotheses and develop a research methodology.

1.2.2 The role of small firms in the West Midlands manufacturing economy

The role of the small manufacturing firm in the context of local economies is critical (Burns,1996, Curran and Blackburn, 1996). In Europe, the small firm sector has been growing significantly compared with the large company sector in terms of both jobs and share of GDP. In the UK they provide 46% of non-government jobs and provide almost 40% of the UK turnover. In the West Midlands region, manufacturing firms account for 27% of all employees mostly in small firms (compared with 18%

nationally), despite a decline since the 1970's (Birmingham Economic Information Service, 2001). The region also accounts for over a third of the UK's total automotive employment (WM Learning and Skills, 2000). In terms of over all employment, jobs in manufacturing are forecast to decline by some 16,000 by 2011. However, opportunities also exist for the small firm to respond to the needs of an increasingly global market. Often these small firms can be seen in the context of clusters (Porter, 1985) of specific industries based in geographical areas. These small firms are increasingly challenged to compete in terms of Quality Cost and Delivery "QCD" (Schonberger, 1991, Andrieux and Kay, 1997) and to meet the demands of a global marketplace. This means that for firms manufacturing commodity products they are increasingly facing competition from non EU countries and for design orientated firms they need to find ways of innovating to maintain their niche within value chains, often operating "virtually" across national borders (Fan, 1997).

These factors have led to an increasing fluidity in supply chains in manufacturing (Hines et al, 2000). This, for example, has meant a reduction in EU automotive production in 2000 from 1,972,000 to 1,816,000, the first drop since 1995 (DTI, Automotive Directorate, 2001). Small firms faced with these changes, therefore, need to adopt strategies, which enable them to compete effectively. Networking has been seen as a key element in how these small firms can acquire tools, techniques and develop methods to be successful in the value chains of the future (Lamming, 1993, Era, 1998, MacNeill et al 2001).

The implicit threat in this is if small firms are unable to change, or ignore these factors, they will find manufacturing very difficult to sustain. Doing nothing, even changing incrementally, does not seem to be an option in the business environment

of the start of the 21st Century in which the context of the research is set. Within the West Midlands region these global issues are particularly pressing with the regional economy still dependent on manufacturing industries, which, furthermore although significant, have been in decline for some years. The need to re-vitalise the local economy has been recognised by successive Governments with White Papers on Competitiveness and Supporting the Knowledge Economy (DTI, 1998). More recently, Government has established new regional bodies (The Regional Development Agencies, RDA's) and local support agencies to support SME competitiveness. (The Small Business Service and the Learning and Skills Councils).

The West Midlands, in the context of this research, can be represented as a key region within the UK economy with a long established manufacturing base with a high proportion of small firms now seeking to support strategies for manufacturing renewal. It can also provide more general insights into small firm networking within established manufacturing economies.

1.2.3 Setting the scene – from process improvements to cluster strategy

In the context of the business environment of 1998 when the research was in its formative stages, the key theme in terms of supporting manufacturing was predicated around the notion of World Class Manufacturing. This meant a desire to significantly upgrade the supply base of the region's small firms to meet existing customer requirements. This was often done in the context of QCD and benchmarking against industry standards. Also, the need to improve the Information and Computer Technology (ICT) base of the region was seen as important, both for design orientated small firms and for those seeking to utilise ICT for improvements in processes. In summary, improving productivity in the UK and the West Midlands

region is seen to be critical, continuous improvement and asset utilisation are key issues.

However, the full consequences of globalisation and the need to differentiate the manufacturing offering to customers was not to the forefront of the policy agenda regionally at the start of the research. Neither was the need for the support agencies to actively support product diversification strategies in order to widen the customer base of these small firms. Contracting was based on a fairly long cycle of business, implying stability if the SME could meet the required Quality Cost and Delivery (QCD) standards set by the customer. The espoused view from both the Original Equipment Manufacturers (OEM's) and the First Tier firms was for partnerships for mutual benefit (Lamming, 1994, Deloitte and Touche, 2001).

At the end of the 1990's, the newly formed Regional Development Agency, Advantage West Midlands (AWM), was seeking to clarify what the new growth sectors would be. These included Automotive, Engineering Design, Craft Based Industries, Medical Technologies, Ceramics, The Creative Industries and ICT related firms, building on the work of the Regional Innovation Survey (RIS) from the mid 1990's. This context was similar for other sub-regions in the EU, faced with similar pressures as highlighted in a Green Paper on Innovation (European Commission, 1997) and in specific policy initiatives (CORDIS, 2002).

The importance of the Italian District Model (Oughton and De Poris, 1997) whereby SMEs organise themselves through trading networks is a key methodology underpinning the Regional Economic Strategy (AWM, 1999). In the context of the research, the importance of small firms was clear for the sub-regional economy, the

threats and opportunities around globalisation were also clear. What was of particular interest to the researcher was how small firms could organise themselves in networks to then effectively compete in this environment.

The predominant culture in the region, however, was still based on a notion of the supply chain and this was led by a customer with a given group of small firms co-ordinated by the customer on a sub-contract basis. The notion of collaboration between and within these small firms was not evident, yet the literature and the thrust of regional policy was towards the promotion of "networks" and networking as a possible solution to the problem. Although networking is seen as important for small firms to adopt, what actually the exact concept of networking would be to support competitiveness was unclear at the start of the research process. The implicit theory was the need to support collaboration within supply chains to improve the whole chain and therefore competitiveness both regionally and nationally. The approach needed to support regional competitiveness can be illustrated below in a representation of the strategy in the region towards new markets and diversification for manufacturing industries:

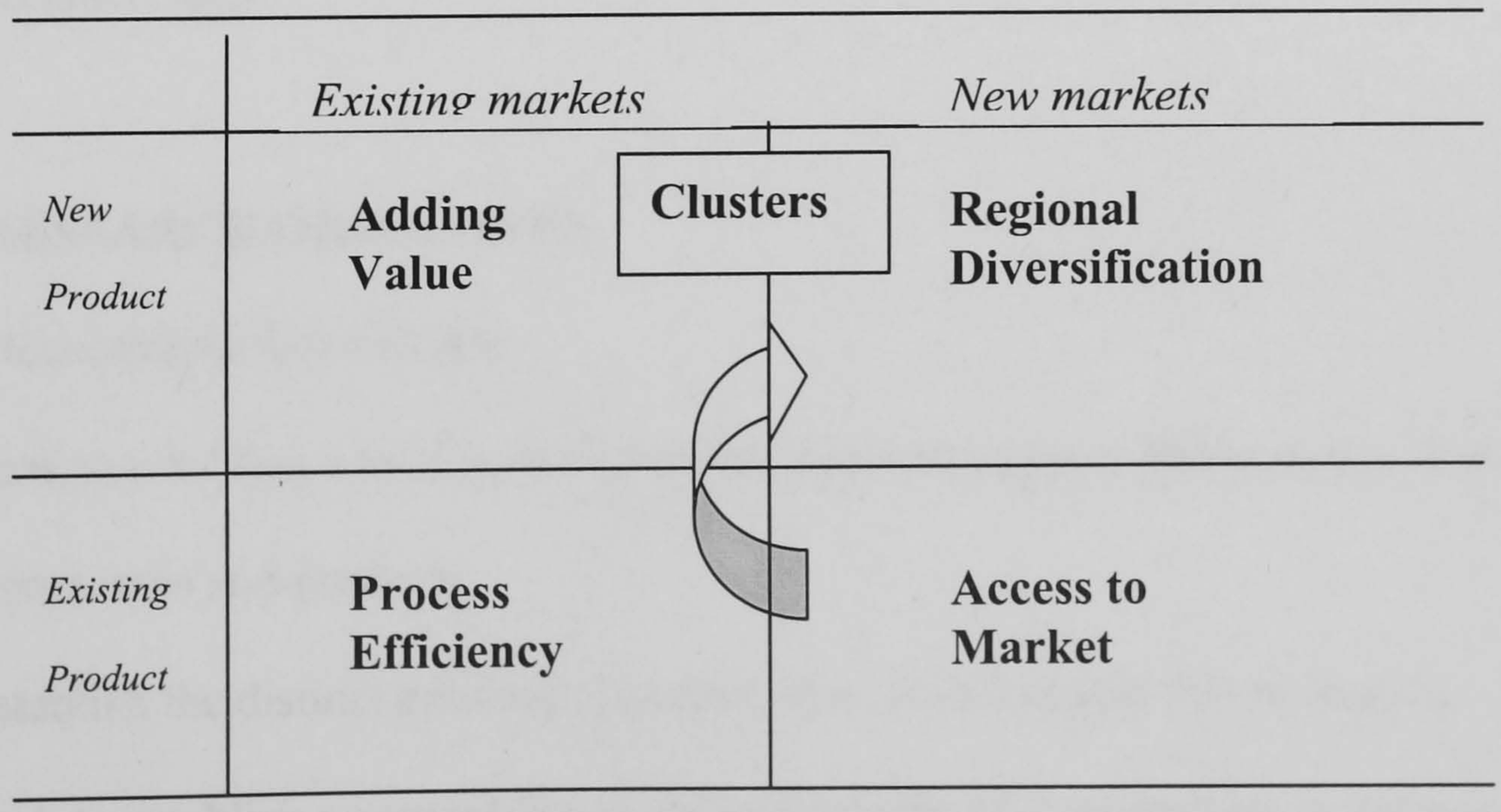


Figure 1: Clustering Policy in the West Midlands Region

However, the evidence of successful small firm networks was hard to find both in the literature and on the ground in the region in the late 1990's.

1.3 RESEARCH QUESTIONS

There are a number of key questions arising from this Research Objective. These are:

- Which type of network can best support manufacturing processes and then lead to more developmental activity in terms of NPD?
- Are there stages in networking and distinct characteristics, which if taken sequentially, will lead to enhanced collaboration in terms of support for New Product Development?
- What are the needs for facilitation from external agencies/individuals and how best can small firm networks be facilitated to support specific policy outcomes – are there different network approaches for different SME strategies?
- Will networks have a specific brokerage function to act as a new type of organisation or will they operate within existing supply chains on a sub-contract basis?

1.4 RESEARCH OBJECTIVES

The key Research Objectives are:

- To seek to establish which type of network can best support SMEs in developing new processes and products.
- To establish the distinct network characteristics, which enable this to happen.
- To seek to establish a networking model with stages of development in support of new processes and NPD.

- To develop the types and levels of facilitation, which will support effective networking.

1.5 HYPOTHESES FORMULATION

From these questions the research hypotheses were configured in three main strands. Firstly "That process improvement in manufacturing SMEs can be fostered by participation in network groups". This hypothesis can be tested through measurement of the ***manufacturing processes*** within each SME at different stages of network development and from direct observation of the networking firms.

Secondly "that levels of ***facilitation*** within the network process affect the ability of the SME to implement improvements". This hypothesis sets out to test the level and degree of facilitation *external* to the SME needed for successful SME networking, a key outcome for the further development of the research ideas. Additionally, there is a need to consider the internal facilitation within individual companies, but this was not seen as the key focus of the research.

Hypothesis Three tests the idea that "participation in networks to foster process development leads to a propensity in SMEs to ***New Product Development***". This suggests a developmental role in the network process from sharing information on manufacturing techniques towards new products, customer relationships and design-orientated activities. It also suggests that process improvements alone will not be sufficient to sustain competitive advantage for the firms within fast changing supply chain relationships. However, it suggests a common baseline of performance within the firms in a network, which can be built upon to then engage in product related activity. It encompasses a wide definition of "NPD" including developing product strategies with new and existing customers (Ragatz et al, 1997, Sharp et al 1997).

The early approach to the development of the research methodology is now described. This gives an indication of the anticipated areas of measurement prior to engagement in the firms.

1.6 HYPOTHESIS ONE

"That process improvement in manufacturing SMEs can be fostered by participation in network groups."[1]

- Quality Assurance

  The focus will be on the ability of the SME through networking to adopt/improve upon systems for managing the QA process. Given the size of the firms, this approach will necessarily focus on "formal" systems and "informal" systems. Measurements will be in the field of scrap, re-work costs, customer returns and warranties. Quality assurance will be measured by determining the views of the SME customer.

- Manufacturing Systems

  The research will consider the implementation of new management information systems to support the manufacturing process and the introduction of new technology onto the shop floor. The implementation of Information and Computer `Technology will be a factor in this approach.

- Customer Responsiveness and the Production Process

  The measurement of other aspects of this relationship manifested in the production process will also be examined. The importance of the implementation of the small

---

[1] Process Improvement is defined as the Quality Assurance, Customer Systems and Manufacturing Systems. Specifically, the ability of the SME to become "customer responsive".

firm's business plan will be examined in this respect- i.e. are the process improvements *consistent* with the stated aims of the plan?

These measures have been taken from a combination of the requirements of QS 9000 (ISO, 2002) and the "Midlands Excellence Awards" (Midlands Excellence, 2001). In all three categories the importance of supporting these issues within the companies will be examined as a key factor and observations upon the SMEs ability to sustain improvements will be made during 1:1 meetings with the researcher.

1.6.1 Summary Hypothesis One

The assumption is that networking firms will have a baseline of current manufacturing standards from which to then progress to developmental issues around NPD. This means that it is unlikely, according to the hypothesis, that firms can quickly move to addressing NPD in networks until they have established common ground in terms of manufacturing processes. Could a group of aspirant World-Class firms also work in partnership with a firm or firms that did not meet, or did not intend to meet, these standards?

1.7 HYPOTHESIS TWO

"That levels of facilitation within the network process affect the ability of the SME to implement process improvements and support New Product Development." The research will develop methods to focus on the different levels of facilitation from "Low" to "Medium" to "High". The "intensity" of the level of facilitation is also an important element underpinning the discussion on Networks. The rationale for the importance of facilitation has been developed through the literature search and in the author's previous MSc work on the topic of "process consultation". This suggested a range of facilitation styles but that a longitudinal relationship with the client makes

for effective change in the context of owner managers in small firms (Schein, 1988, Argyris and Schon, 1996, Harding, 1996).

1.7.1 The Control Group

The need for a "control" group of non-networked SMEs, which are self-sustaining and do not encourage external interventions in pursuit of their process improvements and new Product Development, was also seen as key to the research. These SMEs will be participants in support programmes (i.e. they are seeking to make process improvements in the same categories chosen for the network research group), but they will be undertaking these changes on a "stand alone" basis. The firms will be undertaking consultancy/training support from the support agencies on process improvements. The issue of also including non- - participative SMEs in any form of externally supported process improvement is problematic. Measurement may be possible through the Questionnaire, but non-joiners were considered much less likely to return a Questionnaire or to agree to be interviewed throughout the research process. The closer definition of the Control Group will become clearer once the Networked SMEs had been chosen and interviewed.

1.7.2 Summary Hypothesis Two

The research by seeking to develop a deeper understanding of SME networks, will add to this understanding by addressing the impact of different levels of external support within the network process. This was felt to be important for the further insights it will give to policy makers in the field of SME support. Figure 2 illustrates the progression from a low level of process improvement, through to the top quartile

for a small firm which is NPD orientated. It illustrates stages of network development within Hypothesis Two and which small firms may need to address when moving into NPD. It notes that facilitation will become more intense as the firms seek to utilise networking as a methodology.[2]

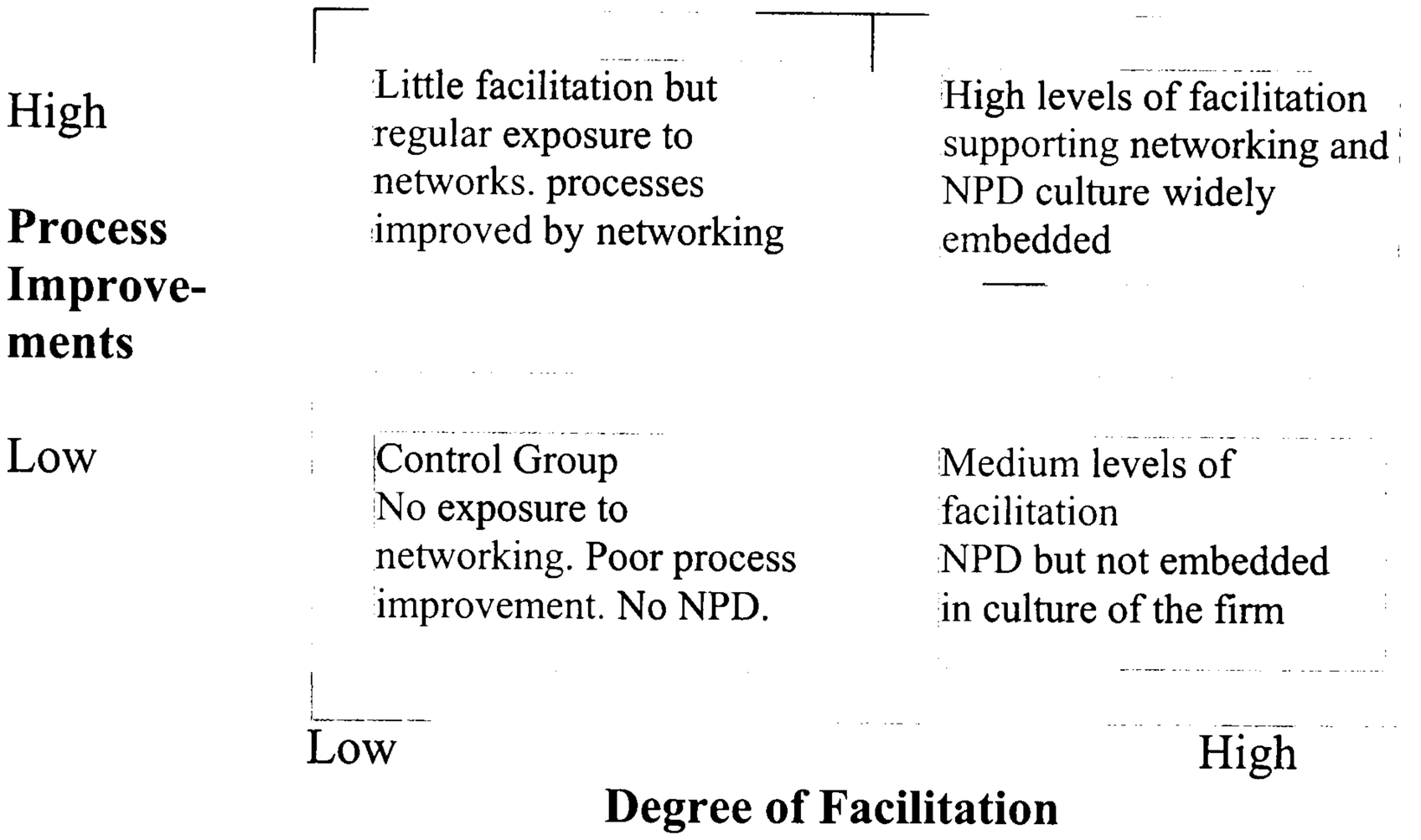


Figure 2: Contextualisation of Hypothesis Two

1.8 HYPOTHESIS THREE

"That participation in networks to foster process development capabilities leads to a propensity in SMEs to New Product Development." This hypothesis will test out whether SMEs engaged in networking to support process improvement demonstrate a willingness and/or ability to begin to become engaged in developmental issues. This is important, as much of the support for networking is predicted upon this hypothesis. The notion is underpinned by the need for innovation as economies are transformed by the "creative destruction" of innovation and change supporting the view that process improvement alone is not a guarantee of economic success for the SME.

---

[2] For the purposes of the research "Low Facilitation" is defined as occasional meetings outside of the Network Group (perhaps once every six months). "Medium" as irregular but fairly frequent contacts and "Frequent" as regular structured and non-structured meetings face to face and on and off line support, which occurs on a weekly basis.

An understanding of the impact of the hypothesis on SMEs is also important in the field of regional and sub-regional support from governmental agencies. The development of networks to encourage under-performing SMEs in the field of new product implementation is predicated on theories of exposure to best practice in process improvements leading to new market opportunities for the SMEs (Lamming, 1993, Curran and Blackburn, 1995). The Literature Search has also shown the importance of networking for SMEs in the field of New Product Development (Rothwell and Zegveld, 1982, Inzerilli, 1990, Thomas, 1993, Chiesa et al 1996).

1.8.1 Summary Hypothesis Three

Will the act of networking, on process issues, then lead participating SMEs into developing strategies for NPD? The hypothesis suggests a ladder of development from process improvements through to new product development. It also suggests a change of approach in the SME from supplier to co – developer of new ideas. At the start of the research this was seen as important as the adoption of new processes, but very early into the networking the SMEs felt that obtaining new customers and developing new products for these customers was the key issue.

1.9 THE RESEARCH DOMAIN AND PLAN FOR THE RESEARCH

The Research Domain and Plan for the Research can now both be shown:

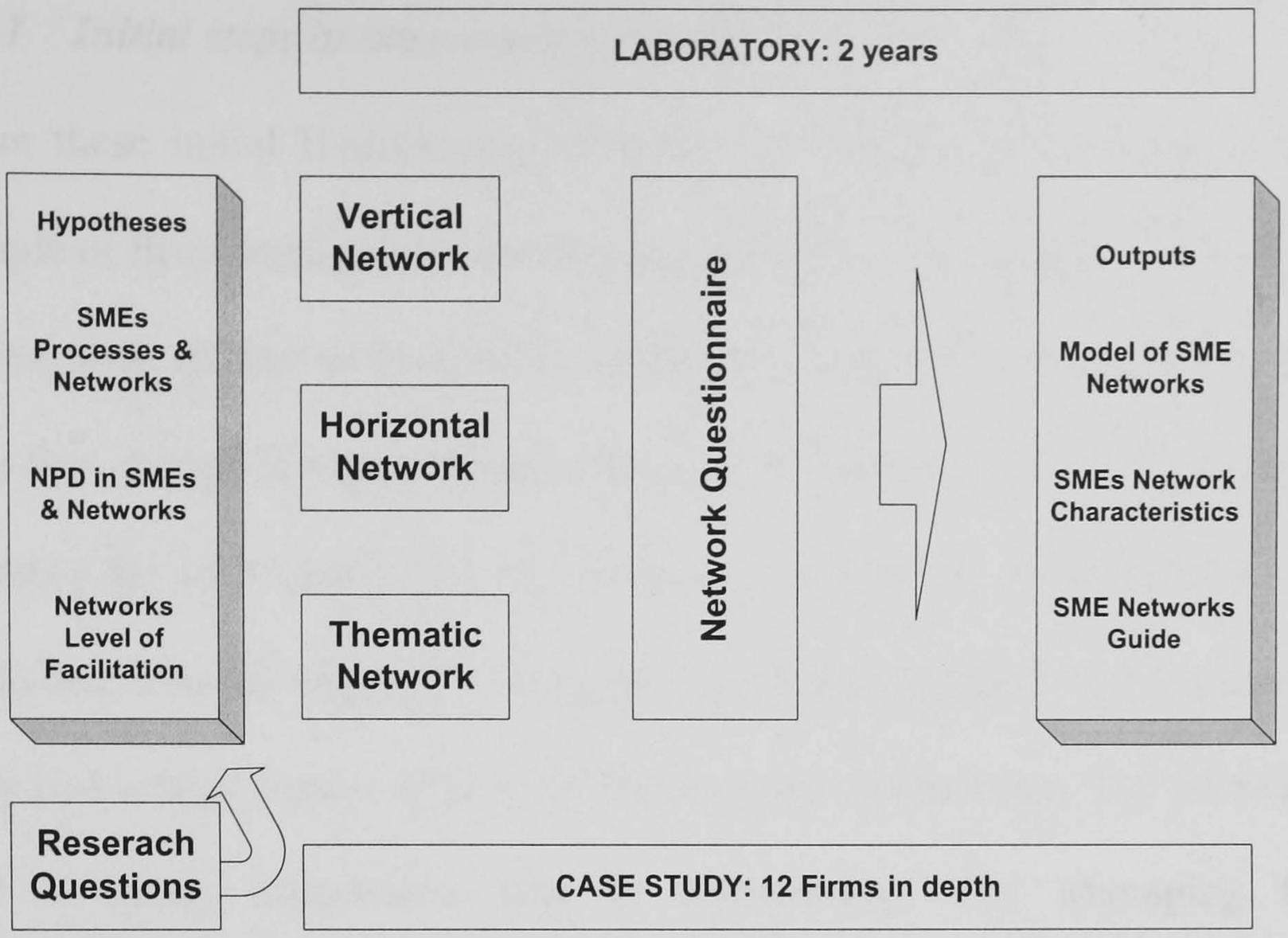


Figure 3: An outline of the research domain/context

Figure 3 illustrates the boundary of the Research Field, showing the three hypotheses, the proposed three networking types to be studied and the intended research outputs. Figure 4 illustrates the Plan for the Research, showing the intensity of facilitation, the three network types, the need for Performance Indicators within a Case Study approach and a Network Questionnaire to validate the findings from the cases.

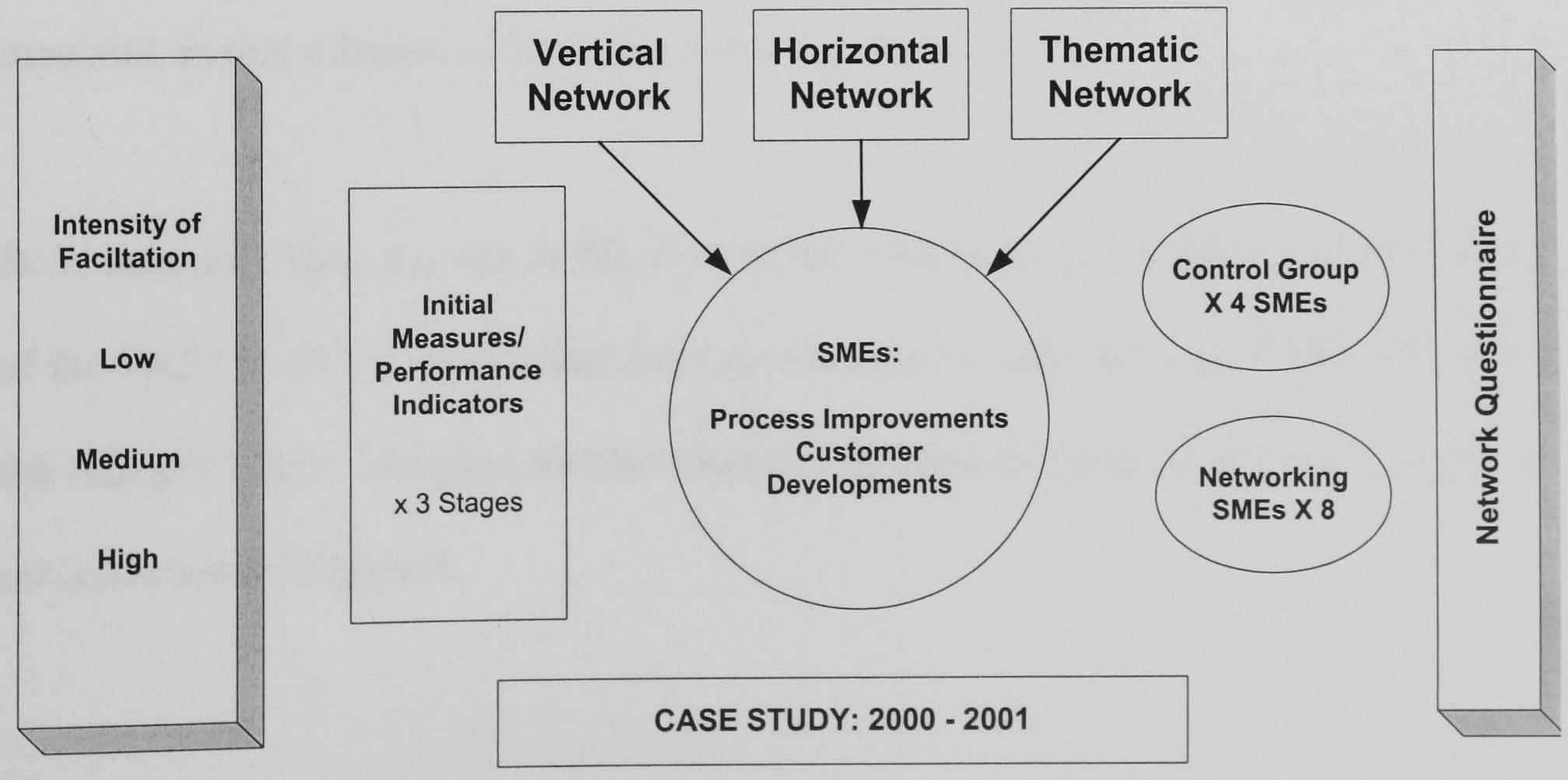


Figure 4: The Plan for the Research

1.9.1 Initial steps in the research process

From these initial Hypotheses, the next step was to test them out initially with a sample of firms engaged in networking to establish the validity of these assumptions. These were chosen as companies engaged in networking from two distinct groups. The first group was an existing network, the World Class Network. This had been meeting for over two years and espoused the benefits of being best in class. The firms had also all engaged in extensive QCD programmes and the assumption was they had a high degree of process improvement knowledge. The participating firms had a strong automotive bias in membership. The Managing Director, or Manufacturing Director, usually attended on behalf of the company, which was critical to get accurate data and follow on networking activity from the interviews. The second network was formed with the intention of sharing learning as a group of small firms, some owner managed, some medium to large firms. This network, called the ADAPT Club, had also been operational since 1997 and had even longer antecedents in being an advisory group to a specialist centre for small firms before this centre became a Company Limited by Guarantee which, made a change of role essential, in that a Board of Directors superseded the network.

Both networks were known to the researcher, who had supported the establishment of the WCN in 1997, but had had little recent contact and who was the Facilitator of the ADAPT Club[3]. The plan for the research outlining the purpose of each Chapter is set out below in Figure 5.

---

[3] The Adapt Club is a network of some 15 SMEs supported by a European Union Project developing learning and IT skills.

CHAPTER	Content
Chapter Two	• Definitions of "Networks" • Current approaches to networks, the literature from the Supply Chain and Industrial District traditions • Gaps in the literature
Chapter Three	• The Research Methodology • Case Study approach and use of Performance Indicators and use of Questionnaires with the case study firms and a wider SME group
Chapter Four	• The Research Results • Case Studies • Questionnaire, Case Studies and Postal Questionnaire
Chapter Five	• Analysis of the results and comparative analysis with the Questionnaires
Chapter Six	• Network Models arising from the research
Chapter Seven	• Conclusions and Contribution to Knowledge

Figure 5: To illustrate structure and content of the thesis

2.0 CURRENT APPROACHES TO THE STUDY OF SMALL FIRM NETWORKS

2.1 INTRODUCTION

The purpose of this chapter is to set out the context for the study of small firm networking in manufacturing firms. Chapter One argues the case for the significance of the phenomenon in order for small firms to support new product development and new processes and that external facilitation needs also to be examined for its influence in the networking process. The context of networking will be explored within the literature on small firm development and the manifestations around networking and networks that have arisen in response to developing a body of literature on the topic. An overview of the economic environment will be discussed looking at the literature which researches the trends in supply chains and the challenges facing small firms as single entities to be able to compete in the Global Economy of the 21st Century. Specifically, this is related to the established firms in the "established" manufacturing economies within the context of the sub-regional economy in which the research is set. This will be augmented in Chapter Three by an overview of the manufacturing strategies and consequent key critical success factors which can be supported by network participation which small firms will need to adopt to remain competitive. These factors will determine the Performance Indicators utilised within the quantitative phase of the results and analysis in Chapter Four and in Chapter Five.

Secondly, specific definitions of networking will be discussed which will support small manufacturing firms as part of their strategy. The definitions of a network will be considered here as the range from the literature is broad and the parameters of a definition for the research need to be clearly established.

The key categories from the literature will be then be discussed. These approaches are broadly

- Supply Chain Network Models
- Industrial District Network Models

The strengths and weaknesses of each approach will then be considered and assessed and the gaps in the current literature will be described. Next will be a section on the *process* of networking, seeking to review the literature on *how* networks operate to meet their respective objectives where the notion of network facilitation will be introduced. This is important as the research methodology is constructed to give insights into network processes to inform the body of knowledge on network formation, stages of appropriateness of different networks for specific issues and development and sustainability with small manufacturing firms.

Lastly, this will then lead into defining the *purpose* of this research, how the gaps may be addressed and how the research will add to the body of knowledge on small firm networking.

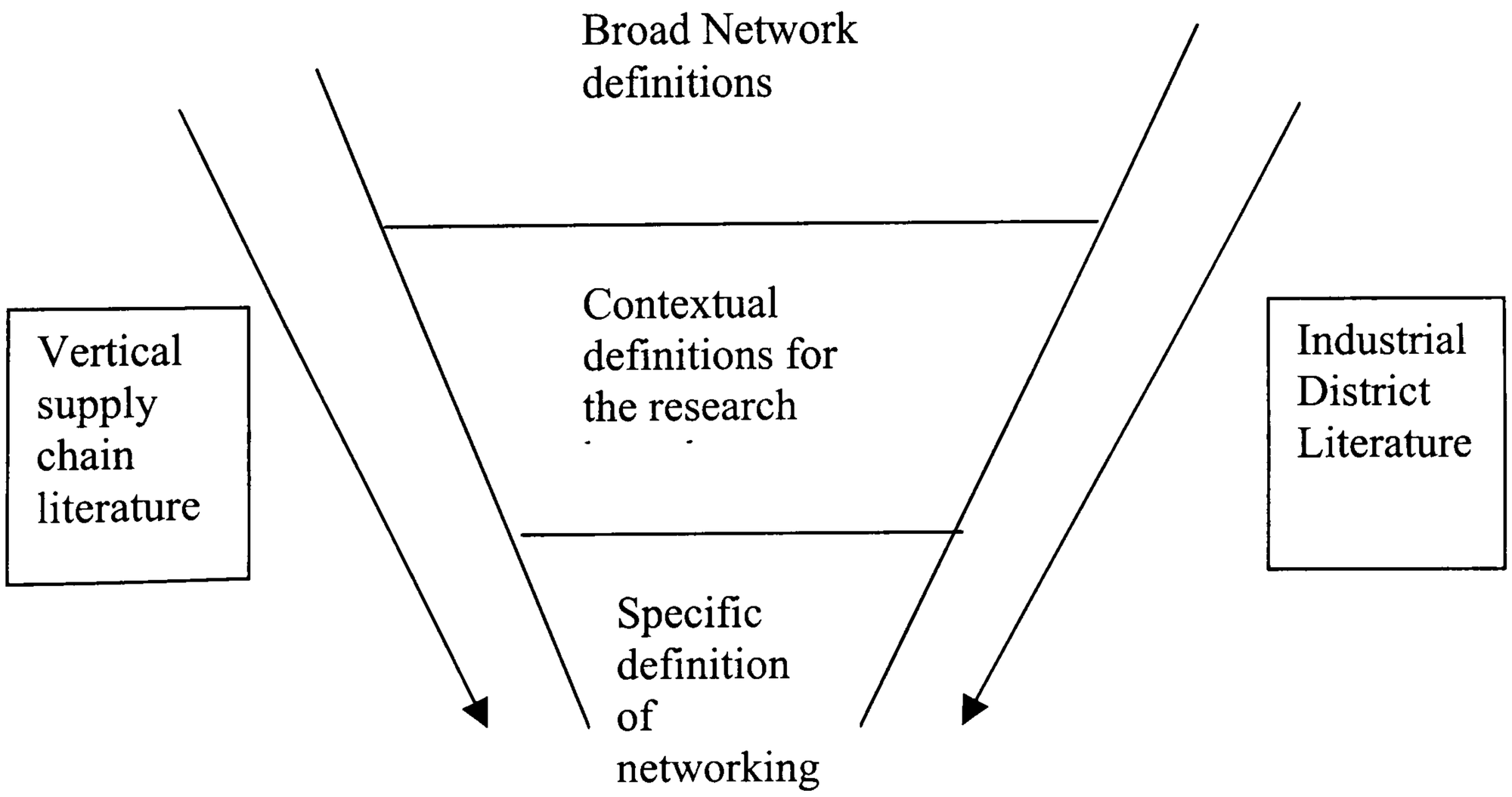


Figure 6: Defining the process for the literature review

2.2 ASSESSMENT OF MACRO-ECONOMIC FACTORS ON STRATEGIES FOR NETWORK DEVELOPMENT

The purpose of this part of the review is to describe the back - cloth against which small firm networks are set in the West Midlands region as highlighted in Chapter One. Networks have arisen as a means to organise small firm activity within supply and value chains and it is important to understand some of the key factors, which have led to networking. Clearly this needs to be an overview only, but is necessary to set the scene for the research context.

There are a number of key factors to be considered. Firstly consumers are demanding higher levels of quality as well as lower purchase prices with products with increasing features (Carrie, 1999). This leads to manufacturers seeking out new ways to meet these often mutually exclusive aims (lower purchase price but more added value in the product). This can be seen as incremental in nature punctuated by major shifts in the external environment (Scherer,1986) the effects of which, are considerable on the small firm sector in particular which, has traditionally in the UK suffered from a lack of investment in design capability, marketing awareness, in skills, and in new technology.

Overlaying these factors has been the shift to a global economy for supply of goods with manufacturers being able to source beyond regional and national boundaries into new producers as well as enterprises linked through new technology to make "virtual enterprises" (Birchall and Lyons, 1995). This level of uncertainty in business transactions makes a vertical hierarchy of trading relationships difficult to sustain as it is too rigid and unresponsive, leading to the need for network focused organisational forms (De Toni and Nassimbeni, 1995).

Additionally, this trend towards global supply defined Europe as a market rather than the individual countries in the EU. This was also made possible by the utilisation of technology for the development of logistics within new configurations of supply chains and the increasing trade with applicant countries to the EU such as Poland and the Czech Republic.

2.2.1 The significance of the automotive sector to the WM Region

There are two aspects here, the key role the sector plays in influencing other manufacturing sectors by setting standards and the relative position of the sector in the region's economy.

Firstly, the sector sets the pace for others to follow – what the sector adopts as best practice becomes the benchmark for other sectors to follow and adapt (Womack et al, 1990). "The automotive sector is at the forefront of the changes that will increasingly apply across the rest of industry" (DTI, 1999). Secondly, the automotive sector is critical to the manufacturing performance of the West Midlands Region.

Over 77% of the decision - makers for spending decisions in the supply chain are now based outside the region. The suppliers that are in the region are smaller than their mainstream European competitors (KPMG, 1998). "To survive as suppliers they will need to joint venture, merge or be acquired". Despite this decline, strategy has only since 2001 actively adopted a diversification strategy following the Rover task Force and Regional Innovation Strategy which both informed the "Creating Advantage" strategy (AWM, 2001).

A recent survey report on the state of the automotive sector (MacNeil et al, 2001) details the move by the OEM's to a standardisation of commodity products within the "region" of Europe with a parallel move towards design based products outsourced from the OEM. The authors see "networks and joint ventures" as a "way forward, especially if a design and development capability can be accessed within the network". However, "the development of collaboration and networking is as yet limited". The survey also found that companies of all sizes "appear to have a narrow focus on Quality, Cost and Delivery and the development of incremental strategies around their existing modus operandi".

The report concludes that for design orientated " smaller supply companies could only stay in the game through consolidation or by entering into JV's or networks". Additionally, for the commodity orientated small firm the utilisation of Internet on-line auctions, such as "Covisint" (www.covisint.com) will be the norm and "networking with other companies is essential to enable smaller firms to participate in this new market place". A further report produced by the Accelerate Partnership (Deloitte and Touche, 2001) reinforces this analysis based on survey analysis of 25 first tier firms and 25 lower tier companies. The Report states that "there is a big question mark on how collaboration can be stimulated, as few first tiers have close links with their suppliers for product/process development other than for design for manufacture advice". Furthermore the report notes the trend to "super suppliers" replacing existing first tier firms. These super suppliers are European based and will increasingly look for QCD issues in commodity products and design capability in "niched" products.

Diversification was seen as a two edged sword. Only 25% of the First Tier firms were engaged in diversification, whereas all the lower tier firm were pursuing new markets. The report questions whether such diversification is in fact an avoidance strategy by these firms which may fall even further behind the required standards of supply required by the automotive sector. Comparisons with the aerospace sector where concurrent engineering and support for integrating suppliers as partners are also insightful (Fan, 1997). This sector with high value-add and complexity in products has strong partnership based models globally within its supply arrangements. If this is the future in manufacturing, enterprises in the region will need to equip themselves for such a scenario if they wish to survive. Certainly, all these recent industry reports note the need to establish how small firms can thrive within an increasingly competitive marketplace and both highlight the need for collaboration through networks as a key policy strand. The research hypotheses are to test out the ability of networks to support small firms by adding a collaborative process through which weaknesses can be addressed and new opportunities exploited.

2.3 NETWORKS AS ORGANISATIONAL PHENOMENA WITHIN THE SMALL FIRM RESEARCH CONTEXT

Before aspects which are specific to small firm networks in terms of manufacturing supply chains can be examined, there is also a need to define the term "network" in the area of small firm developments. This is not an easy task. There are a vast number of definitions raging from the purely social to networks as a new form of organisation for small firms. However, it is important to categorise these approaches and where there are gaps or weaknesses in the literature which the research needs to address to address the type of network which will best support small manufacturing firms in the region.

2.3.1 Network Types

The following definitions have all been considered and have contributed to the definition constructed for this research. "Networks can be conceived as an intermediate or hybrid form of organisation in the middle of the road between markets and firms" (Jarillo, 1988). They can also be described as "a variety of strategies to create an alliance with other firms through people who can help their business grow" (Zeffane, 1997). Networks are "clusters of firms co-ordinated by market mechanisms instead of chains of command" (Fombrun, 1982). Researchers are searching for a new form of organisation between single firms and supply chains" (New and Metropoulous, 1995).

A network is " a configuration of firms, owner managers, support agencies, voluntary associations and other bodies through which small firms connect to the wider economy and community". (Curran et al, 1995). Networks "as the coming together….to achieve results which would not be possible if the enterprises operated individually"(Dean et al, 1997). "Inter firm networks consist of two or more firms pursuing common objectives or working towards solving common problems through a period of sustained interaction." (Huggins, 2000). Networking refers to the "activities in which participants in the network engage which brings the network into existence and sustains it through time." (Curran et al, 1995). Networks as "social relationship exchanges" (Granoveter, 1985). Networks defined as hard or soft (Rosenfeld, 1996). The typology of networks covers issues such as the "Internal-external focus and the Stable Dynamic" (Arias 1995). In summary, Figure 7 shows some key definitions from network literature.

Author	Context	Key definitions/hypotheses
Fombrun, 1982	Clusters	Networks as clusters of firms co-ordinated by market mechanisms instead of chains of command
Granoveter,1985	Networks as social exchanges	Networks have embedded values/operating systems within specific cultural contexts
Jarillo, 1988	Strategic networks	Networks as intermediate organisations between markets and firms
Arias, 1995	Networks supporting innovation	Internal external focus and stable/dynamic
Rosenfeld, 1996	Networks as hard or soft	Business and Social aspects, formal and informal
Dean et al,1997	Networks within context of Australian policy context	Coming together of firms to achieve results which would not be possible through individual actions alone
Zeffane, 1997	Networks as alliances	Variety of strategies to create alliances through people to support business growth
Huggins, 2000	Analysis of public policy initiatives	Two or more firms pursuing common objectives/solving common problems through sustained interaction

Figure 7: Summary of key network theories

The most resonant interpretation from the above and developed for this research from these definitions is where a "small group of firms come together to agree a common purpose to pursue individual business strategies over a sustained period of social interactions which would not be possible as single entities".

There are three broad categories within this definition, which will now be explored to enable the definitions to be incorporated into the research hypotheses on new products, production processes and the facilitation process to overlay above the definitions of Supply Chains and Industrial District approaches.

2.3.2 Networks as trading relationships, the new product dimension

The economic arguments for collaboration can best be described in the opportunity cost approach (Williamson, 1991). This states that firms will act independent of each other in markets and will only come together when the cost of doing so is in their economic interest and will revert to independent behaviour when this ceases to be so. The frequency by which transactions occur, the uncertainty to which they are subject and the type and degree of asset specificity (location, physical assets, know how, brand name and dedicated assets) are all key features. Essentially, the market solution is preferred "when the costs of internal production exceed those of external sourcing" (De Toni & Nassimbeni, 1995). Within the Opportunity Cost approach firms have an inherent predisposition to make things in house – sub contracting can be justified if the risks in terms of frequency, uncertainty and asset specificity make it desirable to work with another company.

The literature seeks to explore the dynamics of networks from the contractual models of tiers in a supply chain to more "organic" representations (Birchall and Lyons, 1995) as companies seek to develop more value added and complex products more quickly to a fickle marketplace. These factors have mitigated against the inherent disposition to make things "in house" as in the contractual theories.

The research literature, therefore, agrees on the importance of networks as intermediate organisations within manufacturing relationships substituting for single firm relationships. The need to explore the demise of large unwieldy organisational forms is highlighted by Mintzberg's work on the "core" and "non-core" organisational forms (Mintzberg, 1989) within larger organisations (used by Nassimbeni, 1998, to also describe subsequent network configurations). The former

axis (internal-external) focuses on Mintzberg's taxonomy in the dynamic in larger firms on the focus on the "core" business and the consequent need to describe the relationship with the "outsourced" function. This phenomenon has different characteristics within market sectors. In the automotive sector it has resulted in First Tier firms developing a systems response to customer needs, co-ordinating a range of functions from the supply chain. This has led to a reduction in the number of First Tier suppliers as firms have acquired complimentary companies to maintain global market share.

However, there is little empirical evidence to suggest the formation of these new "networked" SME focused structures in the literature bridging between customers and suppliers in sub-contract relationships. There is a clear need to describe the importance of the newly networked organisational forms, as described in the literature, (Jarillo, 1988, Zeffane, 1997) but little evidence to describe the stages of development in the networked forms and also a lack of understanding of the processes within these network forms.

2.3.3 Networks supporting development of new processes

The literature suggests that small firms can jointly develop strategies for mutual support by working together on new products and new processes (Rothwell, 1992, Twiss, 1995, Sharp et al, 1997, Mezgar and Kovacs, 1999). The approach may also be to focus quality and on the elimination of waste as a key strategy and continue to remain price competitive through taking out and redressing wasteful processes (sometimes described as non-value adding processes, Schonberger, 1991).

Technology driven approaches to innovation can also have a key networking dimension arising from firms seeking to utilise new technology to develop market

differentiation. This can be seen at a relatively simple level with customer supplier direct exchanges of data to increasingly now with more complex knowledge sharing systems approaches (Venkatraman, 2000, Nonaka, 1991). It can also be represented in the need for firms to develop higher value added products to meet changing consumer demands (Fisher, 1997). This is illustrated in both Figure 1 and Figure 2. This may well lead to the firm moving away from functional products within an efficient supply chain to more innovative products within a responsive supply chain. (This key theme will be developed within the data collection of the research process in the development of Performance Indicators to measure the networking firms).

2.3.4 Rationale for the context of networking within the research

This process by which small firm networks have been categorised has been within two major bodies of literature:

- Supply Chain Approaches
- Industrial District Approaches

These will now be examined and analysed for potential gaps in their application, which the research will attempt to address. Within these broad approaches there are a distinctive number of sub-themes.

	Supply Chain	Industrial District
Networks supporting innovation in new processes, work organisation and technology	Collaborative working on products & processes. Technology transfer emphasis in vertical relationships (Rothwell, 1992, Lamming,1994)	New forms of work organisation. Emphasis on technology supporting horizontal relationships (Venkatraman, 1991)
Trading relationships and approaches and networks	New products in existing supply chain relationships Sub-contract emphasis (Porter, 1985)	New form of organisation Collaborative, distinct from a supply chain (Jarillo, 1988, Nassimbeni,1998)
Social – the process of networking	Emphasis on formal exchanges (Hines et al, 2000)	Emphasis on "social glue" (Mumford, 1995)

Figure 8: Characteristics of key approaches to manufacturing networks

These categories can clearly be seen as both re-inforcing and underpinning the rationale for the hypotheses. "*Innovation*" can be shown in the support of *new processes and new products (Hypothesis One)*, a *Market* emphasis particularly in New Product Development (*Hypothesis Two*) and the *Social Processes of Networking* element represented in the hypothesis on facilitation (*Hypothesis Three*).

The research has therefore been constructed to take place within the following key theoretical areas:

- Supply Chain Models
- Industrial District Models
- Network Processes

The literature for these categories will each now be examined as methodologies and gaps identified in the literature which the research will then seek to address.

2.4 SUPPLY CHAIN MODELS OF NETWORKING

The approach is characterised from an analysis of the trends in the automotive sector. Networks are seen as a process mirroring the developments in the globalisation of the manufacturing process. As manufacturers seek to develop the capability to supply to ever changing customer requirements their suppliers need to be brought along with them so as to ensure this capability is shared. The scale and speed of the need to change means that adversarial relationships and low cost tendering policies are no longer adequate alone. Lamming characterises the changes within a description of a four-stage model:

- from adversarial (Tayloristic) approaches to,
- support for specific process improvement measures,

- joint working on manufacturing problems,
- full "partnership" model encapsulating business planning.

This description best describes the "Japanisation" of the sector with an implicit message of shared goals and even partial ownership of smaller firms by manufacturers in the supply chain (Fujimoto, 1997, Zipkin, 1991, Oliver, 1992) which can be described as "Keiretsu approaches". This model was further developed by Hines who described the phenomena of "network sourcing" (Hines, 1994). This sees a high level of asset specificity (Williamson, 1991) with mutual risk sharing. A maximum "buy" in strategy would be the norm for manufacturers with accordingly a maximum "make" strategy for suppliers. Design would be shared, with suppliers necessarily contributing to the innovation process in processes and products. The Customer and Supplier would be therefore in long term relationships including price sharing with the customer having a strong co-ordinating role. The tiered system would mean that each customer tier would still need to be responsible for supplier development to sustain the model.

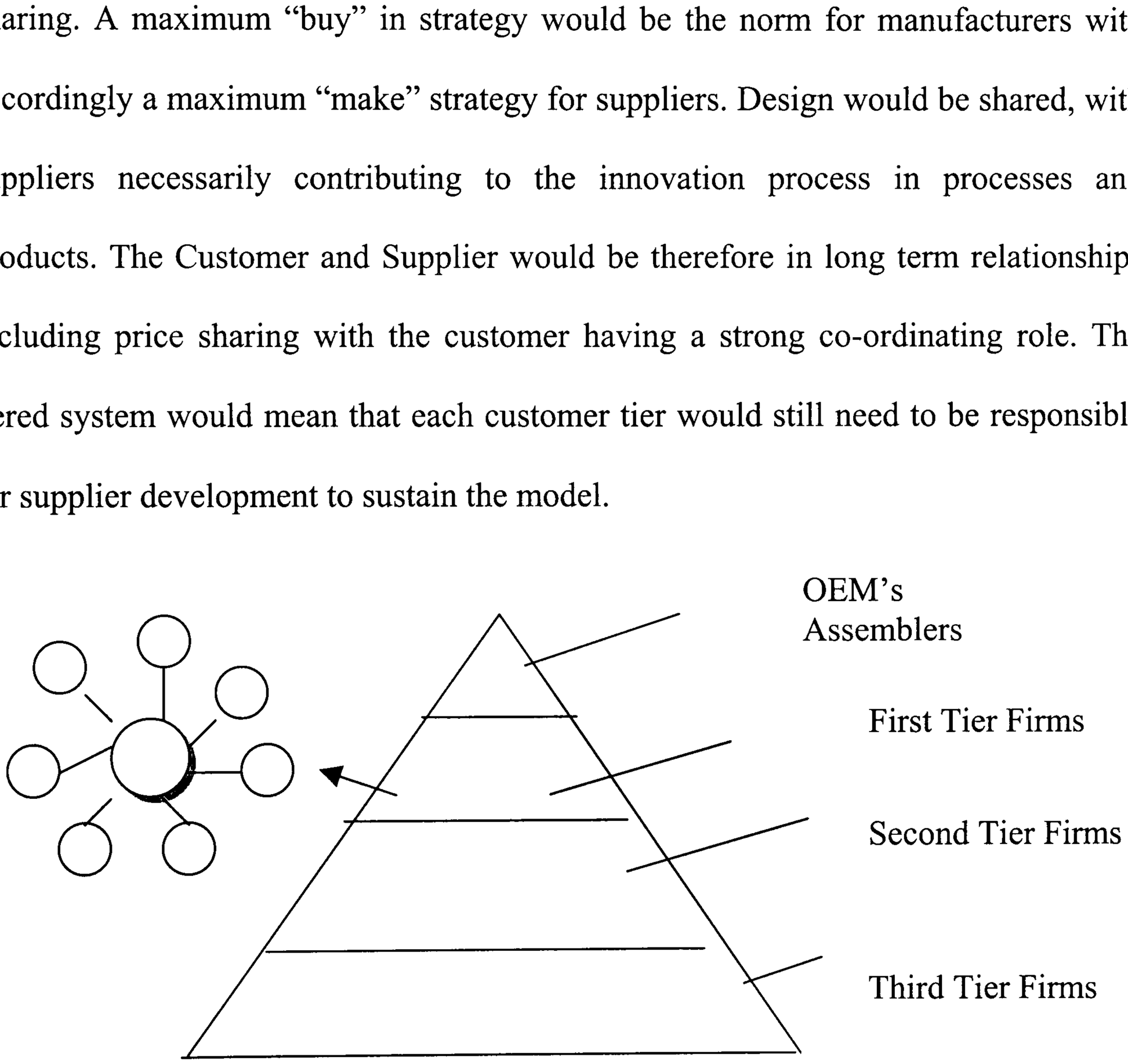


Figure 9: Hub and spoke arrangement in a vertical supply chain

2.4.1 The Vertical Network

The vertical network can be seen in the light of a clear supply chain relationship predicated on a component or series of components within the tiers of the chain. The

model suggests substantial amounts of time and resources being committed to the establishment and maintenance of a series of vertical relationships in the chain within long- term business commitments in terms of sourcing policy and practice.

A hub and spoke configuration is shown within this model as a Second Tier arrangement, although it could be at any of the three tiers of the model. The strength of the model is in the framework it offers for the European motor industry and the Birmingham sub-regional economy. It is clearly underpinned by analysis of the Japanese car manufacturing system (Womack et al, 1990, Deshpande et al, 1997) and seeks to transfer ideas from Japan onto the European system of production. The model focuses on the potential for collaboration within "vertical" relationships – joint working on a "system" to supply to an assembler. Here a small group of companies will collaborate to improve the characteristics of a series of components to supply a system to the customer who may also be a member of the network. The focus may start on issues such as cost reduction in the process and move to more design orientated collaborations. The model is best characterised in the literature on the Toyota Production System where suppliers are included in the design of components (Ohno, 1988, Oliver and Jones, 1994). The partnership approach, therefore, has aspects of the joint ownership of the Keiretsu model and has an implicit internal hierarchy of co- operation within the partnership leading to mutually shared goals (e.g. increased market share, technological advantage, joint cost savings). The approach inherently follows the rationale of co-operation as an economic necessity and that partnerships will be the way products will be developed in a changing environment. An example from the literature is the way Chrysler sought to develop an extended enterprise through cross functional teams with their

suppliers, design involvement, total value chain improvement and enhanced communication and co-ordination (Dyer, 1996).

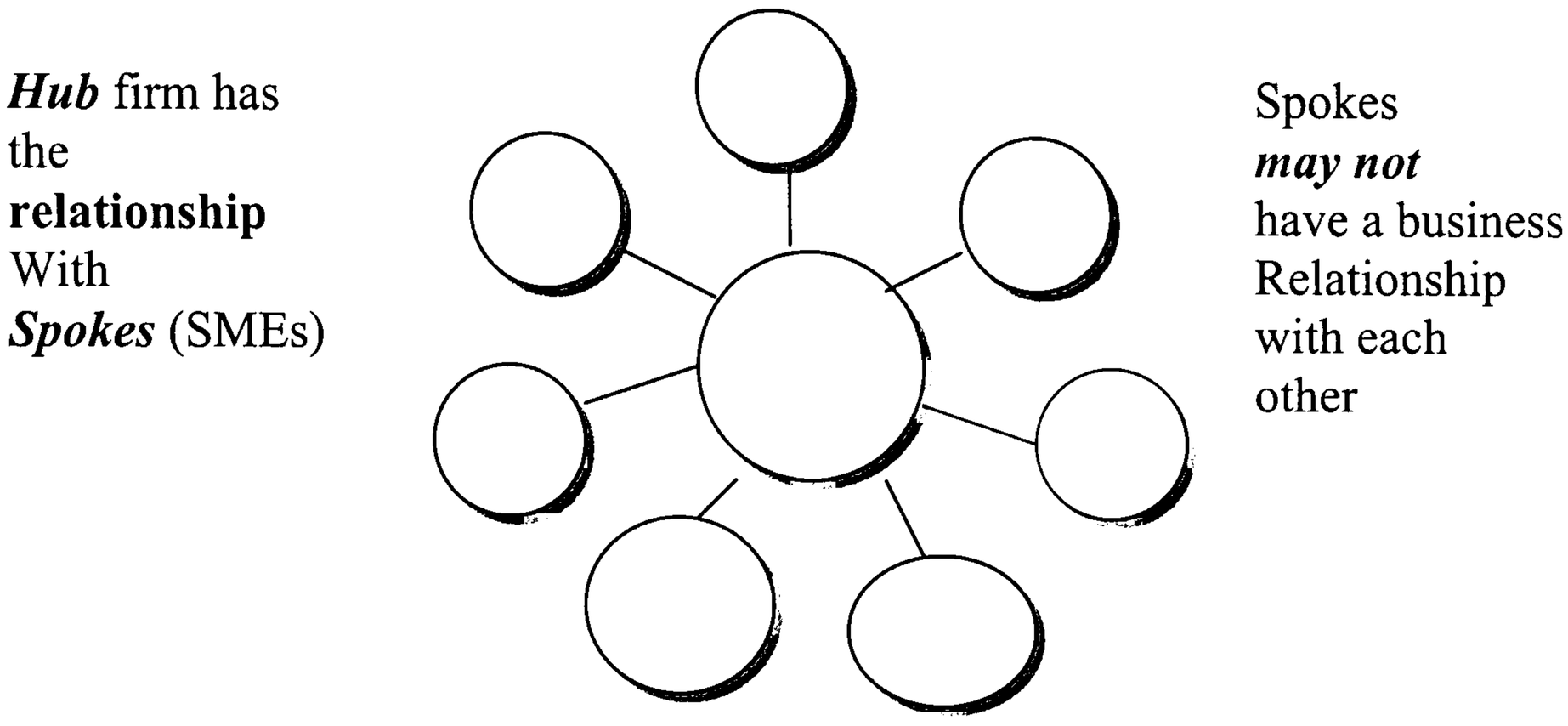


Figure 10: Hub and Spoke arrangements in a horizontal setting

The Hub and Spoke model has a common customer at the centre of a web of supplier relationships. The Model will be considered in terms of Information, Materials and Decision exchange. The model is transactional in nature with sub-contract links between the spokes and the customer, although not between the spokes themselves. Information on customer requirements is transferred out from the hub to the spokes as is product information. Decisions are made in a hierarchy of relationships and the spokes have no inherent motivation to share information, materials or decisions as they may be in an adversarial relationship with other SMEs in the model. Participation, in any case is predicated on the needs of the common customer rather than those of the SME.

2.4.2 Partnership arrangements in supply chains

2.4.2.1 Obligated Relational Contracting within the supply chain tradition

The need to understand the phenomenon of the Japanese manufacturing supply chain saw the development of theories, which sought to explain market capitalism and the notion of goodwill. The notion of "obligated relationship contracting" was thus

developed (Dore, 1983). The theory examined the existence of supply chain relationships with a social responsibility between "unequals" from the large firm to the small firm and between equals, the Keiretsu models. In the former group, larger firms develop sustained relationships with smaller firms whereby there is support for the small firm and recognition of the need to behave in a non-adversarial way. The later idea sees a "network of preferential, stable, obligated, bi-lateral trading relationships" as the key to manufacturing success. This development of trust, almost reluctantly, also arises from the customer not always being able to monitor products and services, which are in its supply chain (Wasti and Liker, 1997).

Supplier Associations ("Kyoho Kai") have been seen as a key factor in Japanese manufacturing's success. The Association can be described as "a mutually benefiting group of a company's most important suppliers brought together …in order to achieve strategic and operational alignment through the development of awareness, education and implementation programmes designed to achieve both radical and incremental improvements" (Hines and Rich, 1998). The Associations have their roots as far back as the 1930's in Japan with a strong influence of Toyota in the way they are configured today.

These theories seemed adequate in the 1990's to explain the system in Japan. However, they are more problematic at the time of this research for two key reasons. Firstly, globalisation of the supply chain supported by the Internet has led to far greater choice and consequent instability within customer supplier relationships (Venkatraman, 2000). Secondly the Japanese model has many cultural aspects embedded in its methodology (Granoveter, 1985, Cox, 1997) which make transfer if not inherently difficult, then needing to take account of the problem in the UK's

manufacturing infrastructure towards establishing stable long term developmental partnership arrangements.

The need to align groups of small firms in a common process could be seen as one partnership method – Value Added Partnerships can also be seen as adding value between smaller a supplier and a customer on a 1:1 basis.

2.4.2.2 Value Added Partnerships

A response to the complexity of manufacturing and consumer "demands for innovation in product needs new organisational forms" (Johnston and Lawrence, 1988). The development of Value Added Partnerships, or "VAPs", posits the establishment of small firm networks acting as partners together and developing innovative products. The VAP firms each will have further strategic relationships with perhaps 2-6 other firms (as customers and suppliers). Within the network trust will lead to information flow, to information on markets and then to the development of new products. The VAP will operate as a mechanism in the marketplace – the culture is to share and not to outsmart the other partners.

The "VAP", which is sometimes described in the literature as a "Technical Partnership" does seem to offer a method for collaboration within the environment of the supply chain context, which should be a feature of the research.

2.4.3 A Critique of the Supply Chain Network Models

Evidence of successful examples of the vertical supply chain approach at the start of the research process was hard to find, both from the literature and from preliminary contact with SMEs and intermediaries. The relative weakness of the sector regionally

and the lack of product development and a focus on process improvements may explain this. However, the idea of sharing knowledge of processes and new product development seems the basis of an effective strategy to mutually improve the situation (Jarillo, 1988, Rothwell, 1992, Mezgar and Kovacs, 1999). However, the importance of networks as a methodology for supporting "clusters" of firms in a common sector is critical to the future success of the region. The Regional Development Agency's (RDA) Agenda for Action (AWM, 2001) focuses on six regeneration zones, ten clusters and three high technology corridors with networks of firms as a key methodology in support of SMEs.

A key methodological issue is the need to better understand the specific context of the small firms in the region rather than necessarily imposing a model upon them which is predicated by specific circumstances and cultural considerations (Cox, 1997). This approach supports the hypothesis building of the research – what makes for competitiveness for the small firm?

2.4.4 Lack of Partnership approaches in supply chains

An important aspect of the research is therefore to seek to understand the processes, which may underpin this type of networking in support of new processes and New Product Development (NPD). There is a gap in the literature and in practical examples, of the approach describing how firms can be developed which are currently in a vertical supply chain to establish relationships with new customers.

A major factor in the development of the hypotheses is the need in the research to develop a deeper understanding of the NPD hypothesis. Are there steps, as suggested in Figure1, which can lead from successful adoption of new processes to new customers and ultimately to new products?

The literature suggests that there may be also less of these "World Class" customers, particularly automotive based, which are located in the UK. This in itself could have a negative effect on the growth of supplier associations (Winfield and Hay, 1997). For example, Toyota has just over 100 UK based suppliers, so the impact on the SME base in the West Midlands region may not be significant in terms of order potential. (Although possibly greater influence in terms of best practice).

The Supplier Association Model championed by Toyota (Hines and Rich, 1998) has four types, a Structural Model, an Efficiency Model, a Value Stream Model and the Extended Value Stream Model. Types One and Two have difficulties in transferring learning from one context to another, resulting from variations in size and product focus of suppliers and lack of commitment. (Hines and Rich, 1998). Types Three and Four develop even deeper relationships in terms of identifying waste and design potential which are then shared with suppliers. Development is based on an assessment of the supplier's perceived capacity and ability to participate in these arrangements. These are important qualifying factors for entry for even medium sized firms. The need to examine how small firms can participate in such associations given the difficulties they face in terms of readiness, capability, design skills and technical know how for process improvements needs to be explored.

2.4.5 Characteristics of West Midlands supply chains

The automotive sector approach is characterised by the arrangement of firms within tiers. These arrangements enable analysis of the customer-focused approach and the impact on smaller firms in the chain. Themes can, therefore, be identified arising from the needs of the customer in terms of their competitive position. The analysis is also bounded by this, inferring that the business benefits cannot also be articulated

from the smaller firm nor that the smaller firm may well have needs quite separate, even at odds with, its own customer base.

Hypothesis One seeks to determine the impact of networks on new processes. There has been a broad understanding from the literature on the possibilities created for improvement from supply chain improvements in processes. This has been reinforced by the regional Accelerate Programme, which sponsors Supply Chain Improvement Programmes within the First Tiers and their supply chains. However the approach also implies stability, or incremental change. Relationships can therefore be fostered to jointly plan for process improvements with a known set of participants.

Hypothesis Two focuses on the need for facilitation. The literature on vertical supply chain developments is not clear on this facet, where it is referred to it is implicit that facilitation will be through the customer, with specific inputs from the business support agencies. There is not the attention to the notion of a "process" of facilitation.

Hypothesis Three with the focus on networks and propensity for NPD, is supported in the literature with the trends to higher asset specificity and added value products, but cultural issues are not addressed in the need for small firms to work together and share development. There is also implicitly a need for trust within the relationships and mutual loyalty to each other often within a regional context of supply. Developments which can be traced to the mid 1990's in terms of globalisation, of decline and over capacity in some sectors and rapid growth and then decline in

others, (electronics) now call for a radical re-appraisal of the network view within a vertical supply chain relationship approach.

From the literature review there would seem to be several key factors at play:

1) Social factors, inability to collaborate after years of competitive relationships (Granoveter, 1985).
2) Business re-configuration factors within large and small firms seeking to come to terms with globalisation, the systemic decline of some manufacturing sectors and the fast growth in others. This means that existing combinations of firms in vertical supply chain relationships may cease to be appropriate (Lamming, 1993).
3) Tensions between firms in terms of dependency, small firms seeking flexibility and larger firms bounded by new global opportunities for supply (Porter, 1985, OECD, 2000).
4) The work undertaken on partnerships does so far suggest that the cultural dimension underpinning mutual trust in such business relationships is lacking (McIvor et al, 1998).

The supply chain model does also not give insights into the ability of the SMEs in the relationships to test new ways of working as a business edge in new sectors. As sectors decline and change (Porter, 1985, Scherer, 1986) small firms need to transfer their manufacturing skills into new growth areas to survive and innovate. The model does not give further insights into how the enhanced vertical networking can be transferable to meet the needs of a range of suppliers which may well be different (i.e. the need for small firms to seek a range of alternative customers).

It is essentially an incremental approach based on a theory of mutual dependence between customer and supplier. This has not proved as robust as may have been posited largely due to the step changes in the supply chain environment which has left many small firms seeking a fresh approach to partnership working in new and indeed existing chains, but fundamentally unsure as to what this may be.

In terms of the hypothesis on facilitation, the literature from the supply chain tradition is very sparse. The author undertook to develop a model based on the Kolb Learning Cycle, which sought to enable managers to develop personal strategies with the support of a facilitator (Harding, 1996). A review of networks in the region (Hogan, 1996) focusing on "The Best Practice Network" noted the role of a university in facilitating discussion. Perhaps the literature on Industrial Networks may throw light on some possible solutions and help develop the development of the research hypotheses. Vertical supply chains also have a geographical focus, will local supply chains provide some of the context to support answers to the research hypotheses?

2.5 INDUSTRIAL DISTRICTS AND NETWORKING

Networks have a strong methodological and epistemological history within the development of industrial districts. The networking literature has had a parallel developmental process to that of the supply chain tradition. It has more of a focus on the perspective of the small enterprise and is more prevalent in craft based areas such as Northern Italy and the Hi –Technology firms found in Technology Corridors and Science Parks. The concept of the entrepreneur is explicit in the tradition. It views the owner managed small firm as the key focus of research activity.

It is, therefore, an important contribution of this research to compare and contrast the two traditions within one research context, rather than only seeking to understand small manufacturing firm networking through only one tradition. It is timely to now review the impact and appropriateness of the body of literature on Districts to judge the applicability of network models from this tradition on the small firms in the region.

2.5.1 Industrial Districts and support for NPD

In terms of *Hypothesis Three concerning networks and NPD*, the literature has many examples of the way networks could inform the research methodology. In the early 1980's networks of small firms were seen as "a means by which entrepreneurs secure competitive advantage and not simply a metaphor for describing business transactions" (Jarillo, 1988). The network firms, usually within a distinct geographical area, share resources and ideas to become more efficient and more effective thus lowering transaction costs (Williamson, 1991). The independent nature of SMEs means that the benefits in collaboration in NPD must be clear (Mezgar and Kovacs, 1999, Post et al, 2001). These could include sharing transaction costs, sharing risk, transfer of technical know how, access to new markets and speed of developing new ideas. The Vertical Supply chain tradition also suggests the need for networks to support NPD in more complex products (Lamming et al 2000) which is further supported in the literature on small firms and NPD activities (Sharp et al, 1997, Dickson and Hadjimanolis, 1998). However, the approach demands high levels of leadership within the networked firms. It establishes the need for one of them to become the "Hub", contractually responsible for the others in the network and customer relationships. The "Hub" or central firm is responsible for outsourcing, developing the capability of the network, introducing new technology and

encouraging rivalry between the firms in the network in a positive manner to ensure it remains competitive (Lorenzoni and Baden-Fuller, 1995).

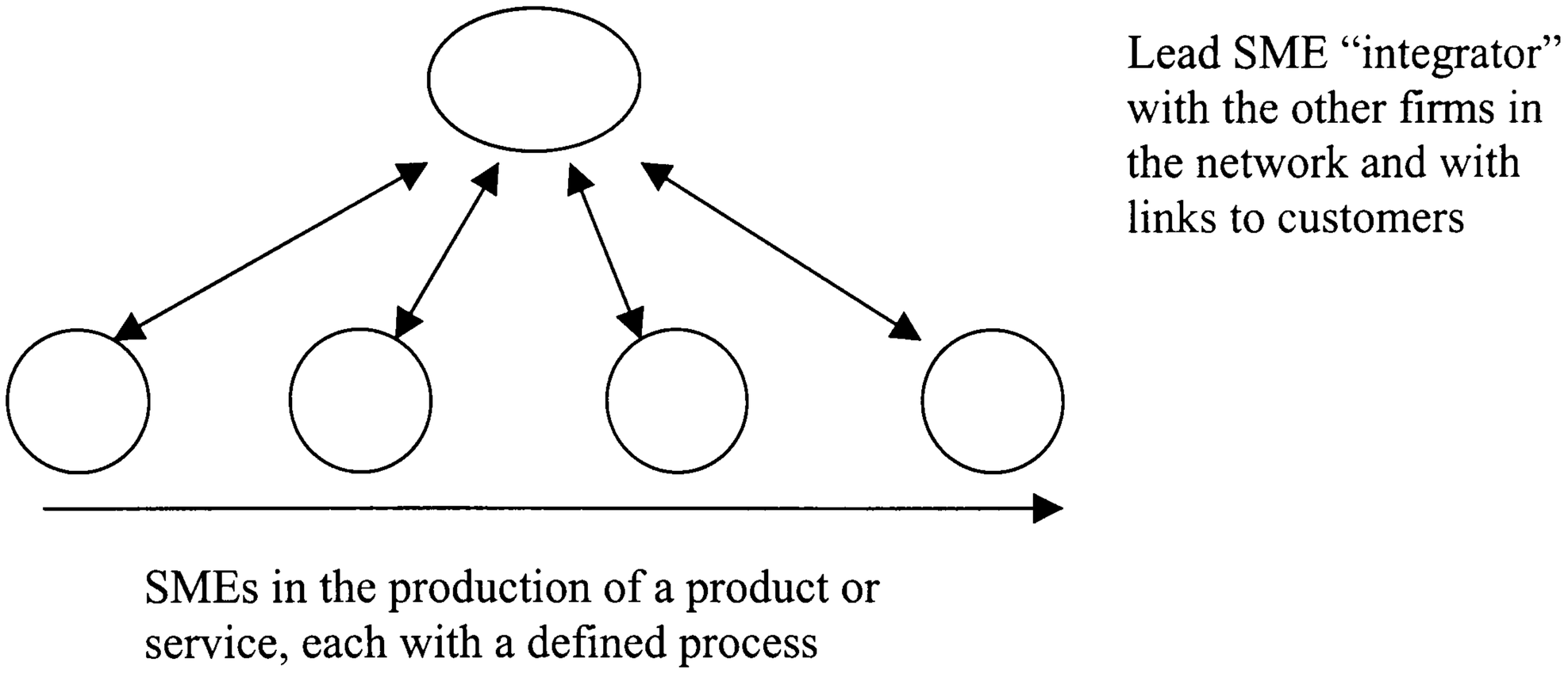


Figure 11: The Industrial District Model

In terms of transaction cost economics, networks have several advantages in that they provide a higher level of certainty to frequent transactions, can be developmental in terms of ongoing design issues, be rich in the development of intangible assets and in the development of integrated logistical systems. This flexibility contrasted to the rigidity of the hierarchical vertical supply chain system makes for responsiveness to changes in the competitive environment and combined with the development of intangible assets (Nonaka, 1991) makes the model attractive. Importantly, there does need to be a "dominant player capable of developing, controlling and managing the supply relationships of the system" (De Toni & Nassimbeni, 1995).

The tensions between individual and collective interest are further explored by the notion of de-coupling. In terms of the Italian District Model, low transaction costs make de-coupling possible. "The typical technology has few indivisibilities, so that the production process can be easily subdivided among different firms" (Inzerilli, 1991). Furthermore, social ties are seen as very important. In a study of 93 firms, Inzerilli notes that 56 based their relationships on trust or co-operation. This will be

further explored within the notion of "embededness" (Granoveter, 1984). The presence of a strategy to assist small firms and the infrastructure to then support this strategy seems a key factor in the success of Baden Wurttemburg (Semlinger, 1995 in Bagnasco and Sabel). Semlinger notes the long history of mutual support in the region beginning in the 1800's which led to strong "Vertical" links within the local economy. These vertical linkages could now be at risk within globalised markets with increased demands for new products (MacNeill et al 2001).

The Baden Wurttemburg example does not easily fit, therefore, the view of Hines (1995) who sees the vertical "Kieretsu" as the optimum model for small firm innovation. Semlinger suggests that "horizontal" links might be of greater value within the scenario of rapidly changing markets. This notion of a system of complex linked inter-relationships, is further explored by Carlo Triglia (1995).

This approach suggests the reasons for entrepreneurship can be part explained by a socio economic study of the industrial region. Triglia examines Valdelsa in Tuscany and Bassano in the Veneto (In Bagnasco and Sabel, 1995). He considers political cultures, the links from agriculture to industry, the nature of industrial relations, the impact of migration of people, the culture of people having relative autonomy at work. The relative harmony of the endogenous relationships, however, needs to be refreshed by external influences if the Industrial District Model is to thrive in a global economy. Triglia feels that SMEs will need more in the way of technological support as well as direct links with firms in other regions. The analysis enriches the perspective needed to construct a model(s) for SME Innovation and suggests some fields for analysis in the construction of the research methodology.

Significantly, much of the literature and research on the Industrial District pre-dates the advent of the Internet and the development of "globalisation", which have been discussed in the literature review for vertical supply chains. This needs to be a factor in the network analysis emerging from the research.

2.5.2 Industrial Districts, small firm networks and process improvements

Studies have shown the need for small firms to learn from each other in the technology transfer process across a range of manufacturing sectors. (For example, Porter, 1985, Romano et al 2000). However, there are few examples of firm to firm networking as effective case studies in traditional sectors as characterised by the West Midlands region where this research is based.

There are a greater number of examples of industry/specialist centre firm collaboration to improve "technology performance" (Rothwell, 1992) often in new technology situations where both parties are able to transfer know how through technology. This is usually in the context of "Clusters" groups of firms of a World-Class stature working in growth markets supported by hard and soft infrastructures. The importance of "business clusters" to the development of ICT in small firms is key (AWM, 1999, 2001 and 2002). At the start of the research, the focus was still on a supply chain approach, but this has been supplemented by the need to develop clusters of firms within sector specific areas (such as medical equipment, ICT, transport technologies, creative industries and food and drink). These clusters will be the key mechanism for improvements in terms of efficient use of ICT (which will necessarily also link with NPD capability). It is important to make links from the research into how cluster characteristics can be supported in the development of indigenous manufacturing SMEs. The literature gives some indications such as the

example of the German Steinbeis Foundation, which consists of a network of technical centres acting as an intermediary for the small firms to access the relevant technical information and advice (Curran et al 1995).

Again, given the importance of this to regional economic policy as a means of re-vitalising the traditional manufacturing base this represents an opportunity for the research to inform regional policy by addressing "gaps" in how by networking "horizontally" small firms can be supported in the adoption of new processes.

2.5.3 Industrial Districts and Facilitation

Unlike the vertical supply chain literature, the need for facilitation is given coverage within the literature. The importance of a "broker" to work within the networks of small firms is critical recognising the characteristics of the indigenous nature of the small firm.

This can apply to managing the business relationships within the network and also the social relationships (Arias, 1995). The literature clearly indicates the need for leadership roles within clusters of geographically based small firms (Mitra and Formica, 1997). One of the companies needs to adopt a co-ordinating role within the network (Chaston, 1995). This degree of trust and mutual understanding will take time to emerge from the vertical supply chain environments which most small firms currently inhabit. How this will happen and the processes involved within a *mature industrial region* is unclear from the literature. There are few examples of brokerage within traditional economies from the literature and this is a key area to be addressed in the research for applicability and effectiveness for the West Midlands region.

Furthermore, the Industrial District Models (Piore and Sabel, 1984, Jarillo, 1988, Brusco, 1990) note the inadequacy of self-facilitating networks alone to improve SME performance. Additionally, the literature points to the role of facilitation by intermediaries in such networks. These intermediaries may be individuals or they may become institutions such as "Real Service Centres" in Northern Italy. Such centres may facilitate property/physical location issues as well as "soft" issues to encourage co-operation and collaboration to take place. The need to develop these capabilities in support of networks needs to be developed.

Within the North East Region in the UK, for example, the idea of a Real Service Centre is already being piloted. The intention is to support clustering of local companies "to access the global market through joint initiatives " covering "Marketing, Finance, Large Contracts and access to R&D" (Ratnatunga et al, 1996). The public sector role is through facilitation within the Centre with a small team of experts focussing on making links with SMEs to support these objectives. There is a particular emphasis on Marine Engineering, rather than automotive or general engineering. Would such a model be appropriate in the West Midlands?

The concept of the network broker as found in the Service Centre concept – a public policy issue – is noted in the literature as a key role. Without a broker who "has the right motivation and incentives" local networks will be problematic (Cegile and Dini, 1999). Generally, the literature favours a "bottom up approach centred on fostering an entrepreneurial vision and supporting local actors" (Cegile and Dini, 1999). Also, "it is formal groups that are the most potent form of inter-firm network, but that it is through an initially informal structure that they are best facilitated" (Huggins, 2000).

2.5.4 Summary of the key characteristics of the Industrial District Model comparing these with characteristics found in West Midlands SMEs

There are a number of key characteristics, which apply to the Italian Industrial District Model. These are now contrasted with the situation in the West Midlands region of the UK.

Firstly within the Italian Model, there is a long history of business to business links within a product context. This means that ties are maintained with other small firms in the context of localised production with distinct roles being undertaken (Brusco, 1995, Lorenzoni and Baden – Fuller, 1995). This is not a feature of firms in the West Midlands region which still has the legacy of an "adversarial" history from the supply chain experiences of the 1980's and early 1990's (MacNeill et al, 2001). There is still "an absence of collaborating subcontracting networks between large and small firms in the UK" (Zeitlin, 1995).

Secondly, there exists in the Italian Districts a long history of co-operation within the context of local culture and politics, whether of the Left (Socialist) or the Right (Christian Democrat). Within the West Midlands Region there are homogenous local sub-cultures (for example in Stoke for ceramics and Hockley for jewellery), but these have not as yet led to local supply chains forming from other manufacturing traditions and developing new business opportunities (AWM, 1999).

Thirdly, the support infrastructures such as "Ervet" in Emilia Romagna, foster explicitly collaborative approaches, whereas, until recently, UK emphasis was on "entrepreneurial" behaviour within the stand-alone firm. This emphasis has recently

changed in the English Regions with the creation of the Regional Development Agencies, but there is a long time lag to catch up with the Italian Districts in terms of infrastructure support to the small manufacturing firm. However, there also needs to be a note of caution in that although these characteristics are important in an Italian context, there also needs to be an understanding of some of the constraints in the model.

2.5.5 Critique of the Industrial District Model

The authors of the Regional Innovation Strategy (RIS) for the West Midlands region (Oughton and De Poris, 1997) note what they consider to be an important trend in regional economies competing globally. "Industry specific assets....are crucial to promote innovation and improvements in design are often found ...in industrial districts where clusters of firms operate in co-operation and competition". Examples of these phenomena are cited in that of the Emilia Romagna and Baden-Wurttemberg regions (Semlinger, 1995 in Bagnasco and Sabel). The RIS authors strongly feel, therefore, that the future for small firms is strongly bound up within the "Industrial, economic and institutional structure in which firms operate". The starting point for the discussion on the theme of industrial districts comes from the Italian experiences around SME development. The need to understand "the mode of integration of the economy in society which is important for understanding local economic systems and the destiny of districts" (Bagnasco, 1995). The social system, which underpins successful networking is incredibly important in this integrating process. This means that it is not appropriate to transfer one "system" to another without understanding the social, cultural and business environment of the host region (Granoveter, 1985, Curran & Blackburn, 1996). It is this very lack of understanding which has

bedevilled the analysis of the industrial district approach in the UK and the lack of take up of the models within local West Midlands clusters (Huggins, 2000).

Certainly, externally imposed cluster developments of small firms within the UK regions has been problematic (Humphries, 1996). UK policy on industrial networks has sought to attract "hub" firms and build upon sub-regional assets. Examples here include motor- sports in the Oxfordshire/Banbury region and ceramics in Stoke on Trent. These are local industries built upon local factors and circumstances and fall into Porter's categorisation of "clusters". But for network development in "declining" sectors to seek to support networks of firms in pooling resources the appropriate network policy is far from clear. Some commentators feel that externally imposed network initiatives are ineffective. "In terms of future network policy development, it is suggested that policies aimed at creating formal networks from scratch be abandoned." (Huggins, 2000). Huggins favours supporting "informal" initiatives in areas seeing what locally works best and critically, then developing "formal" systems from these informal beginnings through sensitive participation building up trust to develop business goals with the network members. Furthermore, to support the testing of the hypotheses there also does not seem to be an analysis of the causal links within the model of the industrial district. The analysis describes a rich pattern of institutional structures but clear evidence of cause and effect is lacking. For example what is the relationship between Industrial Associations, Industrial Societies, Fraunhofer Institutes, Steinbeis Technology Centres, Universities and Government R&D Centres, for example, in the German context? (Semlinger, 1995).

The description seems to suggest an almost "organic" relationship between institutions and small firms bounded by relationships and trust, but quantitative approaches to the subject alone fail to support an understanding of these conditions.

2.5.6 Industrial District approaches – gaps in the research

There are therefore, three key weaknesses identified in the literature in seeking to apply the model, issues around

- Cultural specificity,
- Globalisation and asset specificity within the small firms,
- Networks and High Value Added Activity

The research must seek to fill these gaps in knowledge to better understand the network process in the West Midlands context.

2.5.6.1 Cultural specificity

Networks within the Industrial District tradition are founded on a complex system of rules arising over a considerable period of time from the specific circumstances within the area. Therefore, when applying the models to a region with a strong sub-contract and adversarial tradition this becomes problematic. Co-operation will take time to become embedded in the behaviour of the participating firms. (Granoveter, 1985, Cegile and Dini, 1999, Huggins, 2000). This implicitly depends upon relationships based on trust, mutuality, partnership working and common purpose.

2.5.6.2 Globalisation and asset specificity

Small firms are seeking to define themselves in terms of uniqueness in order to remain competitive. (Porter, 1985, Prahalad and Hamel, 1990). Uniqueness can be described as specific attributes in terms of "Unique Selling Points". Since the advent

of the Internet and globalisation, some of the underpinning factors within Industrial Districts also need to be examined, as in the Keiretsu and Partnership approaches in the Vertical Supply Chain Model, old certainties need to be re-examined. Significantly, networks competing in low value added markets, even collaboratively, may well have new problems given the emergence of new competition from other countries new to the EU and/or "Third World" producers. The literature has yet to address these factors at the time of the research although the research should provide insights into the scale and scope of these changes.

Also, the low asset specificity which can allow for de-coupling (Nassimbeni, 1998) is no longer such a feature of a global and complex market environment – a significant change from the early 1980's when the Industrial District model was the key theory. Conversely, small firms with high asset specificity need to be re-assured that by sharing with other firms this will not lead to dilution of their assets (Post et al, 2001). Small firms even in less turbulent times always needed to be wary of over-stretching as networks to compete in that they may cease to be effective (Miles and Snow, 1992). The demands of the manufacturing marketplace at the start of a new Millennium are increasing in terms of product life-cycle the need for firms to re-configure themselves to offer products and services to meet customer need (Chiesa, 1996). These are real issues, which need to be addressed for local networking to take place.

2.5.6.3 Networks and High Value Added Activity

Further differentiation of the approach to networking defines SMEs away from strict supply chain network relationships (Clarysse et al, 1998). The categorisation of small

firms is helpful in that it points to different types/needs of network, which can be applied in the industrial District Tradition. These are;

- Schumpeterian Pioneers – probably newly formed small firms, relying on the expertise of their owners, controlling their own value chain and with an innovative culture (Rothwell,1992) (Hypothesis Three on networks and NPD).
- Resource Based Innovators – will be "stars" in their respective supply chains supplying "service" to their customers supported by an excellence in systems (Prahalad and Hamel, 1990) and building on their assets. Hypothesis Two on networks and new processes.
- Porterian Innovators – will be determined by a clearly defined market "niche" based on knowledge either tacit (know how) or explicit (patents). Hypothesis Three, networks and propensity for NPD.

Such characteristics of small firms suggest a more fluid approach to networking away from strictly supply chain relationships. The models/categories also imply transfer between a range of bodies, large firms, research bodies, other SMEs and not predominantly the large firm within a supply chain relationship. The need for further understanding of the mechanics of such networking underpins the hypotheses of this research. Again, evidence of this approach is hard to find in the UK and in the region except in "hi-technology" applications and represents a clear gap in the literature to be explored in this research.

What these processes may consist of is a key hypothesis, which is addressed by this research. In some ways it would be surprising if a model grounded in cultural and specific business environments (the Industrial District model) would fit easily in a region with a strong tradition of both vertical supply chain competition and mistrust together with an entrepreneurial tradition based on owner managed small firms. If

this was true for the 1990's when the research on the District model was at the forefront it is even more so now in the current economic climate. Significantly, then, the research, by taking a longitudinal case study approach within these traditions supported by qualitative data, will build the picture from the bottom up. It will seek to research a representative sample of small firm networks *in situ* in the sub-region and the processes, which make them effective.

2.6 FACILITATION IN SMALL FIRM NETWORKS

The last section of the Review is on the *process of networking* itself to seek to identify trends in the literature and to identify gaps, which need to be addressed by the research. The Case Study emphasis within the research methodology makes it important to establish similar approaches to network research methodology and the trends, which have emerged.

2.6.1 Network processes

Recent work on the establishment of networks (Finegold, 1999 in Hendry et al 2001) supports the need to look at network processes from a "catalyst to start the process, on -going support within a healthy environment and a high level of interdependence among the actors in the system." Curran et al begin their critique of small firm networking (Curran et al, 1995) by noting the preponderance of quantitative data analysis alone as for measuring network effectiveness. They note that counting interactions in networks will not uncover the processes of networking or add to the understanding of the value of transactions to the networking small firms. There have also been a number of EU supported network facilitation "kits" developed (Kelleher et al, 2001), but the literature within the supply chain discipline is very thin. This

underlines the importance on providing insights from the research into the network process to better understand the stages of development and to consider appropriate intervention roles to facilitate change within the supply chain tradition.

2.6.2 The role of a "champion"

The literature supporting change processes in SMEs furthermore, notes the importance of "champions" to help steer change in terms of innovation and new technology (Schon, 1984, Rothwell, 1992, Hogan, 1996, Dromgoole et al 2001, Post et al 2001). This role is necessarily focussed on internal change issues in the firm – it should seek to develop links with other companies in similar situations, but it lacks the focus on relationships with other companies. As has been noted, the development an *external* role independent of the interests of a particular customer, to facilitate a network group is a missing ingredient from the literature on supply chains. Both the internal role and that of external facilitation are, however, more widely discussed in the Industrial District tradition. The District Model requires an internal champion within the network to co-ordinate the business and learning activity of the firms. There is also the need identified by UNIDO (Cegile and Dini, 1999) and borne out in recent UK research (Huggins, 2000) for successful networks to have external facilitation at the start of the process to enable them to reach agreement on objectives and to support the subsequent discussions.

2.6.3 Network Facilitation roles and Consultancy roles

There is not a great deal of evidence from the literature on the process of networking facilitation. This research will therefore seek to test out theories of intervention from the literature, which has been applied to 1:1 consultancy situations between a consultant and a firm to test out the applicability of these methods to network

support. The literature identifies a number of consultancy styles (Schein, 1988, Harland and Knight, 2001) which can be categorised as information giver, expert, broker, catalyst and group maintenance roles.

- The information role seeks to support firms through the giving of relevant information, which has been seen as of value by the firm.
- The expert role requires a specific intervention to give direct advice on a problem or issue - the consultant provides the solution.
- The broker role actively seeks to engage interested parties to come together and develop a process or product.
- The role of catalyst for the facilitator is to confront the client with evidence or views on a given subject, which it is hoped will stimulate a change in the client to remedy the problem or address the issue.
- The last role – maintenance- is a process role wherein the facilitator establishes a relationship with the client based on mutual trust and reciprocity with issues being jointly discussed, but being resolved by the client. This last approach has in its methodology a good deal of reflection and the ability for the client to own the solutions, as well as to have a deeper understanding of the underlying causes as typified by the activity inherent in double loop learning (Argyris and Schon, 1996, Kolb, 1984).

These characteristics are also shared by Perrow in his analysis of successful networking (Perrow, 1992). The need for *"trust"* to be established allows for sharing of information, understanding each other's behaviour, long-term relationships, rotation of leadership and a feeling of togetherness as a community. Perrow feels these conditions are not possible in the "integrated production model" of the Vertical supply chain or the "nondependent sub-contracting model" which does so only partially.

The research, by testing these theories of consulting within a network situation, will also add to the body of knowledge in this area and prove useful to external agencies supporting the network processes within small firms. The capacity for the network members to learn from others and develop new strategies rather than have these *externally* imposed will therefore be a feature of the way the hypotheses will be tested (Mumford, 1995). The approach of facilitation within the context of network types and the hypotheses can be summarised in Figure 12:

Network type	New Products	New Processes	Facilitation Characteristics
Horizontal	Ideas generation	Cross company support	External chosen by the network, from brokerage to meetings facilitation
Vertical	Customer product support	QCD customer orientated	Direct through Customer or facilitator sourced by customer
Industrial District	Enterprises operating together	Specialisms within the network	Brokerage by one of the firms with external support from a governmental supported agency

Figure 12: The research hypotheses and network facilitation characteristics

2.6.4 Network processes –what is exchanged within a network?

Coupled with the need to explore network process, the nature of what might be exchanged in the networking situation, needs also to be raised. The review has noted the range of possible interventions from a supply/customer situation (Williamson, 1991), but what is the nature of the content of the exchange? "Hard" exchanges may be classified as materials or goods. However, there are a range of "soft" exchange items which will be of equal importance within the research such as information (which is more quantifiable as an object) to ideas, know how and to the creation of new thinking within the firms engaged in networking (Willax, 1999). Issues on competitive advantage are increasingly being seen in terms of know how to create new products and services (Tidd et al 1997).

It can be argued, moreover, that creating a successful know – how transfer system requires matching the type of experience to be shared to the method best suited for transferring it effectively (Dixon, 2000). In this respect, the definition of know how is how networks can support tacit knowledge in being made explicit through networking (Nonaka, 1991). These issue will be noted in the research methodology in both the way the firms engaged in networking are tracked and in the quantitative analysis of networking firms.

2.7 GAPS IN THE LITERATURE ADDRESSED IN THE RESEARCH

There is lack of clarity in definition within the network literature of the objectives for networking, whether social at one end or formal at the other. Lack of clear objectives for networks and networking is a problem throughout the literature, which specifically avoids the issue of networking typologies for supporting specific SME

objectives. This is particularly so in the context of "declining" industrial manufacturing sectors. The research is extremely timely, in that both traditions, Supply Chain and Industrial District, are challenged to provide an *underpinning networking rationale* for established industries to help them survive the increase of globalisation, the specific and complex cultural factors affecting regions and the need for small firms to compete in higher value added environments. There also is a lack of definition within the broad classification of networks to be able to further *categorise networks into types and to point to specific characteristics*. This lack of typology and network characteristics makes it difficult to assign benefits of one network versus another. There is a need to be able to categorise networks and to then seek to better understand behaviour to assign characteristics to specific network types. Policy makers need to work within the boundaries of an agreed classification in order to support small firms in appropriate developmental activities.

Furthermore, fundamental to the research hypotheses, is a desire to understand the underlying *dynamics of the process of networking*. Collaborative networking is seen as a "key" objective within the fields of supply chain policy, within those seeking the creation of vibrant industrial districts and "clusters" and in the process of technology transfer between firms and research institutions (Porter, 1985, Jarillo, 1988, European Commission, 1997, DTI 1999, AWM, 2002). Yet there seems to be a lack of critical mass of evidence to base an analysis in terms of pinpointing particular network methodologies for manufacturing firms as being effective in support of particular ends. Critically, the need for interventions in support of the different types of networks and the dynamics involved in the process of networking needs to support a better understanding *of the role of facilitation*, the characteristics required and the appropriate organisational forms that this might take.

2.8 LITERATURE REVIEW SUMMARY

The Literature Review shows the need to further explore the role of small firm networks in "traditional" manufacturing regions. Neither the Supply Chain literature nor the literature on Industrial Networks gives an adequate explanation for how a region's SMEs can work together in supply chains or in new forms of supplier/customer relationships to meet the needs of the 21st Century. The research, by highlighting the development of networks in the West Midlands, can also inform network development in other situations. What then are the gaps in the literature and how should the research design be designed to address these within the context of the hypotheses?

Firstly, the literature does not give a clear indication as to how small firms in traditional sectors can change fast enough to survive and thrive. *A longitudinal approach* would seem appropriate with an existing small group of firms to observe the steps taken by small firms in networks to improve processes and in support of NPD. These networks will be categorised from the literature, although they may not take the exact forms described in the literature and may be sub-sets within the main categories given the lack of concrete examples from the context of established manufacturing districts. Horizontal networks of firms from both traditions would seem to provide the most appropriate network form in which to test the hypotheses.

This approach would also benefit from some *recording at different stages* and then *analysis of characteristics* of the networking firms. A set of *Performance Indicators* would be helpful at the outset with other indicators to track network development. Performance Indicators (PI's) can test for degrees of heterogeneity and homogeneity

within the networking firms and the extent these factors support networking in the testing of the research hypotheses.

Secondly, the literature has few examples of small firm led networks from a *manufacturing tradition.* There are links from the artisan based small firm sector in Italy, but how can this model transfer to a regional context in the West Midlands?

Thirdly the need to understand the *stages of development* within a network or networks seems essential. The Supply Chain theories suggest a progression within partnerships between firms at all levels of the chain. This might suggest a *case study approach* with the researcher as participant observer to identify partnership formation, development and outcomes.

Fourthly, the need to test the applicability of specific techniques within the hypotheses is important. For example, will partnerships be applied in terms of mutual support within a supplier customer relationship in support of new processes and NPD? (Hypotheses One and Three).

Fifthly, within the Industrial District tradition, the research methodology needs to be able to capture any emergence of "hub" firms within *brokerage* arrangements, which may emerge from *the informal networks*. These hub firms in other contexts have a leadership role in new processes and in NPD. The research must not create networks to then examine but needs to build on existing combinations of firms and see what processes take place within the context of the research period. The research particularly needs to understand the reasons for the lack of "broker" supported SME networks in the region.

Sixthly, the research methodology needs to examine the issues around de-coupling within any horizontal networks of SMEs as trading entities. Can firms with aspirations of higher value added products come into loose arrangements whereby de-coupling is possible? The literature notes the prevalence of firms in low asset specific areas and the hypothesis on NPD must note the practicability of this. The emergence of knowledge based firms and the impact of de-coupling within network arrangements needs to be examined.

The seventh point is the need for *facilitation* to be broken down into its constituent parts as a process itself, which effects the stages of development in the networks. For example, the role of a *catalyst* needs to be understood and the role of *facilitator* of broker needs to be examined. The Italian Model has a system in which facilitation exists to support new technology, new markets, new forms of work organisation and new products. Such a "system" is not evident in the research region to the extent of the Industrial District Model.

The eighth point from the literature is related to both traditions (Supply chain and Industrial District) that of *cultural specificity*. This relates to particular cultural, political and economic factors that exist in any given region. This means that the research methodology must seek to find out what works for the SMEs in the region in a longitudinal non-judgemental way to develop an understanding of the needs of the firms. This needs to include the ability in the research methodology to note the input of a range of actors within the networks such as other intermediaries, Higher Education Institutes and business support institutions.

If *neither tradition* seems to be able to provide the key to the hypotheses and there seems to be a new typology of network arising from the two traditions, a new combination between the supply chain and district methodologies, then these factors need to be evidenced and discussed within the Research Methodology.

In conclusion, the literature suggests that an approach which is small firm focussed, longitudinal in nature, with Performance Indicators for testing characteristics, with a facilitated approach would be the way forward to test the hypotheses and to add to the body of knowledge on small firm networking. This strongly suggests an approach, which focuses on horizontal networks of firms within a thematic tradition with "vertical" relationships also tested in a control group. The approach needs also to be supported for validity within a wider group of firms from within the region, which can act as an extra test to the results of the case study firms. These approaches will next be described in Chapter Three.

The Review suggests that networks will be important elements in the design of new products and to support firms in the process of adding value to their products. The need for facilitation of the network process to enable small firms to develop network relationships is also critical from the literature. The research methodology designed to address these hypotheses within the context of *"horizontal" networks in the supply chain and Industrial District traditions and a Control Group will* next be described.

3.0 RESEARCH METHODOLOGY

3.1 UNDERPINNING RATIONALE

The hypotheses for the research, that networking can support new process improvements, foster a propensity for New Product Development and that Facilitation styles will impact on the way networking supports SMEs, all demand a research methodology which will seek to establish meanings and linkages within the behaviour of SMEs. The study of networks in small firms in the two traditions of Industrial District networks and Vertical Supply Chain Networks, has fallen into three broad approaches.

The first of these can be typified as ethnographic approaches where researchers have studied a small sample of cases in a longitudinal study. The benefits of this are clearly about gaining deeper insights into SME behaviour, both at the firm and inter-firm level. The drawbacks are in the potential validity of the results when tested within a wider group and the rationale for choosing a small sample.

Secondly, specific cases contacted for interview for hypothesis testing have been attempted. This has involved the researcher choosing a wider sample of SMEs perhaps from a selection of networks and interviewing the respondents to establish success factors and problems encountered in the network process (Huggins, 2000, Curran and Blackburn, 1995). This supports the results for reliability and for validity, but the weakness here is in the insights into behaviour which the ethnographic approach can address, that is the results may reflect factors which are external to the networking process but related to some other factors. Also, the small sample size can be an issue in terms of how representative the sample is of the wider population.

Thirdly the questionnaire approach to a very wide sample of firms, can overcome the reliability issue because of the wider nature of the study, but clearly offers fewer insights into network processes, the nature of the networking or the meaning of network typologies.

3.2 THE RESEARCH APPROACH

The approach for this research, therefore, significantly builds upon the positive nature of the three broad approaches described and mitigates against the negative factors. Therefore the approach selected consists of twelve SMEs, eight active networking locally and four in a control group, studied longitudinally over two years. Additionally quantitative methods will be employed, both within the twelve SME case studies and in a wider sample of firms based on a similar questionnaire as used in the longitudinal study. This approach can be shown diagrammatically in Figure 13.

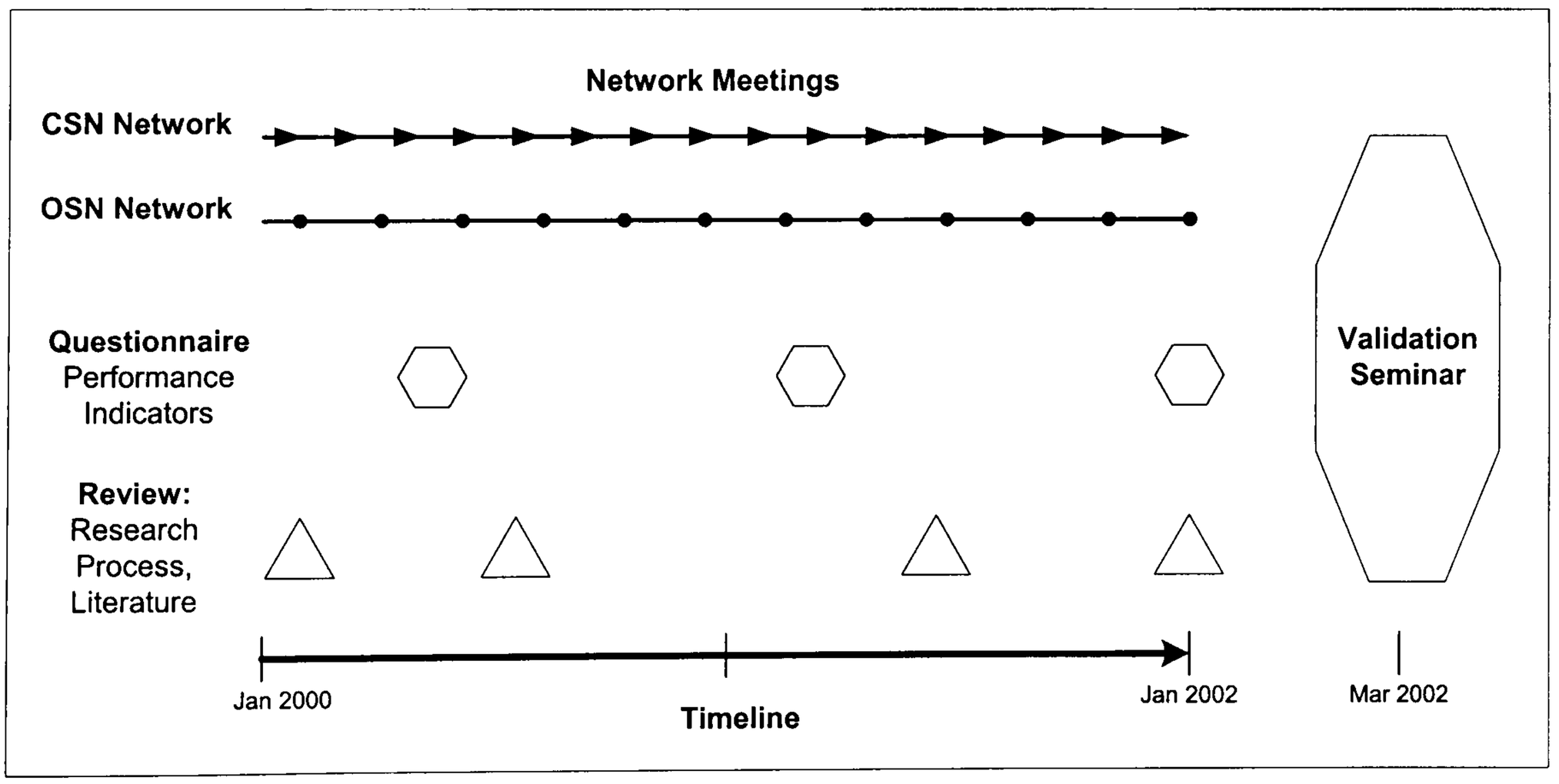


Figure 13: Data collection points and frequency of network meetings

The study of SME networks to support a greater understanding of the processes of networking requires a systematic research approach combining quantitative and

qualitative methodologies which will give the research the deeper insights which are essential to adequately test out the hypotheses.

A Case Study approach alone was considered as too subjective and qualitative. It would have been appropriate for a more "formative" approach to the Research Hypotheses, but this would have made quantitative indicators difficult to apply. Conversely, a wholly quantitative approach would not have been helpful in developing insights into small firm behaviour and would not have been an appropriate way of pursuing the Research Objectives.

In summary the research approach combines Case Studies of SMEs, a Questionnaire incorporating performance Indicators administered three times to each SME and a Postal Questionnaire administered to some incorporating statistical tests. Similar studies of networks (Borch and Arthur, 1995, Huggins, 2000) have focussed on selecting a representative sample and then administering a questionnaire often only incorporating a telephone survey approach. These approaches were not considered appropriate methodologies to test out the hypotheses, a more in-depth longitudinal approach was considered necessary, given the findings from the literature and the difficulty in finding practical examples of networking within the region with manufacturing firms.

A longitudinal approach was therefore adopted at the outset incorporating a Case Study approach as a methodology capable of building a context for the rich insights into network behaviour, which other approaches cannot adequately provide (Granoveter, 1985, Gummeson, 1988, Gibb, 1997). The approach significantly incorporates two quantitative aspects also, a questionnaire within the case study

companies and a wider questionnaire administered within a postal survey to test out the reliability of the emergent trends and data arising from the Case Study Networks. Additionally, the need for longitudinal research is confirmed by studies on the diffusion of technical innovation. Networks are "valuable forms for the acquisition of information" but how this is then utilised within the company needs to be understood as a process over time (Robertson et al, 1996).

This supports the approach suggested by Borch and Arthur. They feel that a case study approach which develops a set of measures to analyse relations is a good way to move beyond studies of large numbers of firms taken as "snap shots" which then" fails to understand the process of strategic learning" (Borch and Arthur, 1995). This is particularly so within the concept of small firm networks where there is an "urgent need for systems and mechanisms that allow coherent models of supply networks to be drawn" (New and Metropoulous, 1995). These are now described within the context of construct validity.

3.2.1 Construct Validity

Within the Network Case Study approach, 12 SMEs were the focus to participate within the longitudinal research process. These were chosen as representative cases in consultation with the researcher and the SMEs themselves and expressed an active interest in participating over the two-year time - scale. Twelve was seen as an appropriate number of cases in which to compare evidence (Yin, 1994) and for the researcher to be able to work with given the longitudinal emphasis of the research and the consequent time implications.

3.3 DATA COLLECTION

There were *three distinct methods* for the collection of data and the development of observations from the Networks.

Method One

This consisted of longitudinal collection of data within the companies. The research was conducted across the 2 networks and the control groups over a two-year period from January 2000 to December 2001. Additionally, the firms were individually surveyed as network members outside of the network meetings on a 1:1 basis. Each of the 12 firms was surveyed 3 times within the research process, at the start, middle and at the end. The underpinning rationale for this methodology and the choice of Performance Indicators is explained at the end of this section.

Method Two

The research developed into the study of eight of the Small firms:

- Four from the World Class Network (WCN) forming a distinct and new network which is set out in the research as a Closed Strategic Network (CSN),
- Four continuing within the ADAPT Club, which changed its emphasis and name at the start of the research process and is set out in this research as an Open Social Network (OSN) and
- Four from the WCN, which became the "Control Group" (CG).

The new network from the WCN then met on a monthly basis and the ADAPT Club network carried on meeting six weekly. These network meetings were fully minuted. The network meetings consisted of some 45 hours from the Closed Strategic

Network (CSN) and 17 hours from the Open Social Network (OSN). These networks will be further described in Chapter Four and analysed in Chapter Five.

Method Three

Within the longitudinal research process, interviews were held with all the SMEs on a 1:1 basis amounting to some 90 hours of contact time with the researcher. As well as these 1:1 meetings, several "ad hoc inter firm meetings" where the researcher was present also took place amounting to some 35 hours. These meetings consisted of discussions between the firms on a 1:1 basis arising from the network process and presentations by the firms to external stakeholders and customers. Significant meetings are described in the results section of this research as rich insights into small firm behaviour were gained as a result of the interactions. The discussions were captured by the researcher in note form and form the basis of the case study examples given in Chapter Four.

3.3.1 Choice of networks to test research hypotheses

The need to better describe and understand "networks" as entities and the underpinning processes is critical for this research activity in order to identify characteristics and benefits for particular network activities. As has been stated, at the start of the process eight firms from the WCN and 4 from the ADAPT Club were chosen to be interviewed on their impressions of networking and the need for further networks in support of their business needs. The eight WCN members were involved to a lesser or greater extent in Vertical Customer led networks with a regional and national scope.

The response from all twelve companies to the success of these vertical networks was not positive and the research methodology focussed on what was taking place within the sub-region, with the strong probability of subsequent contact being established within the vertical tradition if this became significant within the group. The methodology is therefore sufficiently flexible for change to be incorporated into the longitudinal study of networks and also into the questionnaire, which will be carried out at the end of year one with the wider sample of small firms.

Table 1 shows the potential permutations for the study of small firm networks to be found in the sub-region at the start of the research. From this initial classification, the research needed to focus on networks in situ (i.e. which exist and have regular meetings) and which can best test the hypotheses on new processes, propensity for New Product development and for commenting on facilitation styles.

Network Type	New Products	New Processes	Status at start of the research period
Horizontal	Ideas generation	Cross company support	Evidence of successful and sustained activity
Vertical	Product support for specific customer	QCD customer orientated	Customer led programmes for joint development with unclear benefits for the small firms
Thematic	Ideas generation	Specific focus on new techniques	The themed network with a particular focus was well established as a network type
Industrial District	Firms operating together as a manufacturing enterprise	Specialisms within the network	No examples from the small firms of this in action in the sub-region.
Business Group	Promotion of individual firms emphasis	Limited emphasis	Limited emphasis on processes made this difficult
Homogenous groups	Pooling of product knowledge	Sharing of best practices	No examples given at the start of the research
Technical partnership/Value Added partnerships	Collaboration to meet customer needs	Sharing of best practice	No examples evidenced from the initial discussions with small firms

Table 1: Network Position at the start of the research process

From the literature analysis and to test the research hypotheses, therefore, The Industrial District network type, the Business Group network, Homogenous network and value Added partnerships were discounted at the start of the research as foci for the SME cases. (They will all be re-examined in Chapter Seven when conclusions from the research are made).

The research therefore, focuses on Networks, which are

- Horizontal
- Thematic and
- Vertical

3.3.2 The Thematic Network – The World Class Network

These are loose associations of firms coming together to receive insights in the current best practices within a sector mainly from the automotive community context. The network is characterised by regular monthly meetings with an external speaker who speaks on a topic of current interest to the group. The Network is be facilitated externally by a third party seeking to promote "best practice" to the group. The emphasis is therefore developmental in intent, seeking to widen the horizons of the potential of the participants by sharing practices from other firms and sectors. The composition of the group may well be mixed with medium sized and small firms attending. Interaction at the event will necessarily be fairly limited but there may be social interactions, which may lead to low levels of collaboration. (e.g. factory visits between one or two members and information sharing of topics of mutual interest). The World Class Network had been formed in 1997 and consisted of firms from the Vertical Supply Chain tradition. It was classified as a "Thematic Network" within a supply chain environment (Fombrun, 1982) Eight of the firms were interviewed at

the stage when the literature review was being constructed to find examples of networks within the Vertical tradition with a strong emphasis on the automotive sector. It soon became evident that there was a lack of such networks within the sample of firms. The needs of four of the firms from the WCN (all of whom are strongly automotive biased) supported the establishment of a new network, which can be described as a "horizontal" network within the vertical supply chain environment – a hybrid form.

The literature review had already highlighted the propensity of such a network form to have the appropriate characteristics for success as a network (Huggins, 2000). The researcher established contact with the 8 firms in the WCN and visited each in turn to review the progress of the network and discuss their ideas for future plans and their willingness to participate in a longitudinal piece of work. Four expressed an interest in how they could proceed with networking as a group as well as attending the WCN. The other four firms from the WCN were not engaged in consistent networking activity, nor did they state they wished to address this situation. The four firms each had business development issues they wished to pursue but did not see networking an increase in networking itself as a key methodology in support of their objectives. They were infrequent attendees of the WCN, so whilst networking firms were unclear of the benefits of enhanced local and regional networking. These firms were chosen as the Control Group.

3.3.3 The Horizontal network – The ADAPT Club

This network form is collaborative in nature. It has a theme of sharing common problems whereby group members will articulate issues and seek feed back from others in the group. High levels of trust must therefore be present and the group must

perceive that members share common experiences to make observations valid. There will not necessarily be a supply-chain relationship in the group, nor need there be a sectoral focus. The characteristics of the members will be to explore new ideas to help them as managers improve business processes. Facilitation will be necessarily externally focused at first but will move internally once established. The Network will have a strong social dimension and will be perceived as important for the group members.

The ADAPT club is a horizontal (general interest) network. The "horizontal" network such as business clubs seek to build upon a common sense of interest rather than sector. The prime aim of the ADAPT club is to enable SMEs to share experiences with each other and again it meets on a monthly basis. The majority of the members of these networks are owner-managers of manufacturing SMEs. The network from the ADAPT Club was again "horizontal" in nature, but represented many of the characteristics of the Industrial District Tradition made up of small craft firms run by an owner manager and supplying a diverse manufacturing base. The possibility of Customer led Partnerships or for Industrial District brokerage models, was not ruled out by this process – but it did reflect the situation of the firms at the start of the process where partnership relationships were hard to evidence.

The Horizontal Network form was therefore chosen by the firms as the most appropriate form from which to develop further from the Thematic WCN and the ADAPT Club confirming the strong indications in support of this from the literature review.

3.3.4 The Vertical Network tradition

To, recap, these are small firms in a Supply chain within a pyramid of relationships. Vertical networks can vary from Tayloristic (Giordano, 1992) manifestations to "partnership" forms (Lamming, 1993, Hines and Rich, 1998). They have a transactional focus in that the participating firms are involved in the manufacture of a product for a common customer. In some cases the network itself has an exclusively product focus in that a common product is the purpose of the relationship. The initial concerns in the vertical network will be on Quality Cost and Delivery. Change will probably come from the top of the hierarchy within the supply chain and not from the SMEs within the network. Such networks are extremely customer focused and accordingly rely on this stability as a critical maintaining factor within the group of firms. External facilitation may be informal/minimal and may be supported from "the customer" within the group.

The research will note these relationships as they emerge from the twelve firms. The literature review, whilst evidencing network forms from the vertical tradition in which to test the hypotheses, was not borne out by the initial interviews with the firms from the WCN or the ADAPT Network. These firms were all sceptical of the benefits of customer led networks in developing New Products and for new processes. The WCN firms had all engaged in extensive QCD training programmes supported by Industry Forum, specialist trainers and the Higher Education sector. The ADAPT Club members were sceptical as a group of the merits of the QCD approach and saw the approach as "systems" orientated with a focus on the medium sized enterprise rather than the smaller owner managed firm.

3.4 THE CASE STUDY METHODOLOGY

It was decided to capture the changes and development which were taking place in the SMEs at regular six-monthly intervals. A two-tier approach was adopted; the first approach comprised a standardised questionnaire. In each case the selected SME was requested to complete a questionnaire at each interval in conjunction with a researcher. The second approach entailed collection of data based on observations, discussions, informal and formal interviews with the owner-managers at a regular intervals either during network meetings or during site visits to the companies. These were then compiled into case studies. The researcher spends at least one session per month with each firm as well as supporting the firms in network meetings. Activity with the firms also fluctuates with the demands made by individual networks. This approach enables the researcher to make *unique* insights into performance, which are more in-depth than a questionnaire approach alone can provide (Eisenhardt,1989). Borch and Arthur (1995) point out that the use of case studies provides rich insights into the behaviour of the SMEs in complex and fast changing situations, which quantitative methods alone may miss. The approach also allows the researcher to focus on dyadic relationships within the larger network (Fombrun, 1982).

This regular interaction approach also picks up social issues in the context of business decisions made by the SMEs (Granoveter, 1985). The approach of information exchange and research methodology can be seen in Figure 14.

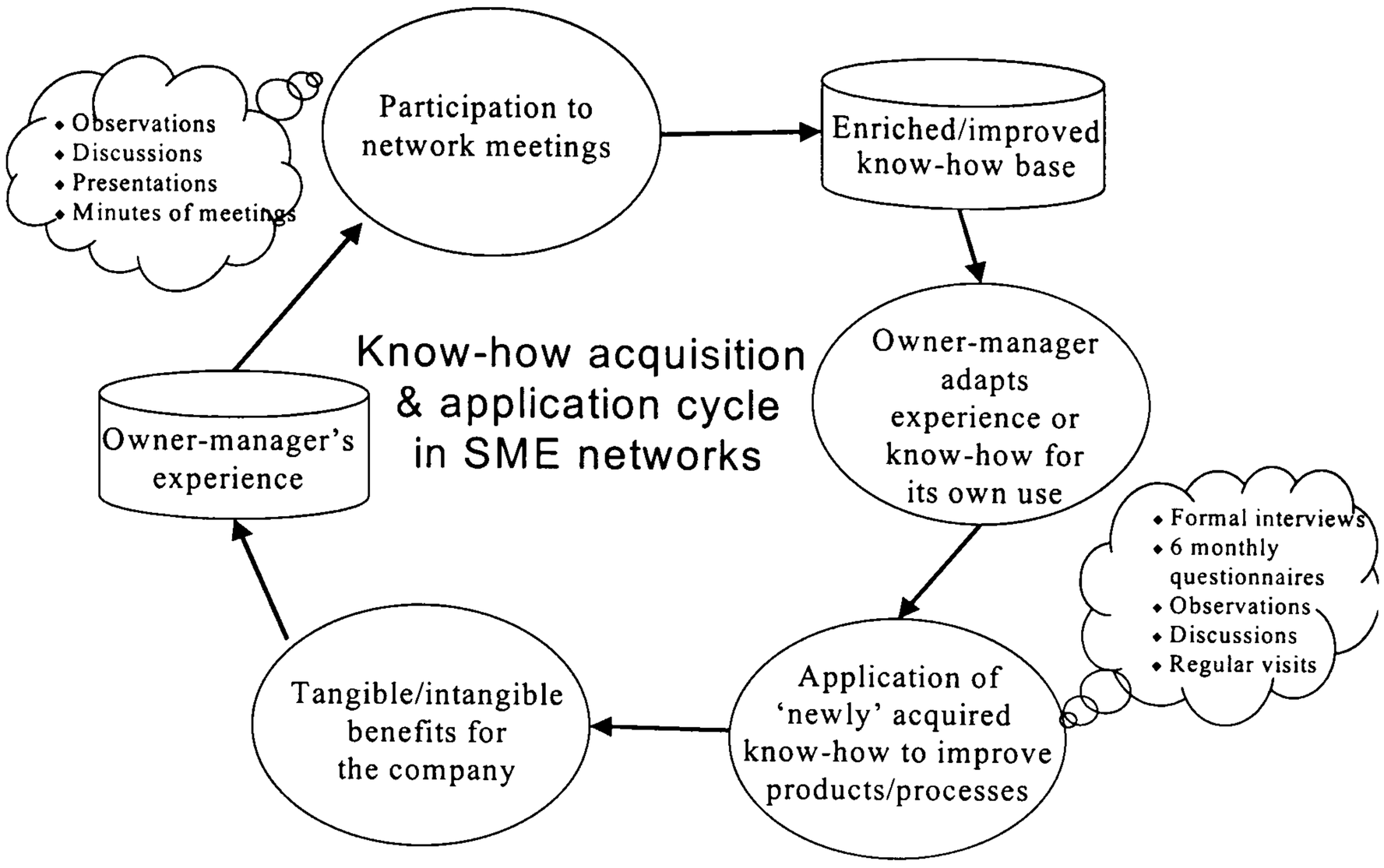


Figure 14 : Illustrates the typical cycle for know-how acquisition and application in SMEs and research data collection points

The researcher was the Co-Facilitator of the Adapt Club, a role, which was re-established with the re-focus to the Open Social Network. The researcher was also asked by the four firms in the new Closed Strategic Network emerging from the WCN to act as facilitator to the group. This was important at the start of the research, as it gave the researcher access to all eight companies and enabled deeper understanding of the issues, insights, which would have been difficult to gain perhaps, if this role had not been suggested by the small firms (Chetty and Sylvie, 1996).

3.4.1 The Rationale Underpinning the Network Questionnaire Approach

A Questionnaire approach was seen as a key part of the case study research methodology. This questionnaire with a series of key Performance Indicators, "P.I's" (see Appendix One for a copy of the Questionnaire) was administered three times with each SME at the start, mid-point and end of the research. The Questionnaire covered key aspects of manufacturing strategy and practice. The Performance

Indicators were chosen as representing areas of manufacturing performance, which are considered to be critical for success. It is important to note that the SMEs selected all aspire to be "World Class" in their field, in this sense they are not representative of the wider population of SMEs, but this is redressed to some extent in the survey approach. However, there must be a presumption to wish to change for a SME to participate in networks over a sustained period in any event. The PI's were chosen to show trends within the two networks as well as the Control Group. The assumption being was that these heterogeneous SMEs from different supply chains and in different manufacturing processes would have broadly similar characteristics in terms of manufacturing performance, quality, financial performance, attitudes to change and networking expectations in order for interactions to take place. Where differences were apparent then these can be analysed for impact on subsequent network development. (I.e. specific strengths could be traded off in one area to support weaknesses in another for each of the SMEs, a notion of reciprocity). The Research Hypotheses, however, do suggest an element of a common trend between the firms in order to network effectively.

The use of PI's also provided some objective evidence from the firms to counter any perceived bias from the researcher as facilitator, on presentation of the evidence of networking.

3.4.2 The Rationale for the Performance Indicators

The rationale for the Performance Indicators (PI's) is supported within the characteristics of Virtual Organisations with a "focus on customer needs, existence of trust, effective communication, use of appropriate technology and organisational structure and new leadership methods" (Christie and Levary, 1998).

These characteristics are also supported by the "resource based" view of the firm (Fuchs et al 2000) with a focus on "direction, product market focus, resources, operational capabilities and organisational culture". These approaches can then be seen in the context of a series of "trade offs" (Hill, 1993), which are internally and externally consistent to manufacturing strategy. The PI's can also be seen in the context of the SME then having a primary focus on one objective as its success strategy (Prahalad and Hamel, 1990 and Porter 1985) innovating within the context of its marketplace.

QUESTIONNAIRE-PERFORMANCE INDICATORS (PI's)	SPECIFIC RATIONALE
SPEED, Order to despatch, efficiency of planning and scheduling	Ability to be "Agile" (Kidd ,1994)
DEPENDABILITY, customer schedule, late delivery, planned maintenance, investment	Resource based view of the firm (Prahalad and Hamel ,1993)
RESPONSIVENESS – Volume and delivery	Flexible specialisation (Piore and Sabel, 1984, Appiah – Adu, 1998)
RESPONSIVENESS – Design	Ability to develop new products (Porter, 1980, Clark and Fujimoto 1991, Rothwell, 1992)
QUALITY-Systems & response to customers	Best Practice, (Schonberger, 1991)
CULTURE, training, questioning how things are done, response to ideas from the shop floor, implementation of these ideas & workforce flexibility	Learning Organisation (Senge, 1990, Argyris and Schon 1996, Lucas, 2000)
ICT & communication, internal and external	Ability to utilise ICT strategically (Poon and Swatman ,1997 Venkatraman, 2000)
NETWORKING – 10 factors	Networking as a characteristic to aid business performance. (Piore and Sabel, 1984, Jarillo 1988, Rothwell, 1992, Twiss, 1995, Lamming et al, 2000)

Figure 15: Rationale for Performance Indicators

3.4.3 Reliability

A potential problem with case study research is the ability to generate general hypotheses from a small sample. However chosen, randomly or by SMEs themselves and or with the Researcher having his/her own criteria, there remains an issue of reliability when testing and reporting on the hypotheses. The research process, therefore from the start incorporated a quantitative element as a means of testing with a wider SME group the emergent hypotheses from the case studies. This survey incorporated a Questionnaire distilled from the Performance Indicators from the Networks, which was then *posted to over 2000 firms* in the region. Responses were then codified into three types, firms with currently no network membership, firms with participating in one network and firms involved in multiple networks. SPSS was

then used to analyse the results from the Questionnaire and then compared with the data and cases study experiences of the 12 SMEs in the longitudinal study.

The use of statistical tests is explained below:

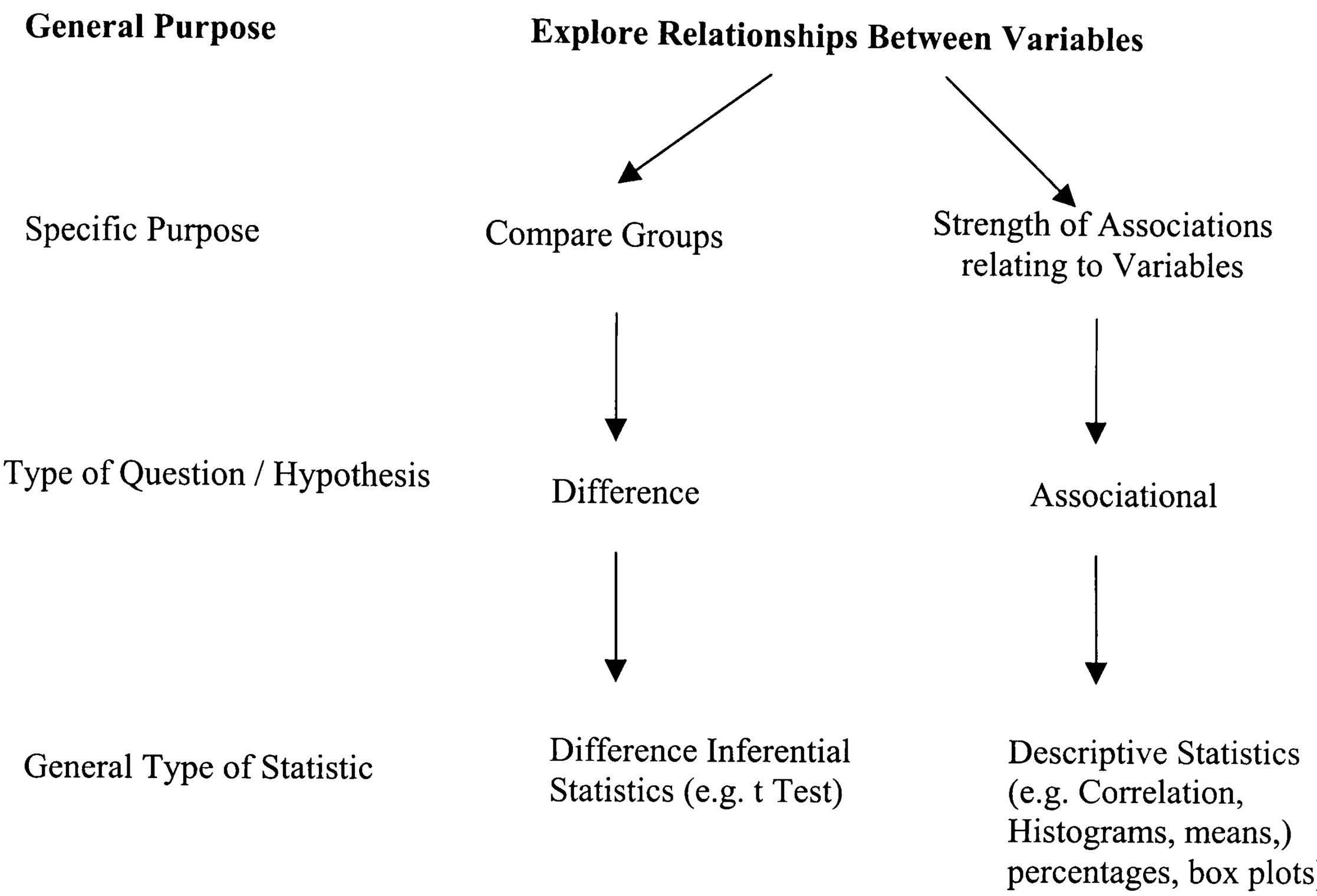


Figure 16: Use of Statistical Tests

(Source: SPSS for windows, An Introduction to use and Interpretation in Research: Morgan, G.A., Griego, G.V and Gloeckner, G.W., Pp17)

Statistical tests fall into two categories, **Parametric** and **Non Parametric** tests. Parametric tests makes it possible to calculate proportions of total variability in scores which are due, on the one hand, networking activity and, on the other, to unknown variables affecting subject performance. Use of a parametric statistical test provides the percentage probability of obtaining a particular ratio by chance is low **($P < 0.05$),** thus enabling rejection of the null hypotheses (which states that the results are attributable to unknown variables) and the results of the experiment can be interpreted as supporting the experimental hypotheses (Greene and d'Oliveira, 1982, Coolican, 1996).

On the other hand, Non parametric tests, rather than calculating exact numerical difference between scores, take into account whether certain scores are higher or lower than other scores. Non parametric tests can be used to measure experimental data only at the ordinal level; that is when it is only capable of being ranked in order of magnitude.

Greene and d'Oliveira (1982) outline below the advantages and disadvantages of using parametric and non-parametric tests.

Parametric Tests: Advantages

1. Parametric tests are more powerful or robust because they take into account more information about difference in scores. This makes them more sensitive in picking up significant difference between subject performances in different experimental conditions.
2. These tests enable to analyse interactions between two or more variables.
3. They measure the exact proportion of the total variability in scores, which are due to difference between experimental conditions.

Disadvantages

1. It is important to meet three mandatory requirements
   - Interval measurement
   - Normal distribution of data
   - Homogeneity of variance
2. The mathematical calculations are somewhat more complicated.
3. Sample size should be sufficient (> 10) to get a more accurate result.

Non parametric tests: Advantages

1. They are useful in investigating the effects of single variables when your experiment data does not meet the three requirements of parametric tests.
2. They are useful to depict trends as well as overall difference between experimental conditions.
3. The calculations are easy and quick to do.

Disadvantages

1. Non parametric method of putting scores into rank order is only measuring the variability in subject scores indirectly and hence less powerful than parametric tests, as they are less likely to pick up significant differences.
2. Use of this test confirms to looking at the effect of single variables in isolation and not allow to investigate interactions reflecting the combined effects of several independent variables and ignores a lot of the complexity of human behaviour, which is otherwise accomplished using parametric tests. This is particularly appropriate within the context of network analysis where associations between factors need to be examined.

Furthermore, the possibility of using other techniques (i.e. Analytical Hierarchy Process - AHP) to enhance the data analysis in the research was also explored. AHP is a decision –aiding method developed by Saaty (1980). It aims at quantifying relative priorities for a given set of alternatives on a ratio scale, based on the judgement of the decision maker and further stresses the importance of the intuitive judgements of a decision maker, as well as the consistency of the comparisons of alternatives in the decision making process (Saaty, 1980). Al- Harbi (2001) argues that the strength of this approach is in its ability to organise the tangible and

intangible factors in a systematic way, thereby providing a structured yet relatively simple solution to the decision-making problems. However some of the criticisms of AHP (Al- Harbi, 2001) is that in order to elicit the weights of the criteria by means of a ratio scale, the method asks decision-makers meaningless questions, for example: "Which of these two criteria is more important for the goal and by how much?". It was also deemed unsuitable for use with owner managers in small firms as it was considered as potentially unhelpful in building up trust and rapport within the networks themselves and with the researcher particularly at the start of the process. This method can also suffer from rank reversal thereby distorting the selection (Al-Harbi, 2001) and finally, for large evaluations, the number of judgements required by the AHP method can be somewhat of a burden. For the above reasons, AHP was deemed as inappropriate method of data analysis for this study and hence disregarded.

In view of all the above findings, parametric statistical tests were considered most suitable for tests for the analysis of data in this study, and hence selected. **'SPSS 9.0 for windows'** is the software package that has been used to carry out the statistical tests. The results from the questionnaire were tabulated and analysis carried out in three stages for the Network Groups and a wider postal survey for comparison. Performing the tests in this manner aided in the comparison of the research network results with the results of the Questionnaire, thereby enabling a greater understanding of the behaviour of the firms to network participation.

3.4.4 External Validity

How can the research findings be tested within an external environment? The hypotheses were presented at a number of external settings during the research period, from academic conferences to strategic meetings with small firm support agencies responsible for SME network strategy. The SMEs themselves were actively engaged in the process within an iterative evaluation framework reflecting on the progress of the networks and the possible causes for network behaviour. The results and analysis were also disseminated at a national seminar at the end of the research process with invitees from SMEs, SME support organisations, research organisations and HE institutions engaged in this area of work. Feedback from this event was included in the research conclusions at the end of Chapter Seven. The major business support initiative in the automotive sector, the Accelerate Partnership, itself adopted support for "Horizontal Networking" as one of three strategic planks in its £70m support programme to help small firms adopt new processes and develop new markets. This was presented at the January 2002 meeting of the CSN.

3.5 SUMMARY OF RESEARCH METHODOLOGY

The approach to test the hypotheses is a combination of both qualitative and quantitative techniques. The qualitative consists of a longitudinal study of eight SMEs over a 2-year period. To record their activities and observe their behaviour during networking there will be a further 4 SMEs as a Control Group which will not be regular networking companies. Performance Indicators will be developed from questionnaires administered at three stages in the research (to start middle and end) to obtain a view of how the firms are progressing. Furthermore a set of characteristics will be developed from the networking literature to apply within the case study firms to measure soft indicators. These results will then be compared and

contrasted with a wider sample of SMEs from the region through a postal questionnaire. The findings from all this activity will then reflected back within the current literature on networks. The research methodology therefore itself represents an innovative approach to the study of small firm networks combining both qualitative and quantitative traditions.

4.0 RESULTS OF CASE STUDY FIRMS AND REGIONAL QUESTIONNAIRE

4.1 INTRODUCTION TO THE CASE STUDY ACTIVITY AND THE QUESTIONNAIRE RESULTS

Firstly the results of the networking activity will be presented detailing the developments within the twelve firms over the two years. The way the networks have themselves changed over the research period will then be described. The key areas will be common to all three to support a consistent approach and to enable comparisons. These will be a description of the historical context, the network aims and objectives, the operational activities (key events, issues, and challenges) and a summary. Following these results, the Case Study firms will be further reported upon in respect of their attitudes to networking and the data from the Performance Indicators again in the three stages covering the research period. This data will be presented as eleven "One Sample "t" tests" and three "Paired Sample "t" tests". The Network Questionnaire is shown in Appendix One. Representative views of six of the firms are included in Appendix Two to be read in conjunction with the results and to add context and to give further clarification to the data.

Secondly, the results from the postal questionnaire of the larger population of SMEs will be presented giving comparative data from which further analysis will be presented in Chapter Five comparing the results on networking activities with this larger sample and the results from the Case Studies. The questionnaire data will be presented as eleven One-Sample "t" tests and three Independent Sample "t" tests.

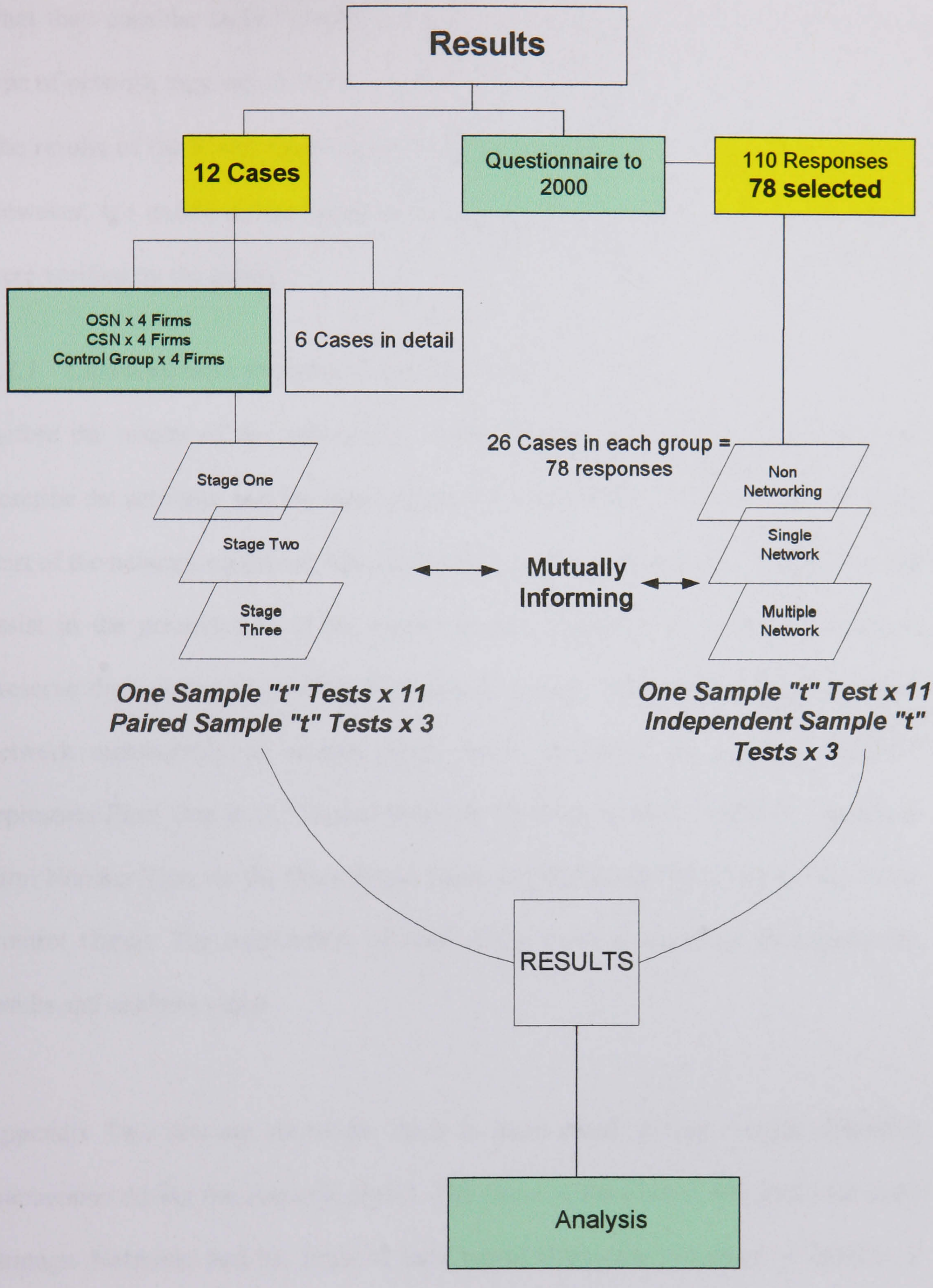


Figure 17: Overview of the Collection of Data Process and the Presentation of the Results.

Additionally, comments from the Postal Questionnaire cases will be presented on what they consider to be "successful and unsuccessful" networks as well as what type of network they would like to see more and or less of.

The results of the Postal Questionnaire are opinion based and therefore, subjective. However, the questions are based on those tested on the Case Study firms, which were verified by the author.

4.1.1 Characteristics from the Case Study Firms

Before the results of the networking activity can be presented, it is necessary to describe the activities and key characteristics of each of the participating firms at the start of the networking period. This will both inform the analysis in Chapter Five and assist in the presentation of the results in this Chapter. The firms are coded to preserve their anonymity within the research process. The coding represents their network membership or control group status, therefore, for example, "CSN1" represents Firm One in the Closed Strategic Network (CSN), "OSN 3" represents Firm Number Three in the Open Social Network (OSN) and "CG2" Firm Two in the Control Group. The codification of each of the firms is the same throughout the results and analysis stages.

Appendix Two sets out six of the firms in more detail, giving insights into their interactions during the research period. The firms in the Closed Strategic and Open Strategic Networks and the firms in the Control Group are presented in Tables1, 2 and 3.

Network Code	Nature of Business	Turnover (Million Euros)	Key Characteristics Closed Strategic Network
CSN 1	Metal Finishers	2.4	Small firm. High quality finishing for metal industry. 70% Automotive Second Tier to BMW, Vauxhall, Toyota and Nissan. 33 Employees. ISO 9000, ISO 9002 ISO 14001.
CSN 2	Press workers	2.0	Specialist automotive presswork. BS5750, ISO 9000 Press of 100 Tons. EDI. Automotive orientated. 35-40 employees
CSN 3	Toolmakers	4.8	Combination of 3 tool- making firms. Hot & Cold forming tools, CNC machining, EDM and Wire Erosion. ISO 9002. 70 employees
CSN 4	Metal formers	3.6	Sheet metal for specialist auto market, precision Metal Cutting, Fabrication, Welding, Laser Cutting. High growth. 54 employees

Table 2: The characteristics of companies in the Closed Strategic Network start year one

Network/ Network Code	Nature of Business	Turnover (Million Euros)	Key Characteristics Open Strategic Network
OSN 1	Badges & Regalia	2.4	Family owned, focus on securing "one off" special orders. Growth through acquisition. 20 employees
OSN 2	Flock coating	1.0	Niche market for specialist "enhancing" process in Europe. 80% automotive, Jaguar and Nissan. Two sister companies in jewellery business. 13 employees. Growth through acquisition and partnerships in Europe
OSN 3	Springs / general engineering	3.6	Family business. Spring manufacture with diversification into CAD /QA & consultancy. 8 employees
OSN 4	Stationery Manufacture Presswork	1.5	Diversification strategy – 3 companies' metal parts for stationery, auto-sports, and office furniture. Old premises in City Centre. 27 employees

Table 3: The Characteristics of Companies in the Open Strategic Network start year one

Network/ Network Code	Nature of Business	Turnover (Million Euros)	Key Characteristics The Control Group
CG 1	Presswork and welding	6.0	Part of group, but is a "stand alone" entity. Automotive market. 80 employees.
CG 2	Heat Treatment hardening	0.4	Small firm focusing on diversifying "heat treatment" skills into new market/technology areas. 9 Employees.
CG 3	Precision turned parts	6.0	Recently moved to larger premises. Substantial new investment in ICT/CAD/CNC. Rover Supplier implementing diversification actively. On – line auctions. 47 employees.
CG 4	Plastic injection Moulding	33.0	Award rich in mid 1990's. Tool-room, in-house robotics, technologically rich, cellular manufacture. 320 employees.

Table 4: Characteristics of Companies in the Control Group start year one

The key issues facing these firms at the start of the process were very clearly related to the hypotheses, particularly on new customer acquisition. The participating SMEs were all facing massive changes in the supply chain, affecting lower value added firms as well as high value add companies as OEMs re-configured their supply chains based on European and Global supply chains (Hines et al, 2000).

Issues around markets and marketing were critical and indeed remain so at the end of the research period. These issues are described for each company at the starting point of the research process.

	New product Development	Process Improvements	Network Facilitation
CSN1	Lack of high value add product	Extensive participation in customer based improvement programmes. Business Excellence model adopted	Highly participative. Keen to champion the idea of a "mechanism" to attract new customers
CSN 2	Problematic – highly dependent on automotive	Excellent – Accelerate SME of the year	Wary – commits to some activities. Follows lead of CSN 1
CSN 3	Based on solving customer problems	Not a priority	Wary and sceptical of support agencies
CSN 4	Rapid Organic growth	Speed, dependability issues	Enthusiastic – keen to support the facilitator with "brokerage" idea
OSN 1	Tension between NPD One Off "specials" and core business	Issues around internal controls	Used to external "coaches" to support aims and develop thinking
OSN 2	Niche developer, transnational links	Automotive biased	A "loner" – strong opinions
OSN 3	Shift from traditional to new ICT based	Dependent on 1-2 individuals	Keen to support facilitator with technical expertise
OSN 4	Declining product base – need to diversify	Reliant on MD	MD uses external facilitators and mentors regularly. Keen to support facilitator and the group
CG 1	Declining customer base, weakness in group re products also	Many adopted, weak internalisation	Fire-fighting – happy to talk on a 1:1 basis
CG 2	Declining product base	Struggling to comply to maintain existing position	Heavily into support programmes – but lack of focus
CG 3	Imperative need for new customers	Excellent systems	Neutral to idea of external facilitation
CG 4	Lack of new products		Internal, led by MD. Happy to discuss with facilitator on 1:1 basis

Table 5: Stage One, Start of networking

Company Case Studies for six of the firms are presented in Appendix Two (CSN1, CSN 4, OSN 1, OSN 4, CG2 and CG 4). These give insights into the activities and views of the SMEs during the research period. Table 6 summarises the turnover % increase/ decrease experienced by the firms during the period. Generally, the firms were more optimistic at the start of the research than was borne out during the period.

Type of Network	%Turnover Growth Start	Mid Point	End Point
CSN1	0	10	20
CSN2	20	20	10
CSN3	5	5	3
CSN4	10	25	10
OSN1	20	40	10
OSN2	0	0	0
OSN3	20	0	-20
OSN4	10	0	0
CG1	-20	5	5
CG2	20	0	0
CG3	5	0	0
CG4	-15	-6	0

Table 6: Changes in turnover within the SMEs during the networking period

CSN firms anticipated turnover growth as a network, but there are large variations which reflect their particular circumstances and indeed their concerns as manifested in network and 1:1 meetings. The over-all figures also mask large fluctuations between customers and the need to maintaining growth or at least stability by attracting new customers to replace lost/declining orders. Generally, the CSN firms did better than the firms in the OSN who did better than the CG firms. The CG firms were all facing large fluctuations in turnover, two were in decline at the start which has been redressed at the end and one anticipated 20% growth which reduced to zero growth by the mid –point.

This adverse effect of sudden and substantial change in the order book may perhaps be related to attitudes on networking and appropriateness when faced with critical situations where management time and energy may need to be turned internally. Paradoxically, it could be at this very time when networking for ideas and information may be of most value. It will be worth discussing this particular point with the CG firms to see if at the end of the period they are more ready to network.

4.2 THE CLOSED STRATEGIC NETWORK

4.2.1 The context of the CSN

At the start of the research period, a number of SMEs known to the researcher were contacted to seek to establish their views on an existing network The World Class Network WCN. This network had been operational for two years and consisted of a monthly meeting at the University of Central England (UCE), which was led by an external visiting speaker on a current topic of interest to an aspiring World-Class firm. Attendance was open to several delegates per firm and to students and business support intermediaries. Eight of the founding members of the WCN were interviewed to establish their views on the network and potential new directions the network could take (supported by UCE, the facilitators). These eight firms became the CSN and the Control Group.

Firm CSN1 was interviewed following a WCN event following displeasure at the launch of a Productivity Improvement Group – the firm had participated in a similar initiative and had specifically voiced an opinion that "customer focus" was his firm's principle priority. The subsequent interview was around possible SME networking which would be of benefit to the company and the outcome was around pursuing a "mechanism" whereby World Class suppliers could be directed to World Class customers in order to pursue new business relationships. Company CSN 2 was suggested at this stage to be approached to seek views, which was undertaken 1:1 with the firm and firms CSN 3 and CSN 4 were both suggested in a subsequent joint meeting with the Facilitator and CSN1 and CSN 2.

4.2.2 Aims and Objectives of the CSN

The expressed needs of the four firms were to move away from discussions on broad topics of "QCD" to more focussed and in-depth exchanges, particularly relating to new customers as the changes in automotive supply chain behaviour were beginning to occur. There was also a business need to find alternative strategies to shore up customer base for two of the firms (particularly CSN 1, 2 and 3) and to seek possible production support in CSN 4 to meet new demands from customers as current capacity was very stretched. These early issues were then taken forward to the October 2000 meeting where meeting format, identification of strategic issues, common needs, external support mechanisms, participation from the companies and delivery of the needs were all discussed. These ideas were then developed by the Researcher into Terms of Reference (TOR) which, were ratified at the November meeting.

The key points relate to four areas of activity, namely,

- To establish a mechanism whereby the firms are presented to large customers in order to develop relationships in new supply chains.
- To identify and discuss current issues of common interest within the network and then commission appropriate intervention activities such as consultancy/training and to evaluate and disseminate outcomes.
- To identify areas of expertise within the group and to then create a culture where the strengths of one member can be used in support of the others. This will be supported at network meetings and in cross company teams on specific topic areas.

- To investigate the prospect of formalising the relationships within a common "virtual" organisation – the Broker idea. This will involve the network acting on behalf of all its members in marketing, sales and project management role. This will evolve steadily over time, growing at a pace dictated by the members and in such a way as to maximise the skills and experiences built up over the years within the member companies.

The Terms of Reference for the CSN were seen as important for several reasons. Firstly, to commit the group to a common agenda for action which could then serve as a measure of success, as a means of securing finances for the Accelerate programme. Secondly, for agreed joint actions and as a means by which the Network could establish a focus for itself in the area of business support organisations and other larger firm networks.

Thirdly, to pursue Objective Four, the Brokerage, which was championed by firm CSN 4, which saw the network as being a possible source of production support for its capacity problem. An early opportunity to develop the TOR was presented by links to a large firm national network (The Inter Company Productivity Group - ICPG) which had been approached by Birmingham City Council to sponsor 10 Birmingham SMEs to participate in their deliberations. One of these firms, CSN1, had already made contact and saw an opportunity to pursue the objectives of the network by exposing the firms to this established large firm gathering.

4.2.3 Relationships with other networks

4.2.3.1 The Inter Company Productivity Group

The CSN presented its TOR to the Inter Company productivity Group meeting in Warwick early in 2000 with the express purpose to investigate the potential for

synergies. This was followed by the CSN hosting the ICPG in Birmingham where the ICPG fed back on the challenges facing the CSN. This feedback can be summarised as the ICPG companies feeling that the SMEs in the CSN needed to change and become responsive to global demands of larger customers, to become more marketing orientated and seek more partnership working in the automotive sector. The idea of a "breakthrough activity" to support strategic thinking (adopted over a year later by the CSN and an external consultancy firm, "Winning Moves") was first suggested by ICPG, but at the time was not taken up.

4.2.3.2 Visit to 3M Innovation Centre

These interactions were then followed in the Spring of 2000 with a visit to 3M in Bracknell which was planned as an attempt to be stimulated by a highly new product development firm to establish indicators for individual SME and network support. The results of the visit to 3M will be the focus of the detailed analysis of firm CSN1 (with clear link to firm CG 4). In brief, 3 other firms, CG 4, accompanied the network and CG 2 plus another SME suggested by a facilitator also working with CSN1. The novel idea of coating metal onto plastic was suggested by CSN1 at the 3M event. 3M did not see the potential for further action, but the discussion led directly to the accompanying firm (itself a plastic moulding company) suggesting CSN 1 contact Dupont. Significantly, this then led to a commercial application between Dupont and CSN1.

4.2.3.3 Network activity in Birmingham following ICPG and 3M

The format of the monthly meetings had by now settled into a formal agenda to be presented a week prior to the meeting, which took place on a rotational basis between the four companies. The Host Company also made a tour a possibility in about 50%

of the meetings at the start. Each of the key network objectives was discussed and from this arose the transfer of know-how, which will be described in Chapter Five. The Facilitator took minutes noting agreed actions, which were then transcribed and circulated around the group within a week of the meeting by e-mail.

4.2.4 Developing Objective One – the Mechanism

There was also a series of meetings with Advantage West Midlands AWM on the idea for a marketing mechanism (Objective One of the CSN) by which large firms might be introduced to SMEs. The Regional Development Agency, Advantage West Midlands, has a strategic interest in supporting clusters as a key part of its regional regeneration strategy. The networking methodology represented by the CSN is therefore important as a test to see how networking can be supported in SMEs. The development of the mechanism took a good deal of time, from mid 2000 to late 2001 to establish need and to find a resource to undertake the setting up of an "intelligent" database to enable customers and the five SMEs to interact. This is still to be resolved, reflecting the time frame difficulties in such structural forms. The approach reflects a "systems" approach to securing new customers arising from the vertical supply tradition. Results on successful adoption of the mechanism are not available at the time of writing.

4.2.5 Developing Objective Two – strategy and marketing plans

The need to develop strategy was seen as important for the individual firms in the network. The discussion centred upon developing strategy for each company through a group methodology, rather than seeking to define a common manufacturing purpose for the group as an entity. These discussions took over a year to come to fruition following the ICPG intervention and feedback.

A developmental activity over four weeks was undertaken with an organisation called Winning Moves, again as a pilot action, but in this instance within the "Accelerate" Initiative. The intention of the Accelerate Team was to see how the take-up of "step change" activity could be developed in SMEs with the intent to then mainstream the approach from the CSN to other networks within the region. Some time was spent on the development of the formalising a proposal to the "Accelerate Project" to secure funding for developmental activity. The Accelerate Project is a substantial multi-million pound regional support partnership. It saw the CSN as an ideal "test bed" for testing strategic "step change" interventions, which could then be used with other SMEs. The 4 sessions were held at the end of year two of the research leading to all four firms starting the process of radically re-aligning their own strategy to meet the competitive environment of small manufacturing firms.

4.2.6 Developing Objective Three – inter-company teams

These teams were the main focus for the development of new processes in the CSN. Activity took place at the start of year two; year one was spent on the customer-focussed objectives, which was the main priority of the network. Activity in March – June/July 2001 focussed on the establishment and development of inter-company teams in the areas of Information and Computer Technology (ICT), Quality Assurance and purchasing of commodity items such as stationery supplies and health and safety. The inter-company teams widened participation within the networks to 9 key personnel. Figure shows the distribution of personnel within the inter-company teams and the lead role is indicated by an *.

	CSN1	CSN2	CSN3	CSN4
QA/TS16949/ QS9000	1 *	1	1	1
ICT	1		1	1 *
Health and Safety	1*	1		1

Table 7: Inter company teams in the CSN

The type of topic chosen reflected the difficulties in finding common issues to interest a group of heterogeneous SMEs. ICT showed potential, but the relatively low use of ICT strategically, curtailed the discussions in terms of scope and interest. There was also a "leadership" issue within the teams – the Directors were surprised by the difficulty their company colleagues experienced in setting up the teams.

4.2.7 Developing Action Four – The Brokerage

This was the suggestion of CSN4 in an attempt at the start of the networking to establish relationships from within the network to help in managing capacity from a buoyant and demanding customer base. Objective four developed in ways not anticipated by the original TOR for the CSN and this will next be described in the views of Company CSN4 and in the network analysis as a key outcome for the research.

Brokerage is a key characteristic of the Industrial District Model (Jarillo, 1998, Chaston, 1995 and Nassimbeni, 1998). It was discussed regularly throughout 2000 but by mid 2001 was seen by the SMEs as problematic. They took the view that it would have been pure chance if the four could be so configured to develop a product and that this search for a product was in fact harming the interactions of the group. The true the benefits were coming from the sharing of information, trends and ideas.

This is a key point – *the network benefited by sharing experiences which stimulated ideas, which were then developed external to the network by the individual firms.*

4.2.8 Characteristics from the CSN for network development

A series of characteristics emerged from the literature and the work within the CSN, which will be used to then *measure and analyse* stages of development within the networks. The characteristics will be used to test against the OSN to see if they hold true for describing the results from OSN and in analysing these results. They comprise the following characteristics:

- ***Purpose*** both tacit and explicit (Nonaka, 1991, Argyris & Schon, 1996).
- ***Facilitation*** – both external and from within the network (Kolb, 1984,Schein, 1988).
- ***Trust*** issues, relationship issues, internal compatibility *within* the SMEs to the objectives of the network (Rogers, 1983, Perrow 1992, Ring, 1997).
- ***Compatibility*** – how suited are the firms to undertake the activities they espouse in the Objectives? Performance Indicators and compatibility as a Group (Huggins, 2000, OECD, 2000).
- ***Entrepreneurism*** v Collaboration, degrees of sharing vis stand alone business development (the Williamson/ Jarillo axis. Inzerilli, 1990, for de-coupling, Ahuja, 2000).
- ***Typology*** (i.e. Open/Closed, Vertical/Horizontal and Heterogeneous/ Homogenous, Inzerilli, 1990, Huggins, 2000).
- ***Equity*** within the networks – balance between inputs and outputs within the networking processes (Rogers and McIntire,1983).

4.2.9 The Development of the CSN

From early stages of dissatisfaction with the general way World Class Network had grown (not addressing specific issues of growth and the lack of the opportunity to learn from other WC companies) the CSN developed clear TOR. It established effective external relationships with other networks (ICPG) and organisations (AWM, Winning Moves and UCE) to then deliver specific objectives. It changed from a grant mentality to become a focus for discussion (particularly away from "we need funding, we apply we wait then we perform") to a more flexible responsive organisation based on trust and mutual sharing of ideas. The benefits were seen as sharing of information and ideas during and between the meetings. The network had difficulties in agreeing and then commissioning joint activities (in essence acting as an entity in the Industrial District Tradition) as well as working with each other in a sub-contract mode to support a common customer (the Vertical Supply Chain tradition).

The term CSN accurately describes this organisation as it is "closed" that is the four firms commit to each other: and strategic, the Terms of Reference (TOR) are all business development focussed. The analysis of the CSN will be described in Chapter Five.

4.3 THE OPEN SOCIAL NETWORK

4.3.1 Background to the OSN

The social and contextual background of a network are important characteristics to build an understanding of the results and then analyse progress (Granoveter, 1985)

The Network was established at the beginning of the research process following the start made by a previous network, the ADAPT network of firms which took its name

from an EU funded project, Learning Support for Small Businesses (LSSB) wherein networking was developed as a learning methodology for SMEs. Its antecedents go back even further to 1994, when a small group of SMEs were called together by the managers of the Birmingham Centre for Manufacturing (BCM) to act as a sounding board for BCM small firm activity. This led, unfortunately, to confusion in the purpose of the group (Twiss, 1995) as this semi-regulatory role was also combined with a discursive element for establishing SME needs, two aims which, were never satisfactorily resolved. The BCM network was then eventually subsumed by a formal BCM Board comprising a new set of SMEs, which led to a year of relative inactivity for the BCM network. However, the discussion element of the network was then resurrected in 1997 through the activities of the ADAPT programmes run through BCM and UCE. The ADAPT approach from 1997 to 1999 saw a small group of firms meeting on a monthly basis to discuss ideas generated within the group on issues which were of topical interest. The Facilitation was both a stimulant to the discussion and a means to help ensure participation was "equitable" and that the firms felt they could participate in an "open" environment (Twiss, 1995). Funding for the facilitation was supported through ADAPT, but there was not an intention for the SMEs to come together to develop network strategies to then seek funding for joint activities.

The change to the OSN came in late 1999 and resulted from a need expressed by the participating firms to develop a clearer identity based on owner managed SMEs rather than medium to large SMEs and larger firms. This resulted in 2-3 firms, which were not regular attendees, then ceasing to attend (one of these was in the Control Group firm CG 1).

4.3.2 Aims and Objectives of the OSN

The TOR for OSN were constructed by two of the Facilitators and the then WCN facilitator and one of the SMEs (OSN 1) when together in Florence during a transnational conference on concurrent manufacturing in mid 1999 and subsequently developed back in Birmingham. The OSN represents, therefore, an "open" social network, in that membership is "open" to invited firms and fluctuates within this core group, that there is no specific intent to trade within the network, but that the clear focus is primarily on experiential learning (Schein, 1988, Dromgoole et al, 2001).

However, the intention is for the owner managers to gain insights into business issues, which will help them to change behaviour within their respective companies following the network discussions. The firms espoused a need to develop a web-based facility to also share experiences between meetings.

4.3.3 Operational and Functional activities in the OSN

The first phase in the establishment of the OSN following the re-focussed objectives from the Adapt Club. Early meetings as the ADAPT Network were clearly focussed on topics such as Motivation (9/12/98), Benchmarking (10/2/99) and Learning (30/6/99). Location was the BCM. A significant shift took place in September following appraisal in July developed from the Florence discussions with Terms of Reference outlined as:

1) Focused on small firms with 50 or less people,
2) Owner manager focus,
3) Operate as a small business club with an emphasis on "self help",
4) Recruitment from a wide cross-section of small firms to include a range of business sectors, gender and ethnicity.

The process was started by the members bringing a new member to the meeting as a personal introduction and to then spend time explaining the nature of their respective businesses. The discussion would therefore provide the agenda for the meeting and subsequent meetings. Suggested names to consider were given, such as Forum for the Future of the small business, "Entrepreneurnet", Manager Development Club and the Small Business Club.

A meeting in October 1999 was held to discuss and agree a way forward. Significant written input was provided by the MD of OSN 3 on documentation for the network, name (he suggested the new name) format, moving meetings to SME venues, the use of video conferencing and Email. January 2000 saw the start of the new format. The essence of this was to have a topic based discussion led by the SMEs and supported by the Facilitator in which current issues were discussed. The need to get even more into the nature of change was next developed in that the SMEs themselves undertook to each lead a session on the nature of the various challenges facing their businesses. The facilitation was split between two colleagues from UCE (including the researcher) and a private sector facilitator ex UCE now a consultant employed on a business support project.

The next significant development in the OSN was the decision to then undertake a series of presentations by the members on their own approaches to strategy for the small firm. The format for this was that an SME would talk for some 30 minutes on the key issues facing them, some of the challenges they were facing, the need to develop strategies to move the company forward. Discussions then took place at the end of the presentation with the other firms of a general nature and specifically giving feedback on the actions proposed by the speaker. The process was welcomed

by the SMEs as it both provided an opportunity to consider strategy (i.e. they needed to be able to articulate their strategy to their peers) and receive feedback from a trusted group of small firms facing a similar business environment.

The web-based discussion, which was envisaged, never really took off. It had been first presented as an option by a contributor from Birmingham Chamber and championed by the MD of OSN 3. Firm OSN 3, however, had difficulties in meeting the offer he had made to the group which involved setting up the web page, posting member details and hosting discussion for the members (see www.mbc.co.uk). Critically, the need for the web site was not seen as an important objective by the SMEs, although discussion of the lack of it was the trigger for CSN1 to withdraw from the OSN. (The MD of CSN1 is a regular attendee of any event which can secure new ideas and business for the company, although he could never fully participate in the OSN and ceased to attend the OSN following the presentation by OSN1).

4.3.4 General Remarks on the OSN

The Network has a long history for an SME network in Birmingham. The change, which coincided with the start of the research period, is one of many, which the network has undertaken, and the research captured a particular stage in its development (which will be subject of analysis in Chapter Five). The heterogeneous nature of the firms underlines their need to develop business in a variety of supply chains. The development in the research period is in line with the objectives as set out in 1999, save for the desire to expand into new sectors and establish a better balance in terms of gender and ethnicity. There may well be barriers to this, which need to be explored in the analysis. Issues around homogeneity and heterogeneity in

small firm networking will also be discussed in Chapter Five. The network developed a core and a peripheral group, which seemed well suited to its objectives and allowed SMEs in the periphery to participate when they could. However, trust and collaborative behaviour were more difficult to establish in the network, an advantage for the CSN in terms of developing deeper insights.

The term "Open Social Network" seems appropriate to define the network within the Industrial District Tradition without the characteristics of brokerage as a group to develop customer relationships as a network.

4.4 THE CONTROL GROUP

4.4.1 Background to the Control Group

The four firms in the Control Group were identified at the start of the research when interviewed as members of the WCN. It was clear at this stage that WCN attendance for them was itself sporadic and in historically in decline (borne out by subsequent non-attendance in the research period). Indeed, this pattern of sporadic attendance was a key factor in deciding to interview them from the list of WCN firms as the "Control Group".

However, the four firms had all been regularly involved in developmental activities sponsored by business support agencies (including Business Links, The Training and Enterprise Council, Higher Education and Further Education) but did not appear to see the benefits gained from local networking. There are probable reasons for this, ranging from size (CG 4 had acquired another company in Scotland and the MD was split between sites), feelings of helplessness caused by lack of autonomy as part of a larger engineering group (CG 1), multiple membership of business support

initiatives, seminars and a declining core business (CG 2) and intensive competitive pressures relating to new capital spend predicated on long term relationships with Rover Group, which led to re-thinking of the core business strategy at the start of the research period (CG3).

4.4.2 Aims and Objectives in the Control Group

Clearly there are not any joint aims and objectives for the four control group firms as a network. (They were chosen as non-networking firms at the start of the research process as a comparative group).

However, the business aims and objectives of the four are entirely consistent with those of the eight firms in the two networks. These include the need to develop new markets; the importance to enter new supply chains and the development of higher value added products and services, together with a need to meet cost reductions through the implementation of new processes. These business aims and objectives were all established through the 1:1 interviews with the Researcher and through the Performance Indicators.

4.4.3 Activities in the Research Period

Clearly, the benefits of networking could be brought to bear on all of these specific business development and operational situations, but none of the four firms committed to sustained local networking during the research period. Firm CG4, for example, hosted 1:1 separate discussions with CSN1 and CSN 4, attended the 3 M visit sponsored by ICPG, sent representatives to the WCN sessions and gave two presentations to the OSN, but itself did not participate in networks where it contributed to the development of local links within a clearly defined group of SMEs

with TOR linked to business development. Firm CG2 was interested in the developments of the CSN in the early stages, but was not invited to join the network (not exactly excluded, but not invited!). Firm CG 3 hosted factory visits sponsored by the BCM, but did not take part in reciprocal discussions with local firms and is still reluctant to engage with the business support services. Firm CG1 has similarly not responded to invitations to participate in developmental events and continues to have difficulties in its core business and to win resources to effect change from the Group M.D.

These four firms were tracked as individual SMEs during the period. They were interviewed on a 1:1 basis and two of them participated in the relationships with both the CSN and the OSN. These two firms will be highlighted as individual cases.

4.5 POSITION OF NETWORKS AT START AND END POINTS

The Control Group fulfilled an important function in the research process. It consists of firms facing similar business pressures to the 2 networks, but not seeing local networking as a factor in addressing these issues. The reasons for this are themselves of value, non-networking factors can of course be reversed to give reasons for participation. No value judgements, however, should also be made on the consequences of non -network participation. The overview of the Two Networks and the Control Group can now be presented as a summary in tabular form at the start and end points.

Characteristics	Network "A" Closed strategic	Network "B" Open Social	Network "C" Control group
Size and scope	Four firms, seeking strategic alliances	Ten firms seeking exchange of experiences	Four firms- wide spectrum
Meeting Style	Experience sharing, alternating venues SME- SME. Formal agenda/minutes and actions	"Open space" concepts of agenda driven by the group. Stable venue.	Experience sharing with customers
Group Objectives	Objective to create a "brokerage" within the group	Create an environment for ideas discussion	Individually orientated
Facilitation	High level of external facilitation. Initiatives with a wide range of support agencies.	Low level of external facilitation and of externally funded projects	Low levels of facilitation
Trust **Style of network decision making**	Fragile, moving towards resilient Formal, minutes, frequent use of emails. Group decisions by consensus	Resilient Informal, Minutes brief. Presentations shared during the meeting.	Fragile Currently focused on MD alone

Table 8: Overview of the Two Networks at the start of the Research

Characteristics	Network "A" Closed strategic	Network "B" Open Social	Network "C" Control group
Size and scope	Four SMEs – no new entrants	As year One	Four firms- wide spectrum
Meeting Style	Informal, ideas sharing on markets, customers, ideas	Informal, but need for a clear programme of events on a theme • Ownership succession • Managing People in the modern manufacturing environment	Experience sharing with customers
Group Objectives	Support for mechanisms to engage with new customers, Cross company teams, developing training which can be transferred. Business ideas developed external to network.	Create an environment for ideas discussion Onus on SMEs to manage the network SMEs requesting specific inputs	Individually orientated, some engagement by firm C4 in the CSN Only Firm C4 sees need to further develop its own networking.
Facilitation	One key facilitator with 2-3 trusted others on specific issues/themes (AWM, Winning Moves, BCM). No need for formal external funds for networking per se	External facilitation supplemented by inputs from facilitators .(x3) Still lack of externally funded projects. No specific funding for the group	Low levels of facilitation
Trust **Style of network decision making**	Fragile, moving towards resilient Formal, minutes, frequent use of emails. Group decisions by consensus. TOR and reporting on progress	Resilient Informal, Minutes brief. Presentations shared during the meeting.	Fragile Currently focused on MD alone

Table 9: Overview of the Networks at end of Year Two

4.6 PERFORMANCE INDICATOR RESULTS

The rationale for choice of Performance Indicators (PI's) has been outlined in Chapter Three. Performance Indicators for Speed and Reliability are indicators of a *Resource* emphasis within the SME; PI's in Design and Company Culture for a *Product* emphasis and PI's in Product Mix/Volume & Delivery of a *Market* emphasis. Companies may of course show tendencies to all three measures, but there may be a stronger category, which helps to place the firm in terms of its directional path, which will be instrumental in terms of network results and analysis.

	Product focus	Market focus	Resource Focus
Speed /Dependability			*
Volume &Delivery/Product Mix		*	
Design/Company culture	*		

Table 10: Showing Performance Indicators and Company Focus

The Case Study SMEs were tested at three critical points during the two- year period, Phase One – the start of the Networking period, Phase Two – mid point, the end of year one and Phase Three – conclusion, the end of the research period at year two. Results from the Performance Indicator scores are now presented. The scores are shown as "scatter-graphs" for comparison as part of the Appendices.

Eight of the SMEs were from the World Class Network (The CSN and Control Group) and espoused a certain standard of performance; therefore a focus on the results in the top quartile was to be expected. However, the Performance Indicators should show differences *in and between* the networks, which will inform the analysis relating to the hypotheses of networking and support for process improvements,

networking and NPD and the importance facilitation can make in the networking process. The use of Performance Indicators in this way can therefore be seen as *corroborative* within the Case Study process and gives insights into the performance of the firms as *individual companies* as a comparison of their networking activities and to help differentiate individual traits from network features. Specific company scores will be addressed in the Case Study analysis, which will be important in the reliability of the data to support the hypotheses building.

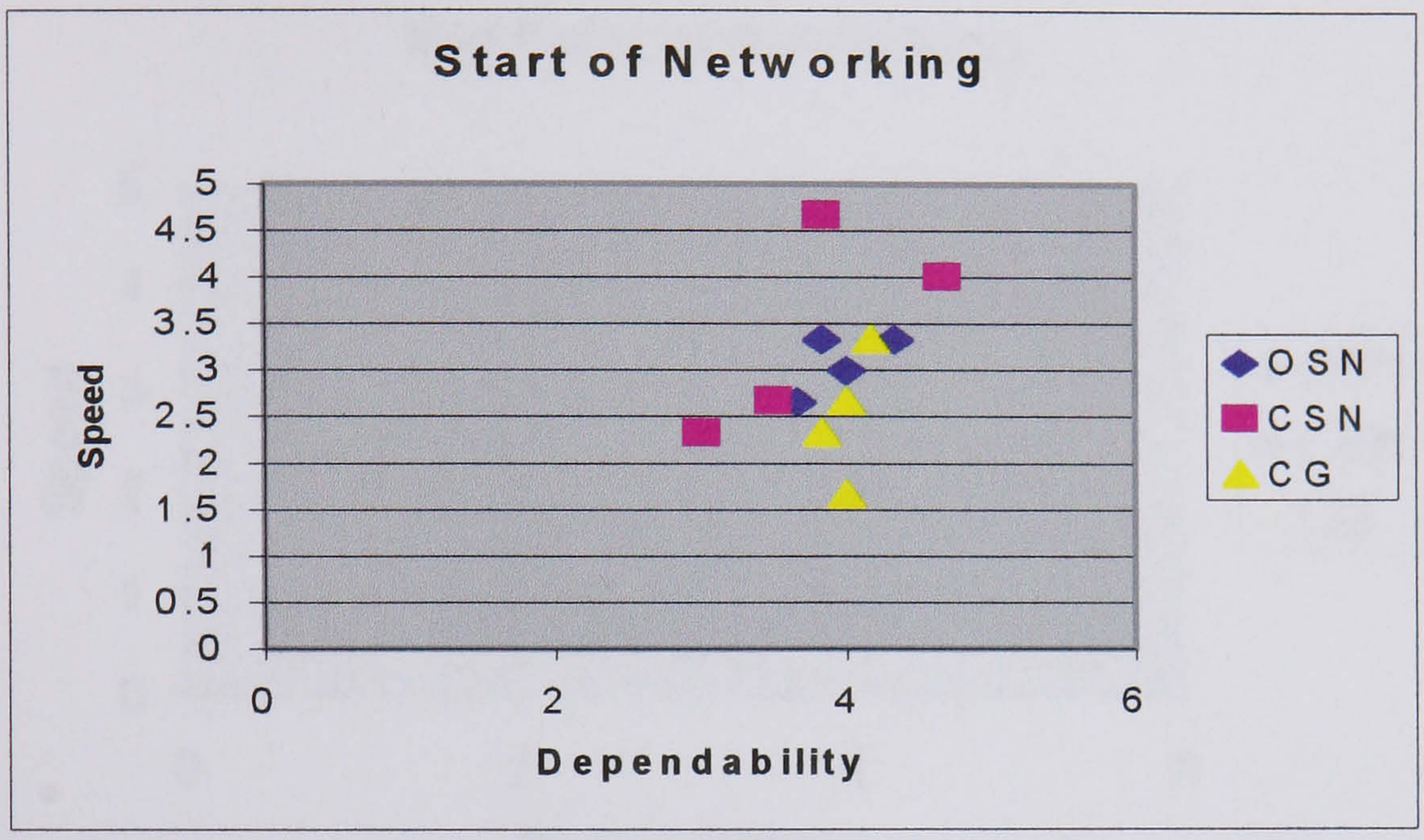
Managing Directors from the 12 firms were all asked to complete a Questionnaire on a range of key questions (See Questionnaire Appendix One). Results were then tabulated for all 12 firms within general characteristics using a Likert type scale (1= Low, 5 = High), then aggregated within these characteristics to give an average score for each Performance Indicator. This data was then used in gaining corroborative data to the behaviour exhibited in the networking process. Put simply, if a company or a network exhibited certain characteristics as realised in the Questionnaire results, say in NPD, how would this be then reflected in networking behaviour?

4.6.1 Results for Speed and Dependability – Start of the research

Generally, the firms with a focus on Quality Cost and Delivery (QCD) would be expected to score highly on this measure, which proved to be the case. All the firms scored well on dependability. However, seven of the firms scored average or below for speed.

Within the Closed Strategic Network, two of the firms the metal finisher and the press-worker scored highest of the 12, which is also reflected in the other PI

comparisons also. Two of the Network scored below average for speed, suggesting that processes could be improved. The Open strategic network clustered around high dependability and average speed and the Control Group were spread high on dependability but with a wide range concerning speed.

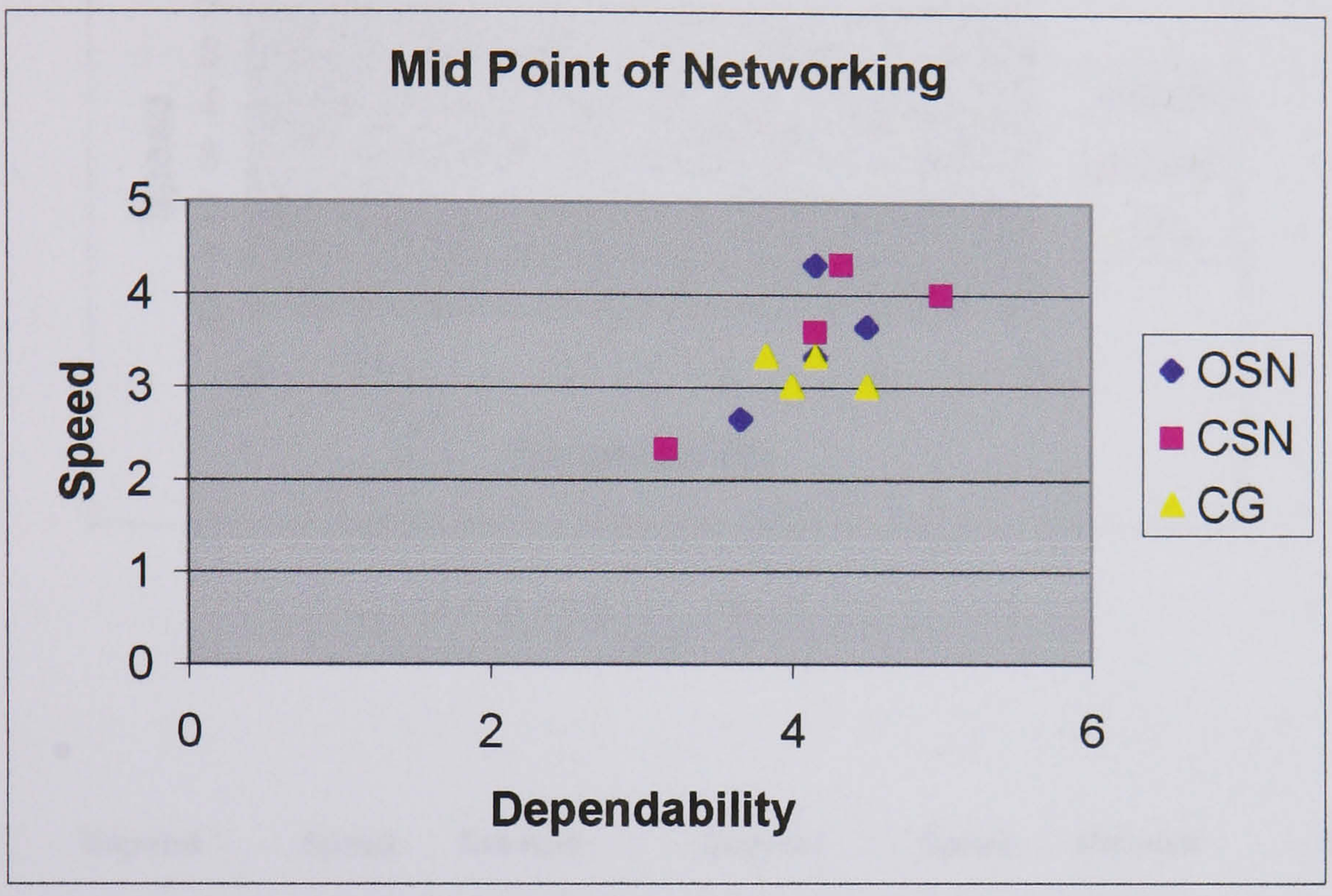


Network	Depend	Speed	Network	Depend	Speed	Network	Depend	Speed
OSN1	4	3	CSN1	4.67	4	CG1	4	1.66
OSN2	3.66	2.66	CSN2	3.83	4.67	CG2	4	2.66
0SN3	3.83	3.33	CSN3	3.5	2.67	CG3	4.17	3.33
OSN4	4.33	3.33	CSN4	3	2.33	CG4	3.83	2.33

Table 11: PI's for Speed/Dependability, start of networking

Mid Point

At the end of year one, there were marked improvements in "speed" with only two firms falling below average performance mark whereas there were seven at the start. The trend to the top quartile continued to show a strong emphasis.



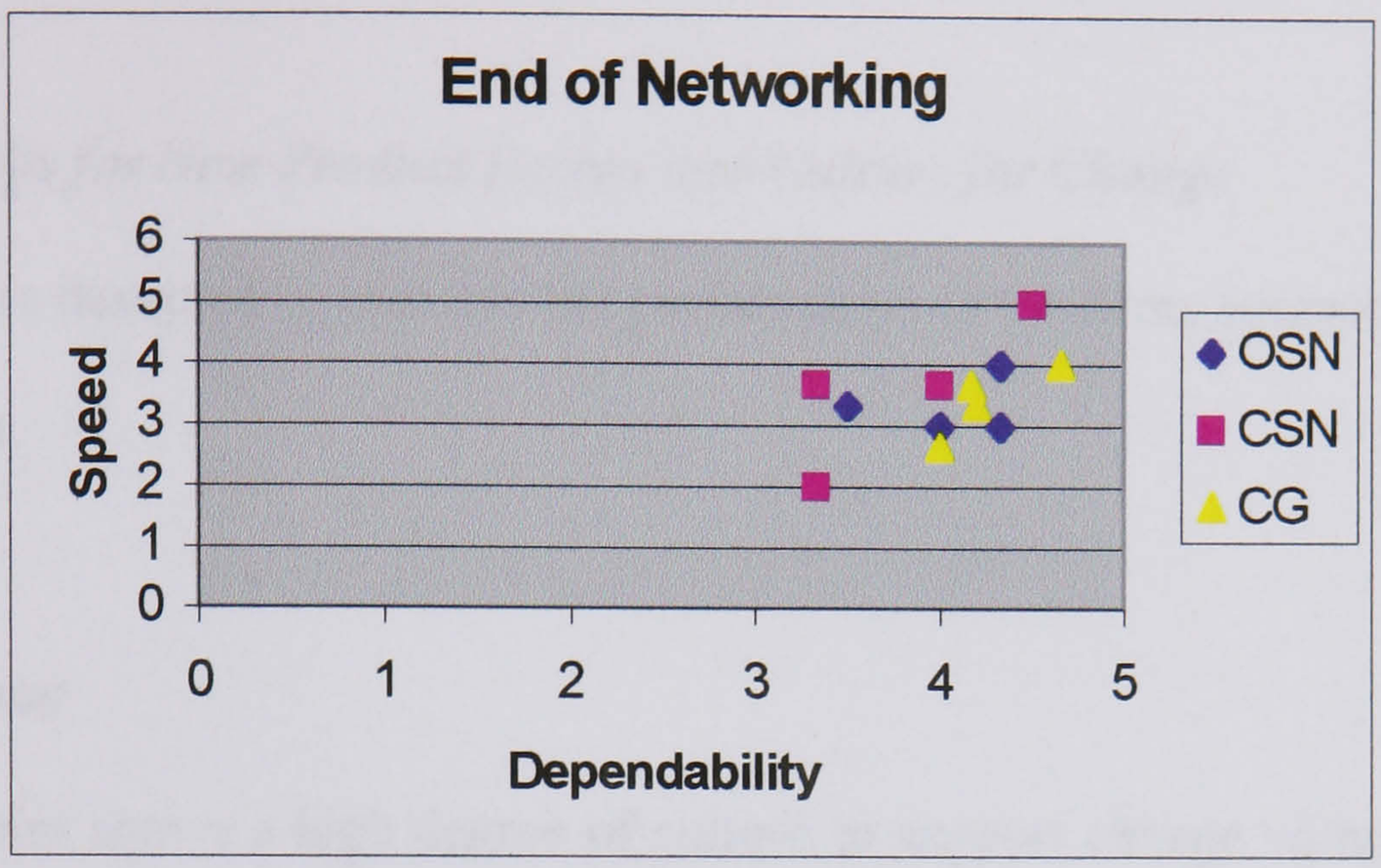
Network	Depend	Speed	Network	Depend	Speed	Network	Depend	Speed
OSN1	4.5	3.66	CSN1	5	4	CG1	4	3
OSN2	4.16	4.33	CSN2	4.33	4.33	CG2	4.5	3
0SN3	3.66	2.66	CSN3	4.16	3.6	CG3	4.16	3.33
OSN4	4.16	3.33	CSN4	3.16	2.33	CG4	3.83	3.33

Table 12: PI's for Speed/Dependability, mid point of networking

End Point

The trends from the previous two stages are broadly similar at the end point with dependability as consistently high. Speed has seen the most improvement in the two networks, with only CSN 4 showing poorly in this respect. (CSN4 has increasingly focused on small batches of bodywork for Morgan Cars where the emphasis will be on other qualities).

Three of the Control Group firms are all scoring highly on dependability, but CG1 is still below average on speed. CG2 scores very well, but at the price of having to keep spare capacity available to meet unscheduled customer needs.



Network	Depend	Speed	Network	Depend	Speed	Network	Depend	Speed
OSN1	4.33	3	CSN1	4.5	5	CG1	4	2.66
OSN2	4.33	4	CSN2	4	3.67	CG2	4.66	4
0SN3	3.5	3.33	CSN3	3.33	3.67	CG3	4.2	3.33
OSN4	4	3	CSN4	3.33	2	CG4	4.17	3.66

Table 13: PI's Speed/Dependability, end of Networking

Results show clear patterns in performance within the networks, which also reflects the specific concerns and challenges which the firms sought to address during the research period. It would seem that there is a case for process improvements to continue to be made particularly when customers were still de-selecting suppliers a key feature of the external business environment for this period of the research data collection. But how would this be reflected in the SME behaviour?

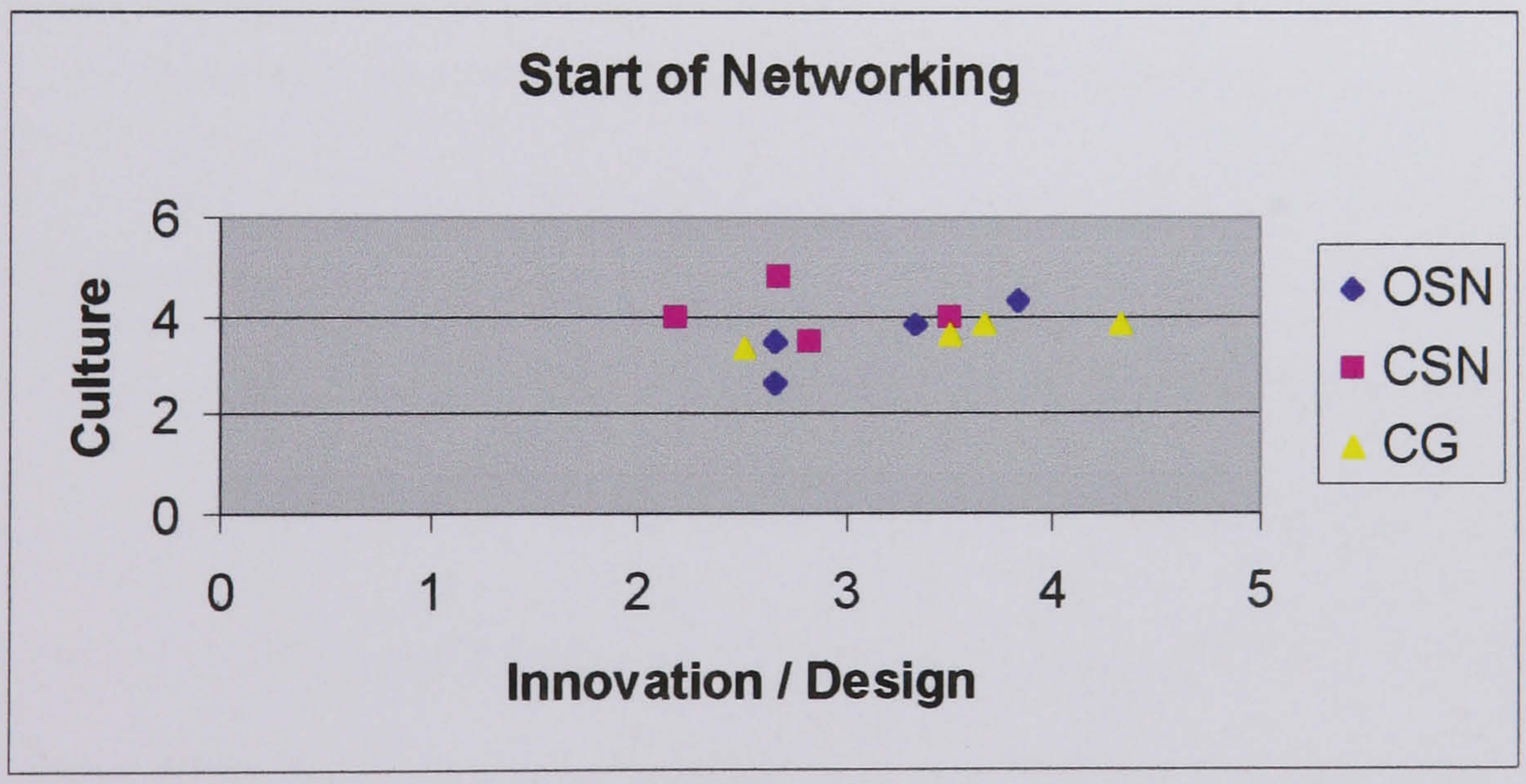
The PI's for speed and dependability are generally high, reflecting good performance, so support for networking towards this process was around specific issues concerning QA systems and use of ICT for customer communication.

4.6.2 Results for New Product Design and Culture for Change

These PI's are designed to measure the performance of the firms against new product development.

The Start Point

The Start Point shows a high degree of culture to support change within all bar one of the firms, but generally a lower performance in then transferring a helpful culture to provide for innovative ideas. This suggests that the foundations for NPD are present, but that they are underdeveloped and also reflects support for the choice of hypotheses to be tested within the research.

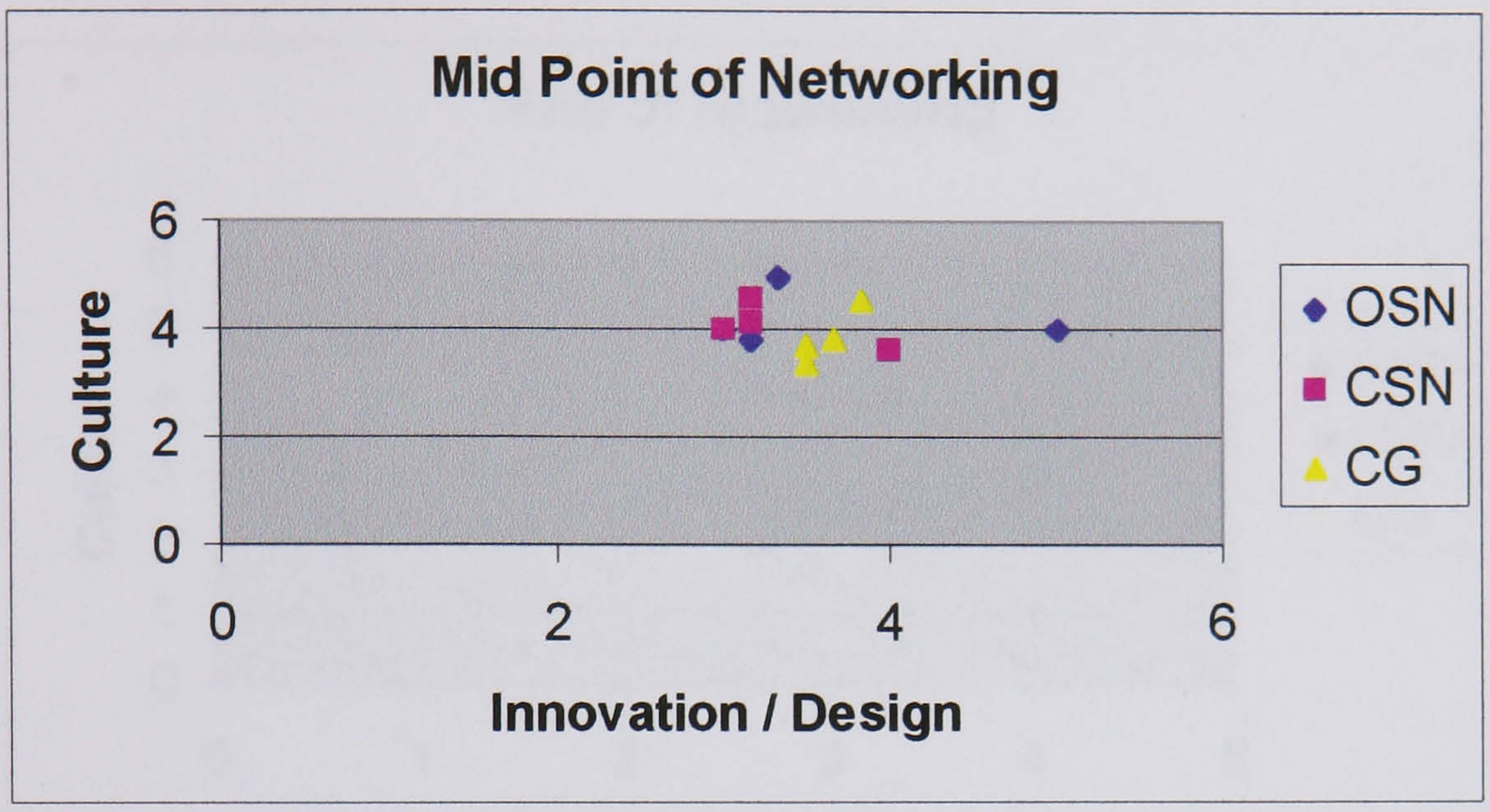


Network	Innovation	Culture	Network	Innovation	Culture	Network	Innovation	Culture
OSN1	2.66	2.66	CSN1	3.5	4	CG1	4.33	3.83
OSN2	3.83	4.33	CSN2	2.67	4.83	CG2	3.5	3.66
0SN3	3.33	3.83	CSN3	2.83	3.5	CG3	3.66	3.83
OSN4	2.66	3.5	CSN4	2.17	4	CG4	2.5	3.33

Table 14: PI's Culture/Innovation/Design start of networking

Mid Point

At this stage, there was a clear move to the top quartile for all the firms showing a trend towards implementation of NPD. The trend needs to be explained together with the Case Study data and the role of networking in this trend defined.

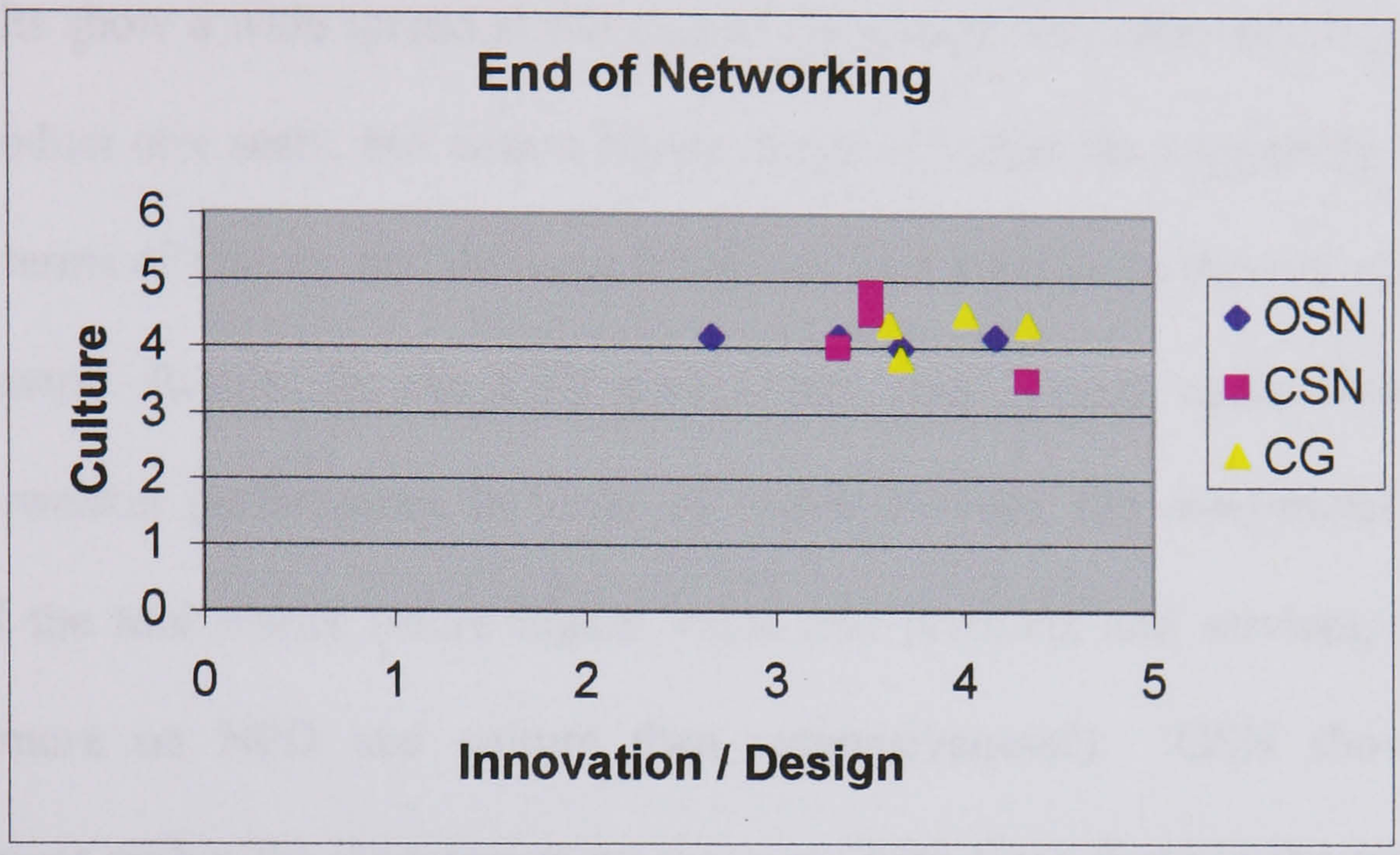


Network	Innovation	Culture	Network	Innovation	Culture	Network	Innovation	Culture
OSN1	5	4	CSN1	3.16	4.16	CG1	3.83	4.5
OSN2	3.33	5	CSN2	3.16	4.6	CG2	3.5	3.66
0SN3	3	4	CSN3	4	3.6	CG3	3.66	3.83
OSN4	3.16	3.83	CSN4	3	4	CG4	3.5	3.33

Table 15: PI's Culture and Innovation/Design mid point of networking

End Point

At the End Point, the significance is that all the firms had moved to the top quadrant for innovation, whereas half had started with below average scores. This fits with the culture for change scores, which were evident throughout.



Network	Innovation	Culture	Network	Innovation	Culture	Network	Innovation	Culture
OSN1	4.16	4.16	CSN1	3.5	4.5	CG1	4.33	4.33
OSN2	2.66	4.16	CSN2	3.5	4.83	CG2	2.5	4.33
0SN3	3.33	4.16	CSN3	4.33	3.5	CG3	3.6	4.33
OSN4	3.66	4	CSN4	3.33	4	CG4	4	4.5

Table 16: PI's Culture and Innovation/Design end of networking

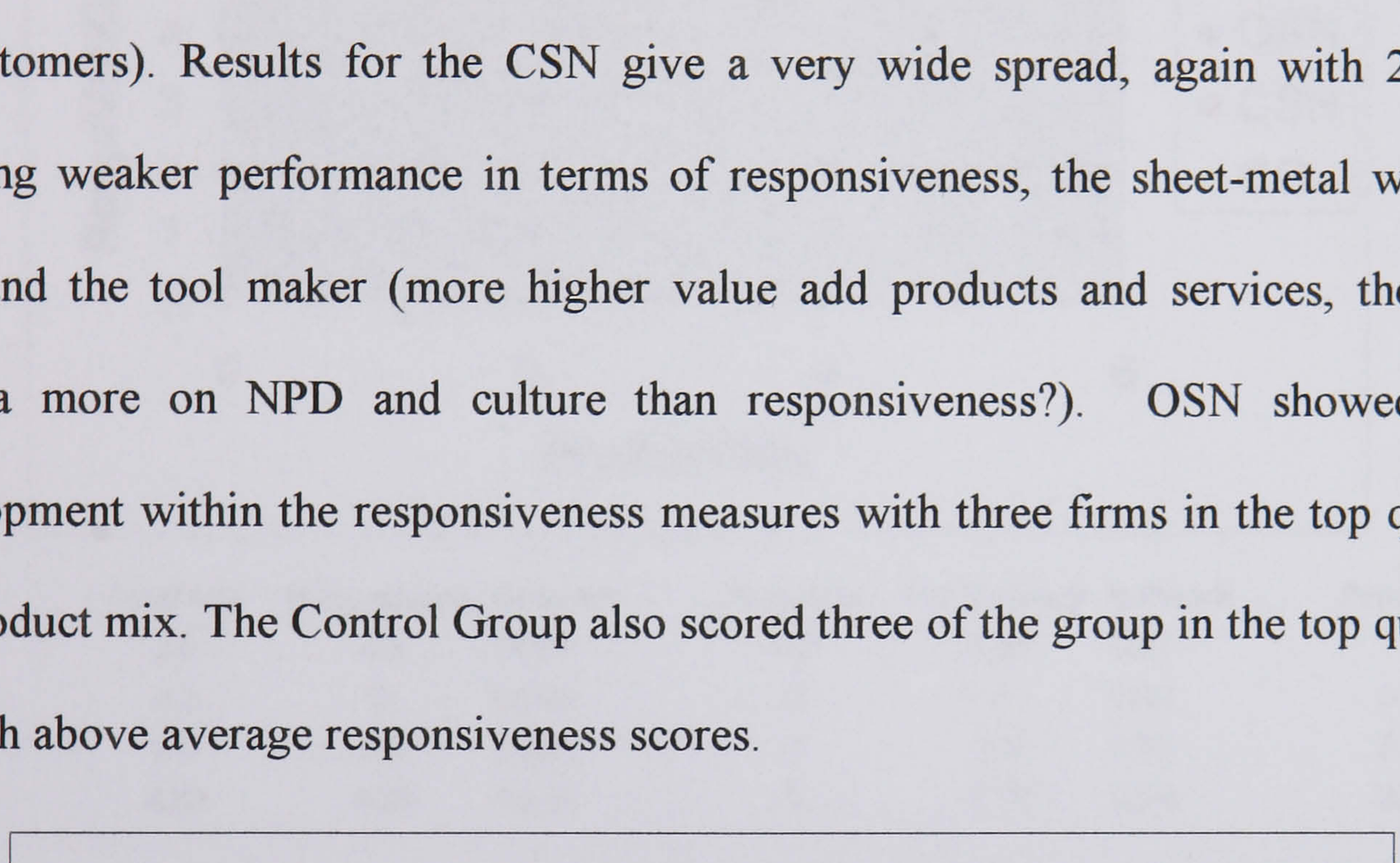
The trend towards consistently high scores for Innovation/ Design and in Culture for Change very much reflects the importance of both customer and product development to the health of the SMEs during this period of turbulent customer relations and change in supply relationships. How much of this can be attributed to networking rather than individual company approaches to changing customer demands will be discussed in Chapter Five. However, it is important to note a trend towards "design" building on a culture for change, which took place during the first half of the research period and carried on to the end. This trend in the Performance Indicators, will also be discussed within the SPSS results and analysis.

4.6.3 Responsiveness Product Mix/Volume Delivery

These PI's attempt to indicate the degree of customer responsiveness in terms of range of products offered by the SME.

Start Point

The results show a wide spread at the start of the period with generally lower scores in the product mix scale, but with a higher range of scores for supporting customer needs in terms of volume and delivery schedules. (I.e. weaker on the mix of products to customers). Results for the CSN give a very wide spread, again with 2 firms showing weaker performance in terms of responsiveness, the sheet-metal working firm and the tool maker (more higher value add products and services, therefore criteria more on NPD and culture than responsiveness?). OSN showed high development within the responsiveness measures with three firms in the top quartile for product mix. The Control Group also scored three of the group in the top quartile, all with above average responsiveness scores.

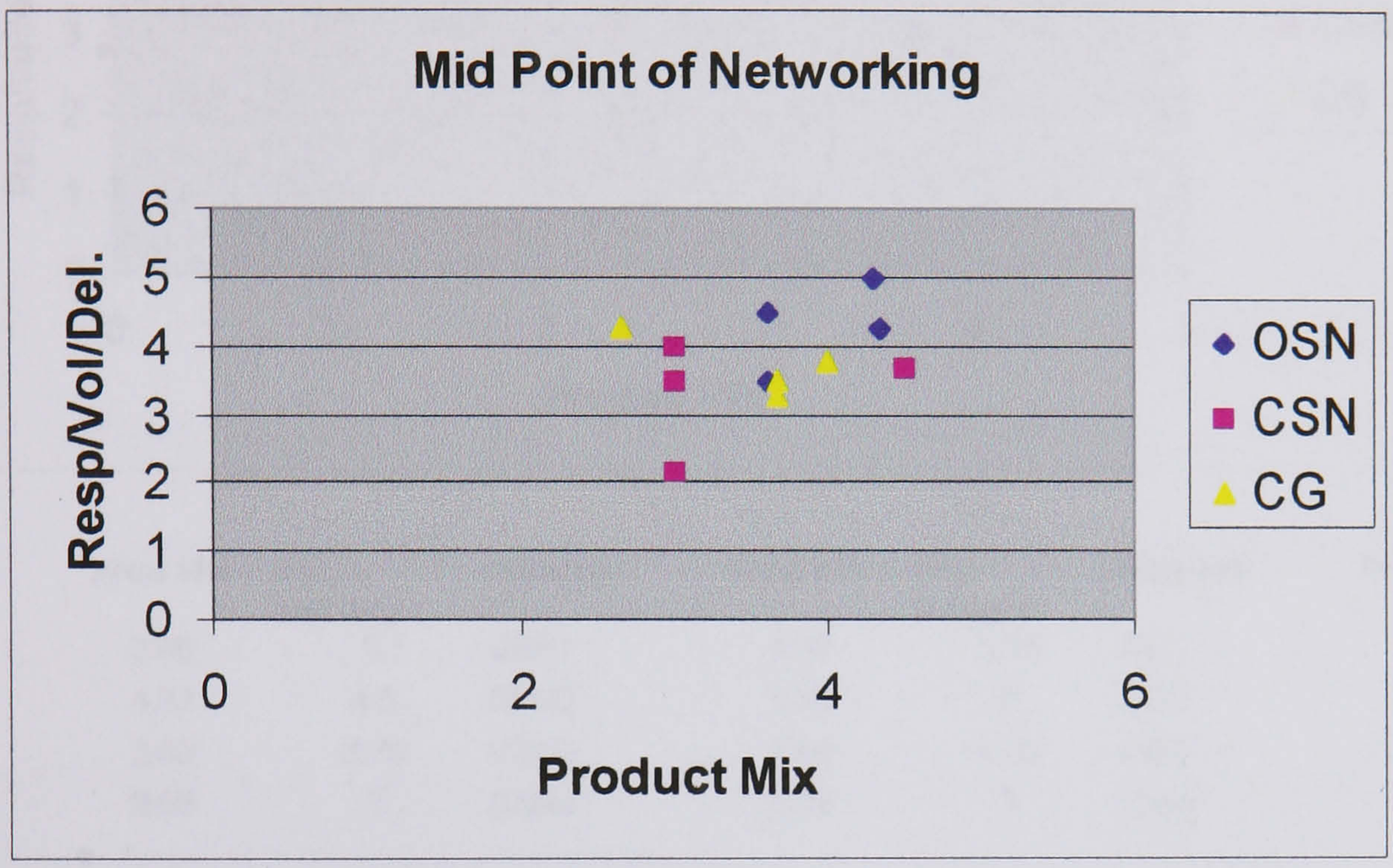


Network	Prod Mix	Vol Delivery	Network	Prod. Mix	Vol Delivery	Network	Prod. Mix	Vol Delivery
OSN1	3.33	4.5	CSN1	4.33	4.25	CG1	4.66	3.25
OSN2	3.33	4	CSN2	3.33	3.5	CG2	2.33	3.5
0SN3	1.66	3.75	CSN3	3	2.75	CG3	3.66	3.25
OSN4	4.33	3.75	CSN4	1.66	1.5	CG4	4	4.25

Table 17: PI's Responsiveness in Volume and delivery/Product Mix at start of networking

Mid Point

These results saw significant positive changes in terms of mix with all of the firms with a parallel maintenance of the high levels for responsiveness in volume and delivery.



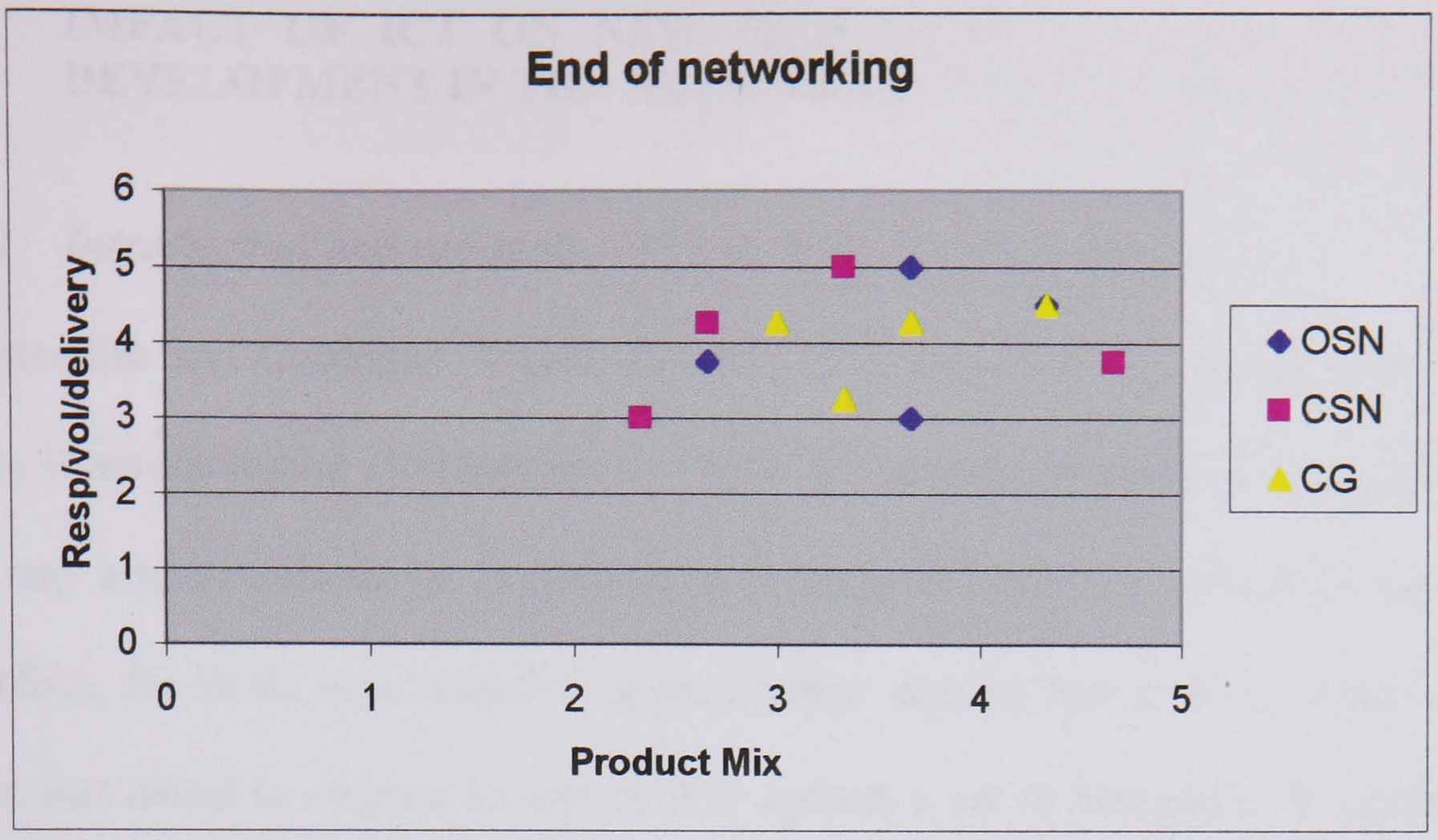
Network	Prod Mix	Vol Delivery	Network	Prod Mix	Vol Delivery	Network	Prod Mix	Vol Delivery
OSN1	3.6	4.5	CSN1	4.5	3.66	CG1	4	3.75
OSN2	4.3	5	CSN2	3	4	CG2	3.66	3.5
0SN3	3.6	3.5	CSN3	3	3.5	CG3	3.66	3.25
OSN4	4.33	4.25	CSN4	3	2.16	CG4	2.66	4.25

Table 18: PI's Responsiveness, Volume and Delivery/ Product Mix, mid point of networking

End Point

By the end point, the PI's in this respect are showing a decline from the Mid Point position. This again is significant, as it shows the inconsistency in approach to product lifecycle issues within the current customer base and underlines the vulnerability of the firms to changes in customer demands.

Interestingly, the two Control Group firms are both now in the top quartile. Issues of growth will be discussed in the Analysis to assess the ability of the firms to translate more attention to product mix and responsiveness on new work or to maintain their current position.



Network	Prod Mix	Vol. Delivery	Network	Prod Mix	Vol. Delivery	Network	Prod Mix	Vol. Delivery
OSN1	3.66	5	CSN1	4.66	3.75	CG1	4.33	4.5
OSN2	4.33	4.5	CSN2	3.33	5	CG2	3	4.25
0SN3	2.66	3.75	CSN3	2.66	4.25	CG3	3.33	3.25
OSN4	3.66	3	CSN4	2.33	3	CG4	3.66	4.25

Table 19: PI's Responsiveness Volume and Delivery/Product Mix end of Networking

The wide spread of scores at the start was definitely more clearly focussed by the end of year one. The resource based view of the firm, supporting more products with existing customers as some current customers de-selected firms from their supply chains, became a feature of competitive behaviour. However, this slipped back by the end of the research. This could be that the firms were not systematically reviewing product mix and the impact of new customers and growth in this respect needs to be examined.

4.7 IMPACT OF ICT ON NEW PROCESSES AND NEW PRODUCT DEVELOPMENT IN THE NETWORKS AND CONTROL GROUP

4.7.1 Introduction and rationale – ICT in the Case Study firms

Information and Computer Technology (ICT) is important in underpinning small firms competitiveness (Venkatraman, 1991). It supports Hypothesis One and Two and may also be utilised for facilitation in Hypothesis Three. As part of the analysis, therefore, the firms were asked to describe their current use of ICT. Each of the firms was asked to express its use of ICT against a set of categories in percentage terms and these are now shown for the twelve firms. The results were taken at the mid point of the research, but did not differ to any great extent by the end. As can be seen these results show a low take up of ICT with the telephone Facsimile and post representing the majority of the communication channels. This hardly supports the SMEs in future attempts to become responsive globally, or to take design data from customers.

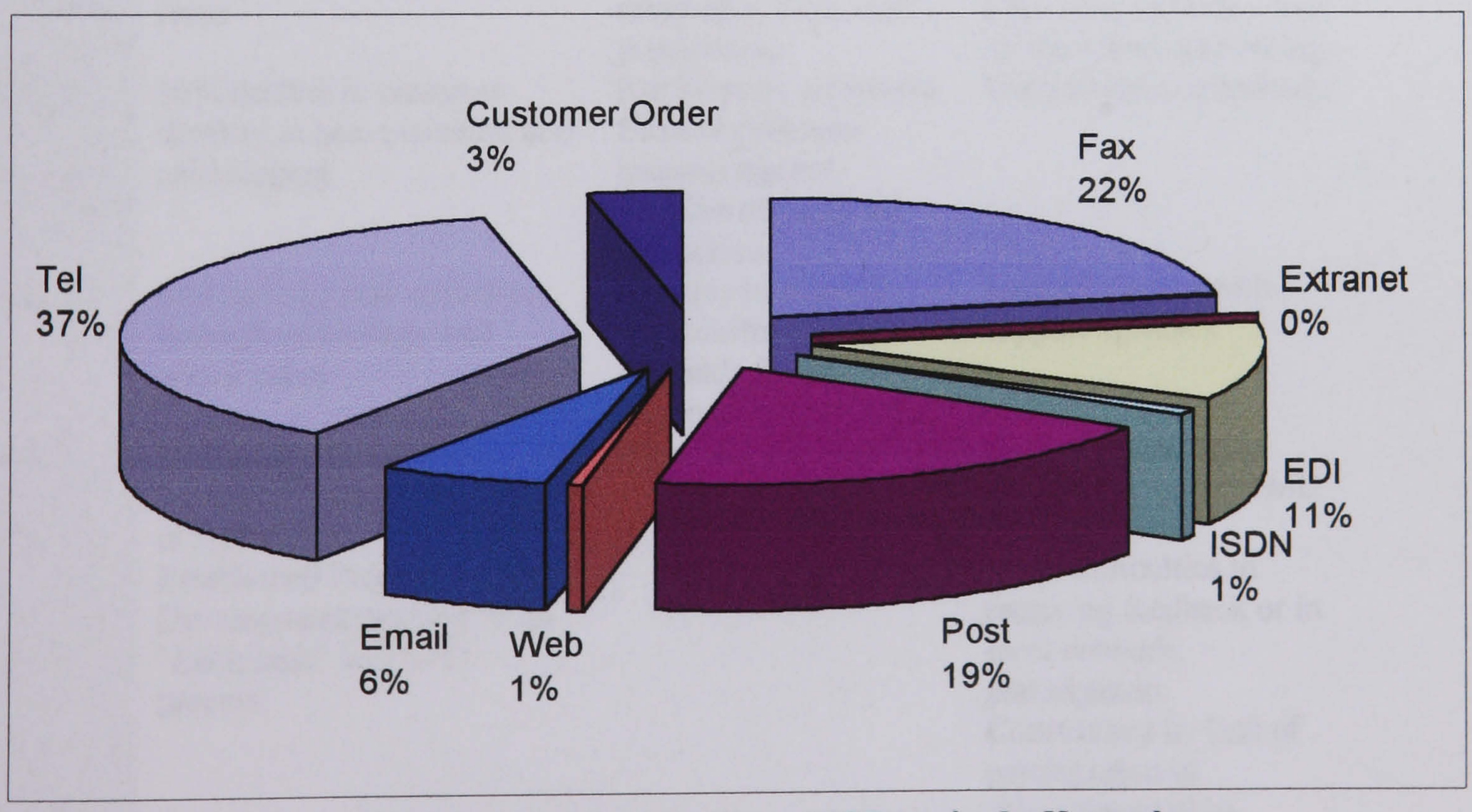


Figure 18 : Summary of all scores and ICT use in the Networks

The results show a low use of ICT to communicate with customers generally. This will be analysed in chapter Five.

4.8 CHARACTERISTICS OF THE NETWORK FIRMS AT THE END OF THE RESEARCH PERIOD

	New product Development	Process Improvements	Facilitation
CSN 1	Unique new process introduced. Strategy supported by network workshop	QA, ICT in place with other firms. Finalist in Business Excellence Regional Award	Internally focussed- Wide use of externals for specialist support
CSN 2	One new sector exploited	Still in top rank of SMEs	Reactive to network – not proactive
CSN 3	Starting to be driven by core competences rather than customer problems	In place, but reluctant to adopt team centred approaches. Too busy to participate in innovative ideas	Use of mentor Supports discussion but not always actions
CSN 4	Managing demand better Wide use of Technical Partnerships	Innovative use of ICT Participative and flexible	Leadership role but frustrated at times by speed of adoption and wariness of the others
OSN 1	Better balance between specials and core	Better internal relations to prevent customer issues	Leadership role in determining direction of the network
OSN 2	Growth through acquisition	Relies, still, on uniqueness of process	More of a force than at the start
OSN 3	Core business taking disproportionate amount of resources. Severe problems with product offering	Weak position – time needed to secure immediate future	Non-attendance for 6-9 months
OSN 4	2 new product areas in related companies	Overly reliant on MD, not systems orientated	Strong influence in the network
CG 1	Still trying to emerge from Group and develop product focus	Processes in place but company culture to implement them still problematic	MD representing manufacturing on an LSC training body – but no inter firm networking
CG 2	30% decline in customer demand in heat treatment and cold forging	Not systems orientated. Edge of problems because market position takes all the MD's time	Unfocussed and sporadic
CG 3	Still seeking new customers through technology and added value	Systems in place to meet customer demands from European perspective	Lack of contact with support agencies
CG 4	Staring to address new customer, product issues (1:1 is 5:5) Established Product Development meeting room "think tank" and NPD process	Excellent	Internal, some networking but still MD focussed Finds difficulties in receiving feedback or in local network participation. Constrained by lack of participation in management team

Table 21: Stage Three, end of Year Two

4.9 CASE STUDY RESULTS QUESTIONNAIRE DATA

The networking results can now be complemented by results from the data. The research methodology chosen for the measuring of the questionnaire results has been chosen as parametric statistical tests utilising "SPSS" as the system. Results are now shown for the Case Study networks with a brief discussion following each table. These results are then analysed in more detail in Chapter Five. In this way a picture can be built up of the case study data, the network activities and the comparisons with the postal questionnaire. This iterative approach will help to better develop an understanding of the research questions and the research hypotheses in what is a complex and inter-connected field of activity within these small firms. How far will the tests help in confirming and clarifying the network results?

The trend towards networks as a focus for discussion and ideas sharing is emerging and the difficulties of trading within the group to supply a customer or to act as an entity to win and manufacture for new business is also problematic. Will the tests corroborate these trends or establish a new set of issues to be reflected back within the networks and the research methodology?

4.9.1 The Tests, One sample "t" – test:

Eleven tests were carried out within the three-stage approach (start, mid point – end year one and end of the research process, end of year two). The tests were to determine the attitude of the firms and whether they have a significant positive attitude to a number of criteria around the potential benefits which networking could bring to them. These criteria include two of the Hypotheses directly, ability of networking to support new processes and the capacity of networking to help with a propensity for NPD. To complement these key hypotheses, the research also sought

to establish other potential benefits, which the firms could see from networking. This is important as it gives an opportunity to measure the significance of other criteria as well as seeking to highlight related areas to new processes and NPD which, the firms can indicate as being helpful. This can then be used in the analysis to seek to understand the processes underpinning networking in small firms.

4.9.1.1 The Test Design

The basis of these tests was therefore to examine whether the companies involved in networking have a positive attitude to participating in networks will result in fostering-

- New Product Development
- Process Improvements
- Sharing of Ideas
- Learning from Others
- Customer strategy supporting NPD
- Benchmarking
- New sales contacts
- Collaboration with other firms (i.e. *not* in the networks) in partnerships
- Information on trends
- Collaboration with other firms in the network
- Funding Opportunities

These tests have been conducted for the three questionnaire levels and the same has been independently evaluated to register any change in attitude of the participating companies over the questionnaire time frame. Each of the tests yielded the following hypotheses:

H0: There is a negative attitude among networking firms to participation in networks, which will be fostered by one of the eleven criteria listed above

H1: There is a significant positive attitude among networking firms to participation in networks, which will be fostered by one of the eleven criteria.

4.9.1.2 The Case Study Research Networks:

A One sample-t test was performed to determine at each of the three stages whether the firms have a significant positive attitude at the start of networking, at the mid point and after two years of network initiation to the below mentioned criteria. The results are shown in Table Eleven. Where there exists a significant positive attitude within the firms to a particular criteria (supporting the test hypothesis and thus rejecting the null hypothesis) this is shown in bold ($\boldsymbol{P < 0.05}$). Where the results show that a significant positive attitude does not exist among the firms, thus failing to reject the null hypothesis, this is not highlighted ($P > 0.05$).

Criteria	Mean	Standard Deviation	't'	'df'	Significance (two tailed)
Foster NPD	2.6667	1.1547	-1.000	11	P>0.05
Process Improvements	3.0833	0.9962	0.290	11	P > 0.05
Sharing Ideas	3.9167	0.6666	4.750	11	**P < 0.05**
Learning from others	4.5833	0.5149	10.652	11	**P <0.05**
Customer strategy supporting NPD	3.9167	0.9962	3.188	11	**P<0.05**
Benchmarking	3.0833	1.3124	0.220	11	P > 0.05
New Sales contacts	2.667	1.3027	-0.886	11	P> 0.05
Collaborate with other firms in partnerships	2.9167	1.4434	-.200	11	P> 0.05
Information on Trends	3.3333	1.1547	1.000	11	P > 0.05
Collaborate with other firms in the network	3.250	1.053	0.821	11	P> 0.05
Funding opportunities	3.6667	1.3707	1.685	11	P>0.05

Table 22: Results for the One Sample "T" test for the Case Study Firms at the Start of the Networking Period

The test results indicated a significant positive attitude exhibited by the firms at the start of network participation benefiting in:

Learning from others participants.

Sharing of information and ideas.

Developing a customer strategy which supports NPD.

This supports the activity undertaken in the networks and is important in establishing a pattern within the qualitative and quantitative results.

Criteria	Mean	Standard Deviation	't'	'df'	Significance (two tailed)
Foster NPD	2.916	1.0836	-0.266	11	P >0.05
Process Improvements	3.4167	0.9962	1.449	11	P > 0.05
Sharing Ideas	4.2500	0.7538	5.745	11	**P < 0.05**
Learning from others	4.3333	0.7785	5.933	11	**P < 0.05**
Customer strategy supporting NPD	4.0000	0.8528	4.062	11	**P< 0.05**
Benchmarking	3.5000	1.000	1.732	11	P > 0.05
New Sales contacts	2.9167	1.3114	-0.220	11	P> 0.05
Collaborate with other firms in partnerships	3.4167	1.2401	1.164	11	P> 0.05
Information on Trends	3.3333	0.9847	1.173	11	P > 0.05
Collaborate with other firms in the network	3.2500	1.1382	0.761	11	P> 0.05
Funding opportunities	3.8333	0.8348	3.458	11	**P< 0.05**

Table 23: Networking period, end year one

The results again indicate a significant positive attitude at the end of year one to sharing ideas, learning from others, customer strategy supporting NPD and since the start of the period, for funding opportunities.

Criteria	Mean	Standard Deviation	't'	'df'	Significance (two tailed)
Foster NPD	2.917	0.793	-0.364	11	P> 0.05
Process Improvements	3.083	0.996	-0.290	11	P> 0.05
Sharing Ideas	4.083	0.669	5.613	11	**P< 0.05**
Learning from others	4.500	0.674	7.707	11	**P <0.05**
Customer strategy supporting NPD	4.167	0.835	4.841	11	**P<0.05**
Benchmarking	3.250	0.965	0.897	11	
New Sales contacts	2.833	1.193	-0.484	11	P> 0.05
Collaborate with other firms in partnerships	3.000	0.954	0.000	11	P> 0.05
Information on Trends	3.667	0.651	3.546	11	**P<0.05**
Collaborate with other firms in the network	3.000	0.954	0.821	11	P > 0.05
Funding opportunities	3.636	1.206	1.750	11	P > 0.05

Table 24: Networking period end year two

At the end of year two sharing ideas and learning from others are still showing a significant association. Information on trends is a new correlation, which is entirely consistent with the needs of the networks. The results for all three phases show a consistent trend over the two years to the benefits of networking perceived by the SMEs and are significant because of this in their consistency and clarity (i.e. they have remained constant over time and this is significant). How would the results of Paired Sample Tests fit within these findings? These results are next described.

4.9.2 Results of Paired Sample "t" Tests

This test was designed to determine for any association between customer strategy, which supports NPD to links with other firms in partnership to supply customers.

This test aims to determine whether 'customer strategy which supports new product development' is associated with 'links to partnerships' with other firms. This would be of particular interest since linking with other firms in partnership may mean a new customer base and hence the need to satisfy that customer base with new products. The responses from the 12 participating firms, taken at the three different time periods for the aforesaid criteria is evaluated. The test yielded the following hypotheses:

H0: There is no association between customer strategy, which supports new product development and developing links with other firms in partnership to supply their customers.

H1: There is a significant association between customer strategy, which supports new product development and developing links with other firms in partnership to supply their customers.

Questions and Period	Mean	Standard Deviation
Q3.1 _1	3.9167	0.9962
Q3.1 _2	4.0000	0.8528
Q3.1_3	4.167	0.835
Q3.5 _1	2.9167	1.4434
Q3.5_2	3.4167	1.2401
Q3.5_3	3.417	1.084

Table 25: To determine for any association between customer strategy, which supports NPD to links with other firms in partnership to supply customers.

A Spearman's Correlation was performed to identify whether there is an association between customer strategy which supports new product development and developing links with other firms in partnership to supply their customers. The results revealed

no significant association ($r = 0.053$: $N = 12$; $p > 0.05$; two tailed), thus failing to reject the null hypotheses.

The above test for the second questionnaire period was also performed and the results then revealed a significant association ($r = 0.591$; N=; $\mathbf{p < 0.05}$; two tailed), thus confirming our experimental hypotheses and rejecting the null hypotheses.

The same test was repeated for the end of year two, again revealing a significant association. ($r = 0.784$: $N = 12$; $\mathbf{p < 0.05}$; two tailed).

Customer strategy development is a key concern for the firms in the networks. They are faced with changes in the way existing customers are behaving and the firms saw networking as a possible solution to gain intelligence on new opportunities and share ideas for then exploiting potential new business.

The importance of NPD therefore became important during the networking process (it was not significant before the research) and the focus on partnerships reflects the "dyadic" relationships made by the firms in developing new business (i.e. not as networks of firms trading as a group). It confirms the Case Study behaviour in that network participation has made the companies realise the possibility of linking with other firms and developing new products to maintain / improve their competitiveness, as depicted by the increase in mean scores.

The results are therefore; entirely consistent to the behaviour exhibited by the firms in the networks over the research period.

To examine any association between collaborating with firms in the network and linking with other firms in partnership to supply their customers.

This test aims to determine whether collaborating with firms in the network has any association with linking with other firms in partnership to supply their customers. This would be of particular interest since we believe that networking activity fosters initiative to firms to seek partnerships to supply their customers. The responses from the 12 participating firms, taken at two different time periods (before and after getting involved in networking activities) for the aforesaid criteria's is evaluated. The test yielded the following hypotheses:

H0: There is no association between collaboration with firms in the network and linking with other firms in partnership to supply their customers.

H1: There is a significant association between collaborating with firms in the network and linking with other firms in partnership to supply their customers.

Questions and Period	Mean	Standard Deviation
Q7.9 _1	3.2500	1.0533
Q7.9 _2	3.2500	1.1382
Q7.9_3	3.000	0.954
Q3.5 _1	2.9167	1.4434
Q3.5_2	3.3636	1.2863
Q3.5_3	3.417	1.084

Table 26: To examine any association between collaborating with firms in the network and linking with other firms in partnership to supply their customers

A Spearman's correlation was performed on the data from the first questionnaire to confirm on the experimental hypotheses. The results revealed a significant association ($r = 0.587$: $N = 12$; $\mathbf{p < 0.05}$; two tailed), thus confirming the experimental hypotheses and rejecting the null hypotheses. However, on carrying out the Spearman's correlation for the data of the second questionnaire, the results revealed no significant association ($r = -0.214$; $N = 12$; $p > 0.05$; two tailed), thus failing to reject the null hypotheses. Similarly this trend continued in the Third Questionnaire ($r = 0.458$: $N=12$; $p > 0.05$). Initial preconceptions of the possibilities of collaboration and product development were certainly present in CSN as this was one of their Terms of Reference, but this was seen to be problematic by the mid point of the research.

This reflects that the network relationships are not perceived as directly related to new business from within the network. The results indicate that firms see that networking provides a different set of outcomes than the two traditions from the literature might suggest. The emphasis in the supply chain and District model is on collaboration and partnerships within networks to develop business. The results from the case study firms suggest networks can provide information and ideas, which can then lead to new opportunities external to the network. This will be further developed in Chapter Five and in modelling the networks in Chapter Six.

To examine for any association between sharing of ideas during networking and links with other firms in partnerships to supply our customers.

This test aims to determine whether 'sharing of ideas' amongst network members has any association with 'linking with other firms in partnership to supply their

customers'. The responses from the 12 participating firms, taken at two different time periods (before and after getting involved in networking activities) for the aforesaid criteria's is evaluated. Consideration of the two-questionnaire level is done to examine the expectations of the firms in regard to the above analysis before networking was initiated and to register whether those expectations have been met or improved upon as a result of networking. The test yielded the following hypotheses:

H0 : There is no association between sharing of ideas during networking and linking with other firms in partnership to supply their customers.

H1: There is a significant association between sharing of ideas during networking and linking with other firms in partnership to supply their customers.

Questions and Period	Mean	Standard Deviation
Q7.6 _1	3.9167	0.6686
Q7.6 _2	4.2500	0.7538
Q7.6_3	4.083	0.669
Q3.5 _1	2.9167	1.4434
Q3.5_2	3.4167	1.2401
Q3.5_3	3.417	1.084

Table 27: To examine for any association between sharing of ideas during networking and links with other firms in partnerships to supply our customers.

A Spearman's correlation was performed on the data from the first questionnaire to confirm on the experimental hypotheses. The results revealed a significant association ($r = 0.657$: $N = 12$; $\mathbf{p < 0.05}$; two tailed), thus confirming our experimental hypotheses and rejecting the null hypotheses. On carrying out the Spearman's correlation for the data of the second questionnaire, the results also revealed a significant association ($r = 0.736$; $N = 12$; $\mathbf{p < 0.05}$; two tailed), thus

confirming our experimental hypotheses and rejecting the null hypotheses. For the third questionnaire (r= 0.445; N= 12; p>0.05) there was no longer a significant association on this test. The test indicates a significant association for both the periods of analysis that can be attributed to network participation for the subject criteria's. Network participation involves co-operation amongst members through sharing of ideas and learning (for which significant positive attitude has been registered). Furthermore, this participation facilitates an attitude among networking firms to linking with other firms to supply their customers. The author considers the possibility of firms assimilating the ideas exchanged during networking and pursuing it by linking with other firm's external/outside the network. This can be explained by the benefits arising at mid point and those expectations for some of the firms were then lower at the end of year two. This might suggest an optimum time for benefit from networking and that companies may need to re-assess membership. The lack of a correlation at the end of year two will be discussed in Chapter Five.

4.10 RESULTS OF THE POSTAL QUESTIONNAIRE SURVEY

4.10.1 Rationale for presenting the results

The research process needed to establish the validity and reliability of the case study examples by testing the hypotheses within the larger sample of SMEs. A one-sample t test was performed to register the attitude of the firms participating in the 2nd level analysis to the previously tested criteria. It was decided to divide the firms into three categories for analysis purposes, namely:

- Non networking firms
- Single network firms
- Multiple network firms

This division was done to provide means to compare the research network behaviour with the general population and furthermore to shed light on firms which take part in multiple networking.

4.10.2 Results for Postal Questionnaires

The test results for the one sample "t" test are shown below:

Criteria	Mean	Standard Deviation	't'	'df'	Significance (Two tailed)
Learning from others	3.4815	1.2222	2.229	26	**P < 0.05**
Sharing Information	3.4815	1.2518	1.995	26	P > 0.05
Information on Trends	3.4815	1.0141	2.467	26	**P < 0.05**
Benchmarking	3.1154	1.1774	0.500	26	P > 0.05
Process Improvements	3.7400	3.6225	1.063	26	P > 0.05

Table 28: Postal Questionnaire, Non Networking Firms

Criteria	Mean	Standard Deviation	't'	'df'	Significance (Two tailed)
Learning from others	4.1852	0.7863	7.832	26	**P < 0.05**
Sharing Information	3.7037	0.9929	3.683	26	**P < 0.05**
Information on Trends	3.8519	1.0267	4.311	26	**P < 0.05**
Benchmarking	3.7407	0.7642	5.036	26	**P < 0.05**
Process Improvements	3.629	0.8389	3.900	26	**P < 0.05**

Table 29: Postal Questionnaire, Single Networking Firms

Criteria	Mean	Standard Deviation	't'	'df'	Significance (Two tailed)
Learning from others	4.3333	0.6794	10.198	26	**P < 0.05**
Sharing Information	4.1111	1.0127	5.701	26	**P < 0.05**
Information on Trends	4.0370	0.8077	6.671	26	**P < 0.05**
Benchmarking	3.7037	0.9929	3.683	26	**P < 0.05**
Process Improvements	3.778	0.8916	4.533	26	**P < 0.05**

Table 30: Postal Questionnaire, Multiple networking Firms

'Learning from others' seems to be the main benefit firms (both non-networking and networking) seek from network participation. The level of expectations depicted by the non-networking firms is subsequently translated into their behaviour as non-participants, as depicted by the significant positive attitude of the networking firms. Sharing of information does not seem to be the priority of the non-networking firms, unlike that experienced for the research networks. The Literature has stressed the importance of having trust in place for any meaningful exchange of information, which firms can perceive only on participation (Huggins, 2000). The above explanation is confirmed by the significant positive attitude exhibited by the single network and multiple network firms to network participation benefiting in sharing of information.

Information of trends seems to be the additional benefit that firms to seek to gain from network participation, something not shown for the research network. All the firms (all 3 categories) have registered a strong mean score for network participation supporting the gaining of information of trends.

Benchmarking and process improvements, also feature as the next most significant reason for networking for single and multiple networking firms. It is not seen as a benefit for the non- networking firms nor is sharing of information. However, networking firms (single and multiple) have confirmed that they do find network participation benefiting in benchmarking activities and process improvements. This result was noteworthy, especially since the Case Study Network firms espoused a desire to develop more market orientated benefits at all stages of the research. This can be explained by the CSN having a strong desire to move from process improvement and benchmarking activities (which all firms had participated in prior to the research) to a new customer and NPD focus. The OSN is from an owner managed tradition which is sceptical of new process developments seeing them as customer orientated to reduce costs, so this would not have featured in their networking needs.

Since the single network and multiple network firms registered a significant positive attitude for all of the above tests, it was interesting to note whether there existed a considerable difference between the categories that can be attributed to network participation. For this purpose, an independent sample t test was performed to register any significant improvement between the following variables:

- Non networking and single networking firms
- Non networking and multiple network firms
- Single network and multiple network firms

	'F'	't'	'df'	Significance (Two tailed)
Learning from others	4.405	-2.669	46.57	**P < 0.05**
Sharing Information	1.679	-0.723	52	P > 0.05
Information on Trends	0.263	-1.334	52	P > 0.05
Benchmarking	3.162	-2.302	51	**P < 0.05**
Process Improvements	2.225	0.155	52	P > 0.05

Table 31: Non- networking f irms and single networking firms:

	'F'	't'	'df'	Significance (Two tailed)
Learning from others	7.942	-3.374	42.80	**P < 0.05**
Sharing Information	2.453	-2.032	52	**P < 0.05**
Information on Trends	4.332	-2.227	52	**P < 0.05**
Benchmarking	0.628	-1.969	51	P > 0.05
Process Improvements	2.218	-0.52	52	P > 0.05

Table 32: Non networking firms and multiple networking firms:

	'F'	't'	'df'	Significance (two tailed)
Learning from others	0.534	-0.741	52	P > 0.05
Sharing Information	0.170	-1.493	52	P > 0.05
Information on Trends	1.806	-0.737	52	P > 0.05
Benchmarking	0.984	0.154	52	P > 0.05
Process Improvements	0.001	-0.629	52	P > 0.05

Table 33: Single networking firms and multiple:

The most promising results from all the above analyses was between the non-networking and multiple networking firms. The results indicate a significant difference, attributable to network participation for:

- learning from other participants
- sharing of information
- gaining information on trends

Benchmarking and process improvements failed to register significant values, although the multiple network firms did register a significant positive attitude for the one sample "t" test.

Also of interest are the test results for the analysis between the non-networking and single networking firms, where a significant improvement was registered for 'learning from others' and 'benchmarking' as a result of network participation. However the other criteria failed to register significant values, irrespective of the fact that the single network firms displayed a significant positive attitude to all the criteria.

Lastly, no significant improvement was registered for the analysis between the single network and multiple network firms. This highlights the need to explore reasons as to why firms go in for multiple networking, once they have derived the main benefits they seek of networking, mainly in terms of:

- gaining information on trends
- learning from others
- sharing of information

It could represent an opportunity for them to review their network participation and determine what benefits are accruing for what activity and focus on the networks which are the most productive. This could help to confirm the lack of correlation in the third stage results for the case study firms in sharing ideas during networking and links with other firms in partnerships to supply customers. The results could suggest a critical re-appraisal of the purpose of the network and the benefits accruing for the participating SMEs.

4.11 RESULTS SUMMARY

The networks have arisen from the two dominant traditions and have been important in suggesting ways that small firms can develop from both a Vertical Supply Chain starting position and from an owner managed Industrial District perspective. Trends and characteristics are emerging from the case studies, which are complimented by the qualitative analysis, justifying the research methodology. The results from the networks have seen the two new networks form, establish terms of reference and develop activities in support of their aims. The focus has been on new product development and working to develop new customers. The focus for discussion has been on sharing information and ideas with each other to then exploit externally from the network. Neither network has constituted itself as a trading entity nor vertical networking has been limited. The results have shown a strong tendency towards partnerships – dyadic relationships- with other firms. The case study CSN has established cross company teams but has found these difficult to sustain. Significantly, specific developmental events have been devised by the networks and then undertaken with support from strategic business development agencies. Some aspects such as the "mechanism" have taken over a year to start and the results are unknown. Generally, activities have taken place a year following initial discussion. The focus has been on discussion within the network to be then exploited by the individual firm outside of the network.

The Control Group of SMEs has found it difficult to sustain local relationships with other SMEs to exchange information or to share ideas. They have similar concerns as the networking firms but lack the will and or ability to participate. The networks have exhibited a range of characteristics, which from the literature can be applied more generally to measure behaviour in networks. The quantitative results show

consistently show associations for sharing ideas, learning from each other and a customer strategy supporting NPD, with gaining information on trends emerging at the third questionnaire stage. The links with the SMEs developing a customer strategy and links with others in partnerships is a strong link at all three stages and is entirely consistent with the discussions and subsequent activity in the networks. The initial intention to collaborate with firms in the network and link in partnership with others had diminished by the mid point and was not present at the end. (The problematic "broker" concept). The results from sharing ideas during networking and links with other firms in partnerships to supply customers, was strong at the start and mid point but not at the end. This might suggest that firms get these benefits after perhaps year one and that they diminish after this. The idea of core and peripheral networking was raised, as was the need to re-visit TOR to meet SME needs. Generally, the case study activity, the results from the Performance Indicators and the results from the questionnaire data suggest similar trends. Networks as good for information on trends, learning from others and sharing ideas, as well as having a desire to develop customer relationships and partnerships with others. The postal questionnaire results significantly also show a positive attitude to networks and new processes and networks and benchmarking which was not present in the case study group. To re-cap, the most promising results from the analysis was between the non-networking and multiple networking firms. ***The results indicate a significant difference, attributable to network participation for:***

- Learning from other participants
- Sharing of information and
- Gaining information on trends

The analysis in Chapter Five will now build upon these results.

5.0 ANALYSIS

5.1 DESCRIPTION OF ANALYSIS

The analysis of the results will take the same format as the presentation of results in Chapter Four within two strands (as can be illustrated in Figure Nineteen). *Strand One Analysis* is of the twelve case study firms with data collected over the two-year period and Strand Two Analysis represents the analysis from the postal questionnaire data. Strand One is necessarily more complex in its representation and its components are designed to thoroughly test out the key hypotheses with Strand Two acting as further validation for the analysis emerging from the cases.

5.1.1 Description of process within Strand One analysis

There are three stages of analysis in Strand One,

- Performance Indicators
- Network Case Studies
- Associational Statistical "t" Tests.

The data from the Performance Indicators will firstly be analysed from the three stages of the research process. This will take the form of comparing the relative position of the Indicators for the *individual companies* and to detect any patterns within the *networks* over the two-year research process. The Performance Indicators were developed to represent key characteristics of company performance specifically to test the research hypotheses.

Next, the Case Study firms will be analysed in the way the two networks, The Closed Strategic Network (CSN), the Open Social Network (OSN) and the Control Group (CG) developed over the research period against the three hypotheses. A set of

characteristics developed through the literature review will be used to allow for comparison and for analysis.

Lastly, in the Strand One Analysis, associational comparisons of the scores for the *twelve firms as a group* will be analysed to secure an understanding of both the validity of the tests and the reliability of the approach. This analysis is of all the Case Study firms as a group and could not be disaggregated because of the small sample size. Conclusions and emerging themes from the Strand One Analysis will then be presented combining the results of the analysis within the three approaches.

5.1.2 Description of process within Strand Two analysis

The results from the Postal Questionnaire will be next analysed for trends in the network process from a wider cross section of manufacturing small firms. These results will then be analysed against the trends from the Case Studies from the Strand One Analysis.

Following Strand One and Strand Two Analysis, the research hypotheses will be either proven, not proven or in need of further clarification and revision.

The analysis of these two strands from the research will then form the basis of the conclusions drawn together in Chapter Seven which will be -

- The development of network models for specifically supporting the development of new processes.
- The development of Network models for specifically supporting New Product Development.
- Facilitation roles in the development of the network models.

- The stages of development within networks which need to be understood to support specific SME development in appropriate network activity.
- Towards a definition of network typology for small manufacturing firms.

The conclusions arising from the analysis are then presented in Chapter Seven.

The steps in the analytical process following the collection of data from the Case Studies and the Postal Questionnaires can be illustrated in Figure 19.

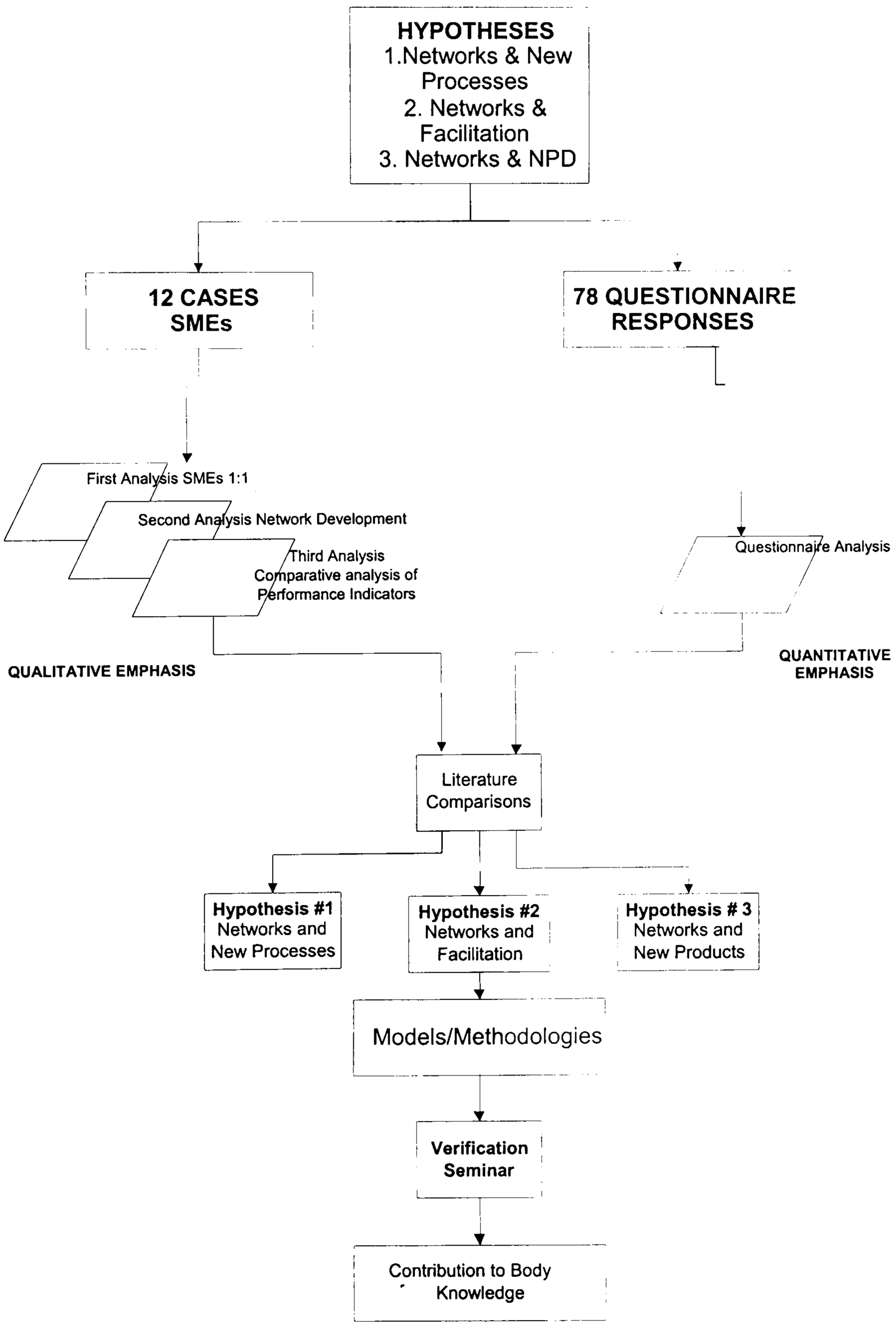


Figure 19: Analysis Overview

5.2 STRAND ONE ANALYSIS

5.2.1 Introduction - The purpose of the Performance Indicators

The purpose of the analysis of the Performance Indicators is firstly to seek an understanding of each *individual firm's position* relating to three specific sets of indicators. These indicators equate to the Hypotheses, one for NPD, and two for developing processes. Therefore:

- Speed is contrasted with Dependability to give a measure of responsiveness and the adequacy of internal processes,
- Responsiveness in Innovation and Design with Company Culture as a measure of design capability (NPD) and
- Responsiveness in Product Mix with responsiveness in Volume Delivery to indicate the ability to meet and further develop customer demand.

These Performance Indicators are then recorded to show if there are *patterns within the networks* and then, to establish if and how these Indicators are then reflected in the *activities* of the networks themselves during the two year period. (i.e. how does network activity reflect the characteristics of the individual firms as reflected in the Indicators?).

The Indicators are *subjective*, in that the respondent self assesses the company against a set of indicators, but these results are also analysed within the context of the individual SME meetings with the researcher over the two years, the inter-company teams and the network meetings themselves.

5.3 THE CSN– ANALYSIS OF PERFORMANCE INDICATORS

5.3.1 Comparison of scores for Speed and Dependability

The Performance Indicators reflect Hypothesis Two, networking and support for new processes. At the start of the networking period, CSN 1 and CSN 2 were very well placed against this score (it is indeed difficult to see how they could or should substantially improve). Both firms represent the requirements of sub contract manufacture prevalent at the end of the 1990's in Birmingham. CSN3, as a toolmaker, scored next highest, well on dependability but below average on speed. The specialist sheet metal firm, CSN 4, likewise scored average on dependability but below average on speed. Both scores for CSN3 and 4 suggest the specialist nature of their manufacturing and the importance of other factors such as design capability and having products and processes which are well differentiated and hard for customers to replicate. However, despite its technical edge and capability in tool design, CSN3 would too soon be faced with competitive pressures to increase on speed from its automotive customers.

Mid way through the networking these relative positions remained the same, only the toolmaker making notable progress related to speed of performance. By the end of the research these relative positions had remained the same with CSN 4 still below average in terms of Speed within the group. This would need to be addressed on a 1:1 basis, perhaps if circumstances changed for the firm. But by being in the network, it can learn techniques and methodologies from the others particularly CSN 1, which they have now developed good relationships with in the cross company teams on ICT and QA.

5.3.2 Comparison of results from Responsiveness in Innovation and Design with Company Culture as a measure of Design Capability

This comparison of Performance Indicators relates to Hypothesis One, networking and the propensity for New Product Development (NPD). At the start of the networking process, only one firm, CSN1 scored highly on NPD and culture for change. "Culture" scored well with the others, but all three had below average scores for innovation and design. By the mid point end year one, all four were in the top quartile. The Terms of Reference (TOR), which were drawn up by the network, clearly reflected the urgent need to develop in this area and builds upon the needs of the firms. That is, if the TOR had espoused new customer development and the PI's had shown weak capacity at the three research stages this would have made progress more problematic; as it is the TOR are built on a firm base.

These PI's best capture the flavour of the propensity to NPD in the hypotheses reflecting the ability to design products and the capacity to have a flexible workforce which embraces change. The lack of high scores at the start reflects the importance placed subsequently on customer development within the network. But, it also highlights the fact that as sub contractors, these small firms saw the business environment as a difficult place wherein control may be out of their hands as they do not themselves have a "product" to develop. The weak association with the direct question of NPD and networking can also be explained by this relative weakness in the profile of the sub-contracting small firm research base. Indeed, a good performance indicator will be the higher profile and importance of NPD as an issue over QCD. All four, however, throughout the research feel they have a flexible and adaptable workforce, receptive to new ideas and change. Networking should be able to build on this within the firms extending to other levels and not solely the owner or M.D.

The shift to the top quartile cannot be solely attributed to networking. However, the PI's allow the network facilitator to take a measure of the performance of the firms and judge appropriateness of interventions and development activities (Hypothesis Three).

By the end of the research CSN 1 had consolidated its position building on a strong culture for change as had CSN 2, which had likewise moved into the top quartile. CSN 4, which is the small batch specialist manufacturer, had also progressed in terms of innovation and design. CSN 3 had made the most progress on the innovation axis, but was still relatively weaker than the rest on culture and ability to affect change. CSN 3 has an owner manager who still influences the style of the company in terms of new ideas and relationships.

5.3.3 Responsiveness Product Mix with Responsiveness in Volume and Delivery

This set of scores relates most directly to the New Processes and networking Hypothesis as it seeks to measure response time in volume and delivery and the degree of product mix. Again at the start of the research process, CSN 1 & 2 score highest as the traditional automotive sub-contractors with demanding customers and the need to vary products. It also seeks to emphasise that the degree of products sold into the existing customer base for both CSN 1 and CSN2 is very high already reflecting the needs in the TOR at the start to develop new customer relationships. CSN 4 scores very weakly in both respects and CSN3 is average for product mix but below average for volume and delivery.

By the mid point, CSN 3 had improved to just above average on volume and delivery and CSN 4 had average performance on mix, but is still below average on volume

and delivery, indicating the potential for more product to be developed with customers and to be more delivery conscious. The scores for CSN 1 could be expected to be 4+ for volume and delivery given their sector and market conditions. CSN 2 achieves a "4" by the mid point. CSN 3 has become more responsive in terms of delivery, again reflecting the business environment of early 2001. CSN 4 scores poorly, it has other competences, which make it competitive, however, the lack of high scores in terms of volume and delivery remain a weakness (probably hidden by the success of its high growth). By the end point these trends have been re-inforced in that CSN 1 and 2 are still differentiated by their ability to supply customers in terms of variations in demand, changeover times and variety of product. CSN 3 has also increased its ability to meet customer requirements where it scored below average for responsiveness in volume and delivery performance at the start and has seen improvements on this axis throughout the research period. Even CSN 4 has progressed well on the responsiveness axis from its poor initial position, but this is through teamwork rather than systems.

5.3.4 General Conclusions and Observations from Performance Indicators

The Performance Indicators in the case of the Closed Strategic Network (CSN) do give a good indication of the individual position of the participating firms highlighting strengths and weaknesses as well as potential new areas to develop. The Indicators confirm tendencies within the firms discussed with the researcher and exhibited as a group during the meetings. They are therefore, extremely useful in terms of determining the *internal validity* of the research approach.

The Indicators were also continuously assessed in conjunction with the 1:1 meetings with the researcher and the network interactions themselves to check for validity.

Direct customer evaluation within the Technical Partnerships, which arose in the latter stages of the research, was not possible within the research timeframe.

The Indicators enable *comparisons* to be made within the network to establish patterns in the performance of the firms at the stages of the research process as well as a useful guide to the *facilitation* process and for firstly determining and then re-assessing the *objectives* of the network. They do provide an indication that some form of assessment of the strengths of the firms and compatibility is important for the group to progress. For example, we can speculate what might be the problems in a network with firms with low Performance Indicators aspiring to learn and share ideas with each other. This may be a slow and possibly ineffective process as learning would be necessarily problematic and would need external stimulus to suggest how the firms might improve. Analysis of the network characteristics can now be undertaken to make comparisons with these PI's.

5.4 THE CLOSED STRATEGIC NETWORK ANALYSIS OF NETWORK CHARACTERISTICS

In this, the second stage of the Strand One Analysis, the network will be analysed using *characteristics*, which have been adopted from the literature review as being significant for successful networking to take place. These are *Purpose, Degree of Trust, Compatibility, Equity and Entrepreneurial Behaviour*. These will be used to analyse the effectiveness of the networks against the three research hypotheses (the impact of networking on propensity for NPD, supporting new processes and impact of Facilitation).

5.4.1 Purpose

The CSN, from its inception in the World Class Network, always had a clearly defined set of objectives. These were derived from the members themselves and were a key reason for the network's establishment – a sense of small firms acting together to address a set of common issues which were derived from the group itself and not imposed externally (Huggins, 2000). These impact on the hypotheses also (Objective One in the Terms Of Reference, "the Mechanism" for SMEs to establish new customers, Objective Four "the Brokerage" idea both for NPD and Objective Three formation of inter-company project specific teams on new processes).

The TOR were also used to attract funding from external business support agencies but in some ways the funding issue proved a distraction to the network. The instinct of the network, based on previous experience, was to seek external acknowledgement from business support agencies and a "contribution" from a funding source to support training and developmental activity decided by the network. In fact, the successful aspects were around inter company teams, 1:1 business relations established from the meetings, exchange of information and views and learning from each other. Funding for joint activities was then subject to separate arrangements with the appropriate funding bodies. These included the development of the SME – Customer "Mechanism" through the Regional Development Agency, Advantage West Midlands (AWM), the support for New Product Development training through Winning Moves via "Accelerate" and the development of an intranet with a key customer of CSN 4, Morgan Cars. The revised TOR reflecting these changes can be seen in the Network Minutes in the Appendices.

The purpose was also helped by the proximity of the firms in that all were from Birmingham itself; issues of sub-district and even closer geographical proximity were not seen as significant for the group in terms of defining its purpose.

5.4.2 Degree of Trust

Establishing trust was a key feature of the Network's early meetings. It can be seen as a key characteristic for the network to develop and meet the objectives set out in the Terms of Reference (Huggins, 2000). Trust can be described as "Fragile", where one mistake can seriously harm the empathy within the group, to "Resilient", where group members have the ability to discuss issues at a deeper level, be forgiving of a "lapse" and are capable of giving and receiving sensitive feedback on behaviour (Gundlach, 1993, Ring, 1997).

The nature of the CSN made this more possible, members could build an ongoing relationship with each other over time and get to understand sensitivities and the business context of the other companies. The development of trust is also reflected in the willingness of the network to discuss differences between "espoused" and "actual" behaviour (Argyris and Schon, 1996). Sharing of customer intelligence in terms of the potential for new business was important in this respect, as without trust these insights would have been less forthcoming if made at all. This was also seen in the development of the TOR in the network discussions, sharing and discussing SWOT analyses and in the training sessions on company strategy.

5.4.3 Compatibility

The CSN can be seen as being based on a *Theme* (World-Class companies seeking improvement) to be *Heterogeneous* (the companies are all different in terms of type) and *Closed* in that membership is restricted to the four companies having agreed the composition at the start. The Performance Indicators also suggest "clustering" or "homogeneity" of key indicators as a group, but with enough difference in terms of product specialism (heterogeneity) to make for new ideas. The four firms did not have exactly the same Performance Indicator scores, but they did all exhibit a trend towards the high performing top quartile and neither were they randomly distributed across the quartiles. There was an assessment carried out intuitively by the firms of this compatibility prior to setting up the network.

It can be said moreover, that there were 2 "dyads" in the network, (Fombrun, 1982) one scoring highly on speed and dependability (CSN 1 and CSN 2) and the other scoring higher on NPD (CSN 3 and 4), which seemed to complement the discussions in the group. (I.e. a group with exactly similar characteristics might not have been as stimulating in terms of a range of experiences and view points). Whether by staying with four firms the network restricted input also needs to be discussed. Early in the meetings the idea of "Associate" member was agreed which meant minutes could be distributed following the meeting and that Associate Firms could also participate in the inter-company activities, but not in the regular MD meetings. This issue was not pursued by the two firms discussed by the network as potential associates, particularly CG4. The CSN is now considering the inclusion of a specific injection moulding firm collaborating with CSN1 over the heat treatment on plastic business project (also came to the 3M visit and was instrumental in suggesting the eventual

commercial partner to CSN1 to pursue the idea). This company will work with the network on a specific project first (Objective One The mechanism supporting SME links with new customers) and the network will then consider appropriateness for them and the aspirant company of full network membership. This formal process was discussed and minuted at a network meeting.

5.4.4 Equity

By equity, this characteristic in some way measures the degree of input to the network and the benefits arising from the input. It is also about relative perceptions of contribution and fairness (Rogers and McIntire, 1983) An unacceptable situation would be for a company to listen, not contribute, not be willing to fully share in activities between meetings and generally to be "passive". This could be seen as inequitable by the other members and lead to tension in the group.

Interestingly, these issues were raised in the September 2001 meeting by CSN1 and CSN4 regarding CSN 2 and CSN3, prompted, but not caused by, the non-attendance of the two. The future of the network was then re-stated in an extra meeting held later in the month, whereby CSN 2 and 3 re-committed to the aims of the network and the other two were entirely content that the issue had been raised and handled in a mature way.

5.4.5 Entrepreneurial and Collaborative Behaviour

The network members need to have an understanding of the individual and separate needs of its constituent parts. The context of the CSN at the start of the research was very much in the tradition of vertical relationships within stable supply chains based on improvements in Quality Cost and Delivery (Lamming, 1993). Collaborative behaviour between the firms was rare and fragile. The firms felt the need to dis-engage from the network if appropriate. This can be seen as the ability to also de-couple from the arrangements if necessary (Inzerilli, 1990) given the close physical proximity of the four and the web of inter–relationships with customers and other stakeholders shared by the group. The notion of the "brokerage" wherein the four would come together to then decide on a common product was seen as both impractical and unhelpful almost a distraction after six meetings. The view was that for the four to be compatible to make a given product with unclear knowledge at the outset of the network was highly unlikely. There would have needed to be a long process to ensure that this was a possibility and then further discussions still on the way this could then be taken forward. This represented the antithesis to the free flowing information and learning exchange, which the members were valuing so highly. (This was only articulated after 18 months of the network and had been felt but remained unsaid for some time, which relates to the internal sensitivities of the group to trust issues and the need to firstly establish rapport and empathy).

Customer developments were often aired in the group and then developed with a customer external to the network members, but the key was in the degree of discussion, which enabled the idea to then be taken up. The group was a means of articulating ideas and of then filtering these same ideas into meaningful action by the

individual SMEs. NPD can be better represented as developing new and existing customers as well as entering perhaps into new value chains – this was where the discussion and information flow was of most benefit. The degree of NPD specific discussion and detail was then undertaken at the individual firm level along business lines.

5.4.5.1 On-going support for internal teams

The need for on-going support of the cross company teams also needs to be remarked upon. Establishing the teams was relatively straightforward, but sustaining interactions after 2-3 meetings has proved difficult.

The network Directors feel this could be due to internal issues in the companies in that discussion, information exchange and ideas sharing are not featured within the company cultures of the network firms, despite the fact that the CSN does this function externally for the Directors. This needs to be addressed as the network enters its third year and is a factor to be considered in future networking within a "Closed Strategic Network".

5.5 THE OSN - ANALYSIS OF THE PERFORMANCE INDICATORS

5.5.1 Comparison of scores for Speed and Dependability

At the start of the process all four firms scored well on dependability – they all make an effort to meet customer requirements. Speed, however, sees OSN 1 and OSN 3 below average and OSN 2 average. OSN 4 is the highest performer in this category. By the mid point, there are three of the firms in the top quartile, although OSN 4 is now performing below average on speed. This reflects the changes within OSN 4, which did undergo substantial change in this period as automotive contracts began to reduce substantially and the company needed to re-align itself in new business

sectors. This meant the MD spending more time on marketing and customer relations with less time in the factory. (This apparent lack of depth in the management teams of the research group is will be commented on as an issue for small firm facilitation in the conclusions).

At the End Point the trend towards high speed and dependability has continued and three of the firms are in the top quartile. However, they still lag a little behind the more automotive supply orientated CSN firms in terms of speed The high performance of the OSN reflects their abilities, the network may be social in emphasis, but the firms are focussed on performance criteria. The firm's score as well as the CSN which espouses World Class Standards. This implies that although the objectives for membership are open, there are in fact informal selection criteria in place, which the network emanates through the way it performs as a group. (I.e. a wider spread of medium and low performing small firms are not found in the network, which could have been inferred as being the case as there was no explicit performance criteria for membership).

5.5.2 Comparison of results from Responsiveness in Innovation and Design with Company Culture as a measure of Design Capability

At the start of the research, OSN 3 and OSN 4 both score in the top quartile, with OSN 2 scoring above average on Culture, but below average on design suggesting room for development. OSN 2 has an innovative process, but it develops customers "organically" connecting new customers to its manufacturing capability. It also operates informal "no-go" areas within its competitor base, which was discussed in the presentation it made to the network as a potential weakness.

OSN 3 had aspirations to move from a traditional metal based business (screws) to a more design and service orientated business. However, lack of key personnel in its core business made this increasingly difficult and network membership also declined from the mid-point of the research. This managerial problem mirrored that in OSN 4, but the MD in OSN 3 lost two key personnel in this period which made diversification highly problematic as the MD needed to spend increasing time and energy on the core business (albeit declining core business). OSN 1 scored in the bottom quartile. OSN1 was the driving force in the network's inception – was this relative lack of performance at the time the reason for the need for action? Design is now an important element in its strategy.

By the mid- point all four were in the top quartile, with OSN 1 scoring the highest in all 12 cases on the innovation/design category. At the end point, three are solidly in the top quartile. OSN 1 has consolidated its position and has the flexibility in terms of staff attitudes, which it lacked at the start of the research to meet customer requirements and has "the ability to support the customer's design process" as its key success criteria also. OSN2 has moved along the innovation /design axis but is still not involved in customer design processes. OSN4 is able to support the customer's design process, but is weak in partnership arrangements and CAD.

5.5.3 Comparison of scores on Responsiveness in Product Mix with Responsiveness in Volume and Delivery

At the start, OSN 1, OSN2 and OSN 3 all scored well in this category, with OSN 4 scoring well on responsiveness, but poorly on product mix. This again reflected the need for the company to re-align its customer base and by the mid point this was above average and all four firms were scoring highly.

The scores reflect the need to secure and maintain market share within the respective customer bases of each of the firms. By the end point, OSN 1 had further increased its responsiveness in terms of volume and delivery, with OSN 2 slipping to average on these criteria, but still scoring well on product mix. If this trend continues for OSN 2, it could spell difficulties for the company as it seeks to become more responsive as it has little spare capacity and acute labour shortages to increase supply at short notice. OSN 4 began the research period with a low score on Mix, which improved at the mid point then regressed at the end, which accurately reflected its changing fortunes in a hostile customer environment for its presswork business in particular. Responsiveness for OSN 4 was high throughout.

5.5.4 General Conclusions and Observations from the Performance Indicator analysis for the OSN

The Indicators accurately reflected the needs of the companies as individual small firms and the way the network developed over the two years.

The Performance Indicators may have been expected to be wider in spread than for the CSN – the OSN had not emerged from the background of the pursuit of World Class Standards- but from a more "Owner Managed" Industrial District tradition than an automotive vertical supply chain tradition. There may have been some tacit

"screening" taking place within the network composition and ongoing membership which focuses on common characteristics in heterogeneous networks. "Design" as a Performance Indicator may have been expected to be higher scoring throughout than the scores in the CSN (OSN firms have a strong tradition of product rather than component). However, this was not so, the firms did not score higher than the CSN reflecting the lack of design orientated strategies in all of the firms within the research sample. Yet, nevertheless, the Indicators reflect a high performing group of SMEs with common characteristics. The OSN firms all scored well on responsiveness and speed. They also see design as important, but two of the OSN are not relating to the customer's design process, although two are in partnerships to meet customer needs. This confirms the arms length nature of the manufacturing process between small firms and customers, but does indicate closer ties with other firms to meet customer needs. The Indicators also highlight issues within the individual firms which are entirely consistent to their network behaviour and which are further explored in the description of OSN 1 and OSN 4.

5.6.1. ANALYSIS OF NETWORK CHARACTERISTICS – THE OPEN SOCIAL NETWORK

5.6.1 Purpose

The OSN had its origins in the ADAPT Network. This represented a "Horizontal" network of like-minded companies from a range of manufacturing sectors. It had a wide membership in terms of size of company and had a semi- formal role in advising the BCM of SME related issues and interests. Its Terms of Reference (TOR) had been in place since 1994/5 and had not been re-visited. It remained an "open" network, with a series of presentations by external speakers as a key ingredient. The

purpose of the OSN therefore needed to be re-clarified and this led to a new TOR reflecting the Open and Social aspects of the group.

The Openness means that membership is not confined to a set group of firms. Companies can be introduced by members at any time, although not by facilitators. The Network is therefore run by the SMEs, the facilitators supporting discussion, providing venue/refreshments and acting as the secretariat. Representation from non-owner managed firms is also not considered helpful to the group – the firms feeling the owner manager has unique insights and needs which a non-owner manager may not have. The need to establish views across gender and ethnicity issues is also an ingredient in the TOR. Fourthly, the OSN has a clear social element, it is very much about self-help and being able to discuss business issues with a group of like minded people. Hence the buffet element, the first 30 minutes of any meeting and the social events within the calendar of meetings are important elements in the operation of the network building up social ties. The close geographical proximity of the group is also important - although membership is not predicated on a City Council Ward boundary or a sub-geographical area basis.

5.6.2 Degree of Trust

The trust within the Network tended to be "resilient" from the start, as the new objectives demanded a degree of commitment and common understanding. The exchanges of business ideas and the ability for the network to present to each other on key business areas, is also significant.

The issue of informal "screening" also needs to be considered. The group had attendance from 20 companies with 3 to 4 at the core. This reflects a core and

periphery structure (Minzberg, 1989) which can be an efficient way for the network to develop in terms of trust, with the peripheral group attending for a different set of reasons then those at the core which should have deeper insights into inter-company networking. On reflection, it would indeed be hard to be at the core of more than one or two networks. However, peripheral membership of others can be a useful way to gain information on specific issues on an ad hoc basis. (This seems to hold true and will be remarked upon in the quantitative analysis of the Questionnaire data).

5.6.3 Compatibility

The OSN can be seen as being based on a "horizontal" group of like-minded small firms seeking to develop business issues. The group is "heterogeneous" by design and aspires for even greater diversity to attract new perceptions from a wide number of viewpoints and it is open in that it seeks to refresh itself continuously by welcoming new firms to its deliberations. It has no specific remit to work as a network to supply a product or service to a common customer.

The need to limit the group to owner managers facing common business issues was a key driver for the Network. It self styled itself a "club" rather than a network and sought to engender an atmosphere where companies could share experiences. Its sector spread within manufacturing is wide, although it has struggled to attract non-manufacturing firms to attend consistently. This was an objective for the network in 1999 – it has problems moving beyond a predominantly albeit heterogeneous manufacturing composition. This homogeneity comes from the social relationships made within the network.

Sector specificity is good for rapport building and seems essential for compatibility for firms to feel comfortable with others facing similar problems and opportunities. However, where do the new ideas come from and particularly ideas to work in new sectors? An answer may lie in the core periphery dimension, with specialist inputs garnered by individual firms in peripheral networks and then shared in the core group. The OSN could be said to be a trust based network reducing "the time effort and uncertainty associated with gathering and processing information" (McDonald and Vertova, 1997).

5.6.4 Equity

Within the OSN there appears to be two aspects to this – the need for openness as well as the ability to empathise with the position of other firms. Generally, from the start, the firms espoused a healthy disdain for the belief in QCD as driving principles of business success. Moreover, they talked with confidence about the need to escape the constraints of customers who had little regard for the fate of the small firm. The willingness to share business goals and engage in debate on these is important. Although open in nature the group has strong views on how members contribute and expect an owner manager perspective.

5.6.5 Entrepreneurial and Collaborative Behaviour

The OSN has a diverse range of SMEs and owner mangers with a range of business interests which cover a wide sectoral base, albeit primarily in manufacturing. It is not dominated by the automotive sector and is more in the Italian District Model tradition (Jarillo, 1988, Nassimbeni, 1998). The firms have acquired new capabilities by acquiring other small firms and most resemble a hub and spoke arrangement developing across boundaries within an organic structure (after Jarillo, they to date

acquire new competences through ***acquisition*** of other firms and people rather than by collaborative relationships or partnerships). They have strategies for exploiting new opportunities within an existing customer base. Consequently, the need for developing within vertical chains with customers or other firms is not seen as important, as it does not reflect their business experience or individual temperament as autonomous Owner Managers. These characteristics can be exploited as a defence mechanism against new entrant firms to home markets and may be reflected in acquisition strategy for higher value added product development in year three of the OSN.

These key network characteristics of the OSN as an *Open, Social, Heterogeneous, Horizontal Network*, will be further explored and discussed in the conclusions.

5.7 THE CONTROL GROUP ANALYSIS OF THE PERFORMANCE INDICATORS

Clearly, the purpose of the Control Group at the outset of the research design is to act as a control for the research process, tracking four small firms which, are not in a regular networking situation with other firms. These firms were also tracked during the period and can be analysed for comparison of Performance Indicators and for an analysis of their characteristics. These findings will be discussed in Chapter Seven along with the network analysis and questionnaire data.

5.7.1 Comparison of scores for Speed and Dependability

Three of the Control Group scored below average on speed but above average for dependability at the start of the research, with one, CG 3, scoring above average both for speed and dependability. CG 1 had the lowest score of the group and for the two

networks also, for speed. At the mid- point the CG were all average for speed, but above average for dependability. By the end point, CG 4 was performing well in terms of speed and dependability, but CG 1 was still well below average for speed, mainly because of problems with its scheduling systems. (Although it was resolving these as it had high scores for meeting customer requirements even at short notice and had high scores for customer satisfaction of QA systems, suggesting a more responsive informal system rather than its computerised system). CG 2 also had very high scores for speed and dependability, particularly at the end point as customer uncertainty meant that the firm had to be responsive to survive and to maintain this capacity at its own cost. All three firms were in dynamic supply chain situations with cost issues being at the fore – this reliance on responsiveness however, does not guarantee customer allegiance, in fact all three were experiencing uncertainty from their customers regarding future business.

5.7.2 Comparison of results from Responsiveness in Innovation and Design with Company Culture as a measure of Design Capability

The Control Group firms at the start of the research were spread widely across the innovation design spectrum, but all exhibited an above average score for culture and change. CG 4 as an injection moulding company needed to develop new products and services within its customer base as well as to expand with new customers. CG 4 felt it needed to move towards a situation whereby it would move from a 1:1 ratio of new to lost customers to a ratio of 5:5. CG1 needed to become more systems supply orientated and move itself into more value added press- work. CG 3 needed to also develop more "value added" work in terms of turned parts and had invested heavily in new plant and equipment to undertake this move. (Although much of the investment was predicated on supplying Rover cars increased capacity before BMW

withdrew which caused huge difficulties for CG 3 throughout the research period in having to seek new work to replace Rover business).

The scores at the start suggest that the Control Group firms' aspirations were design orientated which could be built upon a good internal capability to change. By the mid-point, this had changed to all four firms being in the top quartile. However, on the culture axis, three of the firms were scoring relatively worse than the networking firms by the mid-point. By the end point CG1 and CG 4 were scoring well in terms of culture and innovation/ design. CG 1 felt it had good partnership links, but CG 4 still had poor links with others in order to supply its customers. CG 2, however, was significantly lagging behind in terms of design and innovation, the effort to maintain speed and dependability was taking time and resources away from the MD's diversification strategy and in seeking to incorporate hardening into other processes.

5.7.3 Comparison of scores on Responsiveness in Product Mix with Responsiveness in Volume and Delivery

Again, at the start of the research process, scores for three of the firms for responsiveness/volume delivery was average, with two firms, CG 1 and CG 4, showing high scores for product mix. By the mid point, responsiveness scores were at the same level, but performance in product mix terms for CG 1 and CG 4 had worsened. Product mix for CG 2 had increased from below average to average in this period also. At the end point, CG 1, CG 2 and CG 4 were all in the top quartile, which suggests that responsiveness in volume and delivery and in delivering a wide range of services and products to existing customers, continues to be a priority.

5.7.4 General Conclusions and Observations from the Performance Indicator analysis of the Control Group

The scores for the Control Group indicate the context of the Group as infrequent members of the World Class Network, firms moreover, which did not network systematically during the research period. The Indicators show broadly similar characteristics in the Control Group firms to the two network groups so the analysis may consider the additional benefits brought by networking which the Control Group did not benefit from. The PI's being broadly similar for the Control Group have enabled analysis of the extra attributes made by networking to performance in NPD and developing new processes.

If the Control Group firms had been chosen as poorly performing in terms of responsiveness, speed, innovation, dependability and culture, then cross comparisons with the networking firms would have been extremely problematic. There is a tension within the CG between responsiveness and NPD. The strategy for CG 4 remains problematic (see OSN presentation) and the MD seeks to have a more innovative structure to develop the company. CG 2 is in a very difficult situation and may find that inability to diversify products and services coupled with technological advances and cost down issues may make the company unviable. CG 3 does seem to be able to maintain high scores for speed and dependability as well as for design/innovation. Three of the firms have been interviewed at the end period to establish feedback on the benefits of networking and their particular style of operating in networks which is sporadic, non-local and non systematic. (See Appendix Two for CG 2 and CG 4).

5.8 THE CONTROL GROUP, ANALYSIS OF NETWORK CHARACTERISTICS

5.8.1. Purpose

Clearly, there is no common purpose for the firms as they have no connectivity as a group outside of the research process that is and infrequent attendance at the WCN. However, at the start of the research from the initial interviews, the needs of the companies are of the same order as in the network firms (as supported by the Performance Indicators also).

CG 1 needs to attract new products within its supply chain and to look at new supply chains also. CG2 has to differentiate its products as heat treatment is a commodity service and needs to be supplemented with other manufacturing processes or services. CG 3 needed to develop new customers following cuts in its order book from Rover Group and similarly, CG 4 was experiencing customer difficulties in terms of de-selection from existing business and customers choosing new supply chain relationships.

5.8.2 Degree of Trust

As individual firms they all exhibit fragile trust and an inability to develop local relationships with other firms for sharing of information, learning from others or gaining information on trends. All four attend the WCN, but did not develop other relationships outside the WCN (Post et al 2000). CG 2 attempted to investigate the CSN in the early stages but was not welcomed nor did it pursue membership systematically (i.e. what were the barriers and how may they be overcome?). CG 4 felt that it had little in common with other local firms and CG1 and CG3 were both

intent on finding new customers and saw little benefit in spending time locally with other small firms.

5.8.3 Compatibility

The four are all in supply chains with a strong automotive bias. The notion of sharing within a vertical, heterogeneous and closed relationship with their customers was problematic throughout the research period. No evidence of development in this respect can be assessed from the Control Group firms. That is local networking was not substituted or enhanced by supply chain development with customers – the lack of this was clearly evident from the start to the finish of the research period. Rather, the firms generally, preferred to rely on their own internal resources to address the issues of customer development and process improvements. Acquisition of other companies to supplement their own activities was a consistent option rather than partnerships, but financial constraints made this difficult. (Except for CG 2 which made an alliance with another firm in a low value add process purely for reasons of sharing space and reducing overheads, an alliance which was not a success and by the end of the research was at the point of parting). All firms had difficulty in entering relationships with other firms.

5.8.4 Equity

By this, the characteristic relates to "equity" of input in discussions with other firms. This can best be seen from the perspective of CG 2 and CG 4. CG 2 attended external sessions on aspects of manufacturing process and NPD during the two years attending, for example, the visit by CSN to 3M in Bracknell. However, CG 2 although espousing the need to work with others found it difficult to gain entry to other local networks and when in found it hard also to commit time to the activities

(An exception was a technical collaboration over software development for the metal finishing industry group. This represented supporting a consultant in the development of specific software for metal finishing, which also involved CSN 1. However, progress was very slow on the development of the software and was firmly limited to technical issues - source Network Co-ordinator). CG 4 also had difficulties on perceiving benefits from local networking. CG 4 attended the 3M visit, hosted 1:1 meetings with CSN 1 and 4 and presented twice in the research period to the OSN. The presentation in October 2001 was not followed up either on the evening or in the following period on local links from the firms attending the presentation. This represents a good deal of local contact, but it did not develop into local relationships with other firms. This is also next discussed in the analysis of the Entrepreneurial/collaborative characteristic.

5.8.5 Entrepreneurial/collaborative behaviour

All four in the Group are from the tradition of automotive sector supply chains. Collaboration within these chains with customers and other suppliers was limited for all four during the period. CG 2 and CG 4 have both been written as illustrative examples within the Appendices. It is important to relate the absence of networking on the way the firms behaved during the period. Clearly networking is but one factor here, but the ideas discussed and the attitudes to networking were aired with the Control Group Managing Directors and the researcher to seek triangulation in the process. This iterative approach represents a major strength in the research process and proved very useful for hypothesis testing as was envisaged in the design of the research methodology.

Entrepreneurial behaviour within CG 2 was reflected in the partnership and co-location of the cold forging plant, in CG 3 through the development of Internet based e-auctions and in CG 4 for the establishment of a new ideas "think tank" mirroring the concept seen in 3M. However, CG 2's partnership with the existing cold forging plant newly established in the premises of CG 2 – essentially a screw manufacturing process- was not a success. It did not have enough synergy with the existing heat treatment business and what had been envisaged as a niche market product in fact turned into a commodity product. Consequently, management time from CG 2 was spent with the partner's management team where it could have been spent on developing CG 2's core business. The MD did not discuss strategy prior to the venture or post co-location with external support (as in OSN 4) nor was there a management team to agree the strategy (as in all four of the CSN firms). Networking may have helped to define strategy for CG 2 – this is clearly a supposition only, but it was tested with the MD who felt wider discussion at the time of the leasing of premises to what was an incompatible firm would have been useful. CG 1 struggled throughout the period to define and re-define its business needs given decreases in customer orders.

The experiences of CG 3 were not shared locally in what is a highly developmental and dynamic business area. CG 3 in the research period did not develop new relationships in order to support this change in its business environment. It did, however, seek to re-define relationships with BMW and Rover which stabilised its position and averted extreme financial consequences which could have been terminal to CG 3. This focus on a survival strategy made the company management team unclear of the benefits to be gained from local networking. (CG 3 did participate in hosting a visit from the Birmingham Centre for Manufacturing for other SMEs, but

this was on shop floor issues and not with a focus on joint learning – the benefits to CG 3 were unclear). CG 4 in some senses could be seen to be highly entrepreneurial – the development of the "ideas room" following the 3M visit and the focus on new business development are clear examples of the entrepreneurial thinking which the MD feels are essential for future success. However, feedback on the strategy presented to the OSN and with members of the CSN in attendance was not positive-

CG 4 was seen to be at a crossroads and in need of a clearer strategy to help it move on. This feedback, however, was not given to the firm at the presentation nor was it sought following the event. The MD of CG 4 was rather "aloof" with the other firms at the event and subsequently did not pursue individual contacts made on the night. (From discussions with the researcher, with OSN 1, OSN4 and with the CSN as a group).

5.9 NETWORKING AND SUPPORT FOR E-BUSINESS

The importance of IT to enable the firms to operate in both existing and new supply chains is an important underlying factor in both the NPD and new processes hypotheses (Aldo et al 2000). How do they fare in relation to ICT adoption in relation to the research hypotheses? The analysis of the results is based on Venkatraman's (1991) model, which provides a template to position the relative position of the 3 networks and to assess the role of individual firms.

Degree of change and development	Localised Exploitation	Internal Integration	Business Process Re-engineering	Business Network Re-design	Business Scope Redefinition
Working Practices	Set-up PC/ email link to Internet	Use PC to:	Re-design process of working and learning and use 'e-resources' to:	Create a networked organisation and use 'e-resources' to:	Transform the scope of the business and use 'e-resources' to:
	Access PC/ email and Internet individually	Monitor stock, cash flow etc.	Monitor workflow	Support internal dialogue and collaboration with existing customers	Co-opt customer capability
		Exchange information	Develop new competences	Support knowledge creation and sharing	Manage customer diversity
		Support discussion and business planning			Co-create new products and services with customers

Figure 20: Types of Business Transformations Supported by 'E-Resources'

5.9.1 Analysis of the Closed Strategic Network Support for New Processes and ICT

The firms in the network have in some ways straddled a range of the fields. The firms have established Internet links, they have personal computers within the firms, but individuals still have to share the company e-mail address. The firms have ICT for internal use and exchange of data is common internally. There is little attempt at this stage to have a strategic push for the use of ICT. However, the possible reasons for ICT adoption, new customers, cost reduction, business partnership development and new business models (Hawkins and Prencipe, 2000), would suggest strong pressures can be brought to bear on SMEs in network arrangements. Is this so? Network activity within ICT use has started to take place at the end of year one of the research. Inter-company project groups have been established by the MD's, one of these being the use of ICT (including shop floor data collection). To date, the person

responsible for ICT in each of the firms have met to share experiences. This has proved useful as the firms now have each other to call upon for information sharing, exhibiting elements of business network re-design. The meetings have not led to ongoing discussions however between the firms, which the Directors are unhappy about. The support of inter -company teams is an issue for further discussion following this research.

5.9.2 New Product Development and ICT

What of the entrepreneurial benefits which ICT can bring? Individual Web sites are a feature of all the network firms, used as a brochure in conjunction with an enquiry and not as a means of integrating customer data with production and sales. EDI is only featured in one of the firms. The network has yet to assess the potential of the Internet for E-Auctions within the sector. The GM/Ford system "Covisint" is known of but not yet seen as appropriate for the networks. Possibly this is because of the market structure in the automotive sector seeing the auction site as a cost reduction mechanism with unclear benefits to SMEs.

The CSN has registered itself with a web address at the start of the research, but until the intervention of the support agency had not pursued its use. Within a heterogeneous, horizontal, closed strategic network, it seems trust can be established which can underpin sharing at Director level and increase collective intelligence of threats and opportunities, which may then lead to an increased use of ICT strategically for supporting new processes and new product development. Results to date suggest that the network may consider the strategic use of ICT as a group and as individual SMEs once trust has been established and new business has been developed which leads to the need for ICT support from the SME.

5.9.2 Analysis of the Open Strategic Network and use of ICT Support for New Processes

The network has barely registered the importance of ICT as individual firms. All four are elements. The MD is the focus for Internet communication with little in the way of devolving this within the firms. There is little use of shop floor data collection technologies or use of ICT to support workflow management. However, there is a close relationship with the customer maintained by personal contact with the phone. The network does not aspire to work together to address NPD issues collectively. However, by presenting strategy to each of the other firms ICT is included as a key enabling factor – but there is no single thread here. The network, like the Closed Strategic Network, has a registered web address, but this has not been seen as a priority by the members to develop as yet, preferring to establish individual web sites as a priority first.

Significantly, individual firms are seeking to reposition in ICT. OSN 2 is moving into auto-sports and design of office furniture and OSN 4 is investing in new plant and equipment and by acquisition. OSN 3 is aspiring to move away from manufacture of springs to re-position as an ICT solutions firm and OSN 1 is using ICT to support design capability. These developments are shared in the Network meetings and feedback is given from the group on experiences from comparable situations.

5.9.4 The Control Group Analysis and ICT - Support for New processes and NPD

Again as in the Open Network, there has not been a collective influence in this area

(Nor should there necessarily be, as the companies do not inter-act collectively as a

group). As individual firms, this has been interesting; particularly to pick up trends from the Questionnaires which can then be developed. The firms do have an interest in E-auction sites, one firm CG3, have embraced this as an opportunity when faced with a dramatic cut following the Rover problems. This firm had invested heavily in Computer Aided Engineering, CAD/CAM and Computer Numerically Controlled machinery and turned a "problem" into an opportunity to use this resource to bid for new work from new customers. Firm CG4 clearly sees the problems of an ICT based supply chain situation whereby customers can move work between suppliers within Europe rapidly. Firm CG4 has a number of technologically advanced assets within its business such as design, tool making, robotics and flexible manufacturing systems, which it is seeking to re-position towards new customers to compensate for the possible loss of existing customers. It is seeking to pilot the use of e-auctions within this process and wishes to work with the business support infrastructure to share experiences.

5.9.5 The use of ICT within the networks, conclusions relating to the hypotheses.

Closed Strategic Networks can from this research be seen to be able to support small manufacturing firms from internal integration in ICT use to some elements of business network re-design. Collaboration seems a key driving force along this process, with support for inter-company exchanges on processes important. In terms of NPD and ICT, the transforming nature of the Internet has yet to be realised individually or collectively by the CSN. Support for ICT awareness, therefore, within "closed" groups of SMEs would seem an effective area for public policy intervention.

The Open Strategic Network has exhibited more entrepreneurial aspects relating to ICT through sharing of experiences – but there has not been a pooling of resources to work together, which would come through formal approaches as in the CSN. Nevertheless, sharing of experiences within a trusted group of like-minded SMEs has proved an effective way for these firms to judge relative positions relating to ICT. Again, support for SME-SME dissemination would be helpful.

The Control Group – have two firms in the business network redesign/redefinition area, but seemingly no mechanism or incentive to share experiences with others, an aspect which needs to be addressed within the context of public policy measures and small firm support. An issue from the research to date is that of providing effective benchmarks for small firms. They need to know how relative to others they are adapting to ICT, but this has proved difficult given the time-scales facing these firms and the growth of ICT developments. There certainly needs to be further work done in this area of E-Business adoption and possible strategies to be undertaken by local enterprise agencies and public bodies in support of this. These conclusions will inform the development of the Network models next described within the research.

This section on analysis of ICT use concludes the qualitative analysis, which will now help to inform the quantitative analysis next presented.

5.10 DATA ANALYSIS FROM THE PERFORMANCE INDICATORS IN CASE STUDY FIRMS

As well as using the Performance Indicators to show *relative strengths and weaknesses* in the areas, which the hypotheses were testing, the PI's were also used to show *associations* within the twelve on the impact of networking. The basis of the associational tests from the results of the Case Study Data was therefore to examine whether the companies involved in networking have a positive attitude to participating in networks, which will result in fostering:

- New Product Development
- Process Improvements
- Sharing of Ideas
- Learning from Others
- Customer strategy supporting NPD
- Benchmarking
- New sales contacts
- Collaboration with other firms (i.e. *not* in the networks) in partnerships
- Information on trends
- Collaboration with other firms in the network
- Funding Opportunities

These tests have been conducted for the three questionnaire levels and the same has been independently evaluated to register any change in attitude of the participating companies over the questionnaire time frame. Each of the tests yielded the following hypotheses:

H0: There is a negative attitude among networking firms to participation in networks, which will be fostered by one of the eleven criteria listed above

H1: There is a significant positive attitude among networking firms to participation in networks, which will be fostered by one of the eleven criteria

The case study data, in this instance is not disaggregated, the twelve firms responding have been analysed as a group to allow for statistical analysis to be carried out. The data has been collected at the three stages of the research process and includes 3 control group firms.

5.10.1 One sample "t" test

The one sample "t" test was administered to establish the attitude of the firms to particular criteria. The test results at stage one and stage two indicate a significant positive attitude exhibited by the firms towards network participation and Sharing Ideas, Learning from Others and a Customer Strategy Supporting NPD.

Criteria	Mean	Standard Deviation	't'	'df'	Significance (two tailed)
Foster NPD	2.6667	1.1547	-1.000	11	P>0.05
Process Improvements	3.0833	0.9962	0.290	11	P > 0.05
Sharing Ideas	3.9167	0.6666	4.750	11	**P < 0.05**
Learning from others	4.5833	0.5149	10.652	11	**P <0.05**
Customer strategy supporting NPD	3.9167	0.9962	3.188	11	**P<0.05**
Benchmarking	3.0833	1.3124	0.220	11	P > 0.05
New Sales contacts	2.667	1.3027	-0.886	11	P> 0.05
Collaborate with other firms in partnerships	2.9167	1.4434	-.200	11	P> 0.05
Information on Trends	3.3333	1.1547	1.000	11	P > 0.05
Collaborate with other firms in the network	3.250	1.053	0.821	11	P> 0.05
Funding opportunities	3.6667	1.3707	1.685	11	P>0.05

Table 34: Results for the Case Study Firms at the Start of the Networking Period

Criteria	Mean	Standard Deviation	't'	'df'	Significance (two tailed)
Foster NPD	2.916	1.0836	-0.266	11	P>0.05
Process Improvements	3.4167	0.9962	1.449	11	P > 0.05
Sharing Ideas	4.2500	0.7538	5.745	11	**P < 0.05**
Learning from others	4.3333	0.7785	5.933	11	**P < 0.05**
Customer strategy supporting NPD	4.0000	0.8528	4.062	11	**P< 0.05**
Benchmarking	3.5000	1.000	1.732	11	P > 0.05
New Sales contacts	2.9167	1.3114	-0.220	11	P> 0.05
Collaborate with other firms in partnerships	3.4167	1.2401	1.164	11	P> 0.05
Information on Trends	3.3333	0.9847	1.173	11	P > 0.05
Collaborate with other firms in the network	3.2500	1.1382	0.761	11	P> 0.05
Funding opportunities	3.8333	0.8348	3.458	11	**P< 0.05**

Table 35: Results Case Study Firms, Networking period end year one

Criteria	Mean	Standard Deviation	't'	'df'	Significance (two tailed)
Foster NPD	2.917	0.793	-0.364	11	P> 0.05
Process Improvements	3.083	0.996	-0.290	11	P> 0.05
Sharing Ideas	4.083	0.669	5.613	11	**P<0.05**
Learning from others	4.500	0.674	7.707	11	**P <0.05**
Customer strategy supporting NPD	4.167	0.835	4.841	11	**P<0.05**
Benchmarking	3.250	0.965	0.897	11	P>0.05
New Sales contacts	2.833	1.193	-0.484	11	P> 0.05
Collaborate with other firms in partnerships	3.000	0.954	0.000	11	P>0.05
Information on Trends	3.667	0.651	3.546	11	**P< 0.05**
Collaborate with other firms in the network	3.000	0.954	0.821	11	P > 0.05
Funding opportunities	3.636	1.206	1.750	11	P > 0.05

Table 36: Results Case Study Firms end of year two

In terms of the positive associations, how can these be interpreted against the qualitative analysis for similarities and for differences? Sharing Ideas and learning from others are both enshrined in the TOR of the networks. These are also "soft" benefits which are definitely borne out in the network behaviour (Both the CSN and

the OSN). At all three stages, the firms see "sharing ideas" and "learning from others" as key benefits from network participation. Access to funding opportunities is a feature of the mid point, but this is not seen important by the end of year two. Information on trends is seen as important by end of year two, which again reflects the information and ideas sharing elements of the networks. From the one sample "t" tests neither NPD or process improvements were seen as directly correlating with networking.

A key factor is that the learning and sharing elements can be said to be essential underpinning elements for the "business" benefits to come through in terms of partnerships external to the network. This again bears out the experience of working in the networks where the benefits of learning from others and sharing new ideas to then develop new business with others in external dyadic relationships started to be evidenced in the CSN and the discussion of business plans occurred for the OSN. The issue of funding became significant at the mid point. This probably reflected the activity at the time, which was focussed on finding common goals as a group to then fund activities as a group. This was seen as unhelpful by the networks and the focus became sharing ideas and information to then develop as training or consultancy initiatives to be pursued separate to the network. (There were two notable exceptions to this. These were the strategic training sourced and delivered as a group, initially by the CSN, but then developed individually as consultancy interventions for each member and the inputs on succession planning, again delivered to the OSN as a group with individual SMEs pursuing separate interests following the group sessions).

The other positive associational test for all three stages was that of "customer strategy supporting NPD". This is ***significant,*** as it underlines the behaviour of the SMEs in their approach to networking and is entirely consistent with the Case Study results. It emphasises the dichotomy of learning as a group then pursuing customer strategy separately depending on need. The emphasis on the individual SMEs networking is to have a customer strategy supporting NPD – the problem at the start of the research was that the firms were unclear of how to best pursue this objective and had difficulties in addressing internally how best to do this. It was for the SMEs a fundamental re-configuration, for some, of a customer compliance culture to a marketing culture. This emphasises the importance of customer relationships within the networks as being more important than NPD (where there was no correlation) per se – the firms can be seen as component manufacturers and are coming to terms with the idea of product development as a strategy within diverse supply chains. The lack of association with new processes is also consistent with the needs and activities of the firms. The CSN had, arising from the Supply Chain tradition, as individual firms, participated heavily in QCD initiatives and was seeking to redress customer development/product development issues as a priority. The emergence of ICT as a process improvement issue became more important towards the end of year two, although only in 2 -3 of the firms.

The OSN, from the Industrial District tradition, was and is still sceptical of "process improvement" issues, seeing these as driven by and for larger customers to reduce prices and not to support them as small owner managed firms. Support for cross company teams and for measures to improve processes in the OSN is still difficult to foresee.

5.10.2 Analysis of the results of the Paired Sample "t" tests

The first of these was to determine any association between *customer strategy, which supports NPD* to links with other firms in partnership to supply customers. This test revealed no significant association at the start of the research but by the mid-point, significantly, there was a positive association in this respect.

H0: There is no association between customer strategy, which supports new product development and developing links with other firms in partnership to supply their customers.

H1: There is a significant association between customer strategy, which supports new product development and developing links with other firms in partnership to supply their customers.

Questions and Period	Mean	Standard Deviation
Q3.1 _1	3.9167	0.9962
Q3.1 _2	4.0000	0.8528
Q3.1_3	4.167	0.835
Q3.5 _1	2.9167	1.4434
Q3.5_2	3.4167	1.2401
Q3.5_3	3.417	1.084

Table 37: To determine any association between *customer strategy, which supports NPD* to links with other firms in partnership to supply customers.

A Spearman's correlation was performed to identify whether there is an association between customer strategy which supports new product development and developing links with other firms in partnership to supply their customers. The results revealed no significant association ($r = 0.053$: $N = 12$; $p > 0.05$; two tailed), thus failing to reject the null hypotheses. The above test for the second questionnaire period was also performed and the results revealed a significant association ($r = 0.591$; $N= 12$;

p < 0.05; two tailed), thus confirming our experimental hypotheses and rejecting the null hypotheses.

The test was repeated for the third questionnaire period and the results revealed a significant association once again (r = 0.784; N= 12; **p = < 0.05**). The need for a customer strategy for NPD itself was beginning to become important and the realisation that working can also support this with other firms is an **important finding for the research.** The results indicate that a plausible hypothesis is that as firms develop new product strategies, links with other firms in partnerships becomes important. Note the emphasis on ***partnerships*** – the nature of these business relationships is explored further in this chapter as a trend emerges for firms seeking information and ideas from networks and then exploiting business ideas in partnerships with other firms (Dyads for business opportunities, networks for ideas and information).

Developing a "customer strategy which supports NPD" and developing links with others in partnerships are both key features of the Terms of Reference of the networks and of the subsequent discussions within the groups. The quantitative analysis can therefore be said to entirely support the qualitative research. This will be further developed in Chapters Six and Seven when the analysis is compared with the current literature on networks and new network models discussed.

H0: There is no association between collaboration with firms in the network and linking with other firms in partnership to supply their customers.

H1: There is a significant association between collaborating with firms in the network and linking with other firms in partnership to supply their customers.

Questions and Period	Mean	Standard Deviation
Q7.9 _1	3.2500	1.0533
Q7.9 _2	3.2500	1.1382
Q7.9_3	3.000	0.954
Q3.5 _1	2.9167	1.4434
Q3.5_2	3.3636	1.2863
Q3.5_3	3.417	1.084

Table 38: To examine any association between collaborating with firms in the network and linking with other firms in partnership to supply their customers.

A Spearman's correlation was performed on the data from the first questionnaire to confirm on the experimental hypotheses. The results revealed a significant association ($r = 0.587$: $N = 12$; $\mathbf{p < 0.05}$; two tailed), thus confirming the experimental hypotheses and rejecting the null hypotheses. But the subsequent two tests revealed *no significant association*. Expectations at the start were that new business might come from the networks themselves, but this was seen to be problematic by the mid-point (Resulted in the TOR of the CSN being rewritten and the "broker" idea dropped).

The results indicate that firms see that networking provides a different set of outcomes than the two traditions from the literature might suggest .The emphasis in the supply chain and District model is on collaboration and partnerships within networks to develop business. The results from the case study firms suggest networks can provide information and ideas, which can then lead to new opportunities external to the network. The lack of correlation would help to explain the lack of "brokered" SME networks in the region. (SMEs acting in concert to seek out new business as a

group and then to manufacture the results of any new business sourced as a group also).

H0: There is no association between sharing of ideas during networking and linking with other firms in partnership to supply their customers.

H1: There is a significant association between sharing of ideas during networking and linking with other firms in partnership to supply their customers.

Questions and Period	Mean	Standard Deviation
Q7.6 _1	3.9167	0.6686
Q7.6 _2	4.2500	0.7538
Q7.6_3	4.083	0.669
Q3.5 _1	2.9167	1.4434
Q3.5_2	3.4167	1.2401
Q3.5_3	3.417	1.084

Table 39: To examine for any association between sharing of ideas during networking and links with other firms in partnerships to supply our customers

To re-cap on the results, a Spearman's correlation was performed on the data from the first questionnaire to confirm on the experimental hypotheses. The results revealed a significant association ($r = 0.657$: $N = 12$; $\mathbf{p < 0.05}$; two tailed), thus confirming the experimental hypotheses and rejecting the null hypotheses. On carrying out the spearman's correlation for the data of the second questionnaire, the results also revealed a significant association ($r = 0.736$; $N = 12$; $p < 0.05$; two tailed), thus confirming the experimental hypotheses and rejecting the null hypotheses. For the third questionnaire ($r = 0.445$; $N = 12$; $p > 0.05$) there was *no longer* a significant association on this test.

The test indicates a significant association for the both the periods of analysis that can be attributed to network participation for the subject criteria's. Network participation involves co-operation amongst members through sharing of ideas and

learning (for which significant positive attitude has been registered). Further, this participation facilitates a positive attitude among networking firms to linking with other firms to supply their customers. Even though the complexity involved in this relationship needs to be explored more deeply, primarily because of the negative attitude registered to linking with other firms in partnerships. The author considers the possibility of firms assimilating the ideas exchanged during networking and pursuing it by linking with other firm's external/outside the network. This can be explained by the benefits arising at mid point and expectations for some of the firms were then lower at the end of year two. The lack of a correlation at the end of year two can be explained by the firms which were inclined to get ideas to then exploit have done so and the others are perhaps unlikely to do so. It suggests perhaps an optimum lead-time of 1.5 years for network benefits to arise and also that not all will benefit in this way. It might also reflect the lifecycle of a network, reconsidering TOR at mid way through year two suggests a one to one and a half-year cycle. Firms may then wish to consider their own membership (multiple networking firms may cease to be core and become peripheral), inclusion of new members, change to the TOR, or exit altogether, given the constraints of time and how this is aligned within networking by the participating Director/Manager.

5.11 CONCLUSIONS – STRAND ONE ANALYSIS

These are now presented in summary form prior to the *Strand Two Analysis*, which will seek to validate the results from the case studies with a wider statistical sample of small manufacturing firms.

5.11.1 Summary Analysis and Trends for the Closed Strategic Network

The results for the CSN can now be presented in summary form from the three phases Strand One Analysis, Performance Indicators and Network Characteristics and thirdly from the Data Analysis.

Performance Indicators	
Speed/Dependability	Compatibility of scores, but not uniformity. Two Dyads in the network mutually supportive
Innovation/Design and Culture	General trend to improve to top quartile – design still a weakness
Product Mix/ Volume Delivery	Pairs/ Dyads within each set of PI's, which change for different characteristics
Characteristics	
Purpose	Clear purpose from the start – changed TOR to reflect needs – focus on sharing ideas and not on seeking funds for the network or for Brokerage as a group
Trust	Fragile to Resilient
Compatibility	PI's reflect network discussions – compatible as a group
Equity	Issues of equity raised and resolved
Entrepreneurial	Brokerage not to be pursued – links with customers
Collaborative	to be made from discussion of strategy in network (trust). Sub contractual in nature if customer involved
Statistical Data Associations	
Sharing Ideas	Association strongly reflected in revised TOR for the network
Learning from others	As above
Customer strategy supporting NPD	Key focus on individual Network Firms to better understand the external customer environment in which they operate
Customer strategy and partnerships	Moving from no association at the start to strong association as sharing ideas and learning with the firms in the network transfers to the possibility of partnerships externally

Table 40: Summary results for the Closed Strategic Network

5.11.2 Summary Analysis and Trends for the Open Social Network

The results for the OSN can now be presented in summary form from the three phases Strand One Analysis, Performance Indicators and Network Characteristics and thirdly from the Data Analysis.

Performance Indicators	
Speed/Dependability	Improvement to top quartile – compatibility of scores, but not uniformity (exactly as for CSN)
Innovation/Design and Culture	General trend to improve to top quartile – still weakness in design
Product Mix/ Volume Delivery	Lack of Pairs/ Dyads of firms within each set of PI's which is a feature of the CSN
Characteristics	
Purpose	Clearly defined TOR set out by the firms
Trust	Fragile towards Resilient, however, discussions fall short of deeper understanding between firms
Compatibility	PI's reflect network discussions – compatible as a group
Equity	Informal/discrete selection process of members who will participate and not "observe"
Entrepreneurial Collaborative	No intent to work as an entity for new business, unlike the CSN at the start. (CSN now has dropped the "brokerage" Objective). Collaboration focussed on exchange of information and developing business ideas through network discussions.
Statistical Data Associations	
Sharing Ideas	Key statistical association reflected in TOR from ADAPT Club to the new network
Learning from others	Key part of the group's activity supported by the correlation
Customer strategy supporting NPD	As in the CSN, focus on the network as a means to better understanding the external customer environment
Customer strategy and partnerships	Moving from no association to strong association as sharing information and ideas with other firms in the network transfers to the possibility of external partnership building

Table 41: Summary of results for the OSN

5.12 STRAND TWO ANALYSIS - ANALYSIS OF THE POSTAL QUESTIONNAIRE RESULTS

How can the data from the wider sample of SMEs refute or support the research hypotheses and the results and analysis from the Case Study firms?

As has been shown in the Results Chapter, the firms in the Postal Questionnaire were divided into three distinct groups

- Non Network Firms
- Single Network Firms
- Multiple Network Firms

This was done to support the analysis of the results and to differentiate between levels of networking. The main purpose of the analysis of the postal questionnaire data is to seek clarification on the validity and reliability of the analysis arising form the Case Studies. The data will firstly be analysed to see what trends it can suggest were important arising from the wider sample of SMEs and then to compare and contrast this data analysis with the findings from the case studies.

Finally, the results and analysis from Strand One and Strand Two will be brought together to act as the "back-cloth" canvas to the conclusions in Chapter Seven. What trends can be suggested that were important arising from the wider sample of SMEs?

5.12.1 Non-Networking Firms

Criteria	Mean	Standard Deviation	't'	'df'	Significance (Two tailed)
Learning from others	3.4815	1.2222	2.229	26	**P < 0.05**
Sharing Ideas	3.4815	1.2518	1.995	26	P > 0.05
Information on Trends	3.4815	1.0141	2.467	26	**P < 0.05**
Benchmarking	3.1154	1.1774	0.500	26	P > 0.05
Process Improvements	3.7400	3.6225	1.063	26	P > 0.05

Table 42: Results non-networking firms

The one sample "t" test on the association of networking and learning from others and information on trends was present even in firms not currently networking. Expected benefits can be said to be in the most "passive" category – information sharing and learning from others- reflecting relatively low expectations of networking generally which is similar to the low expectations of the Case Study firms at the start of the period. However, the results would suggest that these two positive criteria could be useful starting points for new networks on which to focus their initial activities, as even non-networking firms can recognise these characteristics as being of benefit. The importance of these in the early deliberations on network Terms of Reference are also reflected in the experiences of both the Closed Strategic Network and the Open Social Network providing significant corroboration on the network behaviour from the quantitative data.

5.12.2 Single Networking Firms

Criteria	Mean	Standard Deviation	't'	'df'	Significance (Two tailed)
Learning from others	4.1852	0.7863	7.832	26	**P < 0.05**
Sharing Ideas	3.7037	0.9929	3.683	26	**P < 0.05**
Information on Trends	3.8519	1.0267	4.311	26	**P < 0.05**
Benchmarking	3.7407	0.7642	5.036	26	**P < 0.05**
Process Improvements	3.629	0.8389	3.900	26	**P < 0.05**

Table 43: Results Single Networking Firms

Here more benefits from networking begin to emerge. The importance of benchmarking and support for new processes from networking are clearly additional

benefits perceived by the single networking firms. The results suggest again that these are effective areas for networking to address within West Midlands manufacturing firms. They continue in the learning and information trend from the non- - networking firms and can be seen as developing the internal processes of the firms. Networks, which focus on these areas, would seem to be meeting a clearly articulated need. However there are a range of potential network benefits which are not evidenced by the survey data. These are, getting new sales contacts, providing help in training, supporting NPD, collaboration with other firms and assisting in gaining access to funding. The link between networking and new processes is confirmed by the survey data for these firms with the correlation with Process improvements and Benchmarking. Learning from others, Information on Trends and Sharing Ideas seem to be part of the customer development focus which the case study firms exhibit as necessary steps in the NPD process.

5.12.3 Multiple Networking Firms

Criteria	Mean	Standard Deviation	't'	'df'	Significance (Two tailed)
Learning from others	4.3333	0.6794	10.198	26	**P < 0.05**
Sharing Information	4.1111	1.0127	5.701	26	**P < 0.05**
Information on Trends	4.0370	0.8077	6.671	26	**P < 0.05**
Benchmarking	3.7037	0.9929	3.683	26	**P < 0.05**
Process Improvements	3.778	0.8916	4.533	26	**P < 0.05**

Table 44: Results Multiple networking Firms

Would the questionnaire results from the multiple networking firms show more or different benefits from networking? The results show no difference in the benefit of multiple networking as compared with single networking for features such as support for NPD, developing new sales contacts, help in training, collaboration with other firms or gaining access to funding. More networking per se needs to be better understood. Some of the SMEs are in 2-4 networks and meet on a regular basis, but

regular basis, but no new benefits seem to be emerging from this activity. Clearly, some of the increased participation could give re-enforcement to the firms by getting benefits on similar issues from different environments. However, given the external economic forces within the environment of the firms with an emphasis on product and customer development the need for more focused support in these areas seems a clear imperative. This will be addressed in Chapter Six within the proposed Networking Model arising from the research (Figure 33).

5.12.4 Analysis of Differences between the Network Types and Key Characteristics

Since the single network and multiple network firms registered a significant positive attitude for all of the above tests, it was interesting to note whether there existed a considerable difference between the categories that can be attributed to network participation. For this purpose, an independent sample "t" test was performed to register any significant improvement ***between*** the following categories of firms and benefits of networking. The comparisons were made as previously between:

- Non networking and single networking firms
- Non networking and multiple network firms
- Single network and multiple network firms

	'F'	't'	'df'	Significance (Two tailed)
Learning from others	4.405	-2.669	46.57	**P < 0.05**
Sharing Ideas	1.679	-0.723	52	P > 0.05
Information on Trends	0.263	-1.334	52	P > 0.05
Benchmarking	3.162	-2.302	51	**P < 0.05**
Process Improvements	2.225	0.155	52	P > 0.05

Table 45: Non Networking Firms and Single Networking Firms:

	'F'	't'	'df'	Significance (Two tailed)
Learning from others	7.942	-3.374	42.80	**P < 0.05**
Sharing Ideas	2.453	-2.032	52	**P < 0.05**
Information on Trends	4.332	-2.227	52	**P < 0.05**
Benchmarking	0.628	-1.969	51	P > 0.05
Process Improvements	2.218	-0.52	52	P > 0.05

Table 46: Non Networking Firms and Multiple Networking Firms:

	'F'	't'	'df'	Significance (two tailed)
Learning from others	0.534	-0.741	52	P > 0.05
Sharing Ideas	0.170	-1.493	52	P > 0.05
Information on Trends	1.806	-0.737	52	P > 0.05
Benchmarking	0.984	0.154	52	P > 0.05
Process Improvements	0.0001	-0.629	52	P> 0.05

Table 47: Single Networking Firms and Multiple Networking Firms:

The most promising results from all the above analyses was between the non-networking and multiple networking firms. The results indicate a significant difference, attributable to network participation for

- learning from other participants
- sharing of ideas
- gaining information on trends

Benchmarking and process improvements failed to register significant values, although the multiple network firms did register a significant positive attitude for the one sample "t" test.

Also of interest are the test results for the analysis between the non-networking and single networking firms, where a significant improvement was registered for 'learning from others' and 'benchmarking' as a result of network participation. However the other criteria failed to register significant values, irrespective of the fact

that the single network firms displayed a significant positive attitude to all the criteria's. Lastly, no significant improvement was registered for the analysis between the single network and multiple network firms. This highlights again the need to explore reasons as to why firms go in for multiple networking, once they have derived the main benefits they seek of networking, mainly in terms of gaining information on trends learning from others sharing of information. It could represent an opportunity for them to review their network participation and determine what benefits are accruing for what activity and focus on the networks which are the most productive.

Table 48 shows the analysis of the responses which the firms made to the network which was of most benefit to them, of least benefit and what consequently they would wish to see more of (Sample size of 78 SMEs from the 3 networking categories).

Network Type	Most Benefit	Least benefit	More of
Technology Based	3	3	3
Geographical Area Based		2	
SME to SME Marketing/Customer Focus	19		22
Externally Led		3	
Training	4		4
Benchmarking and Company Visits	2		2
Focus on QCD	1	1	
Social, with Business Emphasis	1		3
Funding Opportunities	1		

Table 48: Assessment of network benefit from sampled SMEs

5.13 KEY FINDINGS FROM STRANDS ONE AND TWO AND COMPARISONS

This section draws together the three levels of analysis from *Strand One* (The Performance Indicators, the Network Case Studies and the Associational "t" Tests) with the analysis from *Strand Two*, the Postal Questionnaire. The key conclusions can be best distilled in tabular form as shown below. (Figure 22) Each of these key conclusions form the analysis will then be further discussed.

5.13.1 A comparison of the Postal Questionnaire Data Analysis with the Findings from the Case Studies.

These are set out in tabular form against Networking Characteristics (supporting the hypothesis testing and derived from the literature search) as utilised in the Questionnaire and compared against the Case Study and Postal Questionnaire Analysis. The Networks are referred to as CSN (Closed Strategic Network) and OSN (Open Social Network).

Networking Characteristics	Case Study Analysis	Postal Questionnaire Analysis
NPD and Networking	Strong support for customer development and marketing in networks	Strong support for SME/SME networks with marketing/customer focus
New Processes and Networking	Networks supporting cross company teams in the CSN	Strong support for process improvements in networking firms as a key benefit
Learning from others	Key benefit and in TOR of both networks	Strong correlation as a benefit even in non networking firms
Information on trends	A feature, but not a key benefit	Seen as a key benefit in all three sample groups
Sharing ideas	Key benefit for consequent business development outside the network	Seen as important for single networking firms and multiple – but not non-networking firms
Benchmarking	A feature, but not a key benefit	As above, only 2 firms see as an area for future network development
Customer strategy supporting NPD	Clear Association in both the CSN and the OSN	Not identified as a strong correlation
External Facilitation	Support for enabling role. Focus on SME "owning" their Terms of Reference	Externally led networks not in favour
New sales contacts	Not seen as important	Not seen as important
Support for training	Collaborative training seen as important initially in CSN but did not materialise	Some support, but not a key feature or benefit
Access to funding	Not seen as a benefit in OSN, benefit in CSN as new projects developed	Not seen as a direct benefit

Table 49: Comparison with Postal Questionnaire analysis and the case studies

5.13.2 New Product Development and Networking

There is a strong desire from the analysis of the Case Study firms and the Questionnaire respondents for firms to participate in networks with an SME focus which are related to marketing. These networks can be said to be heterogeneous in nature because of problems in perceived competition from other firms. The CSN exhibited dyadic relationships on business strategy within its deliberations, which were re-configured according to circumstance and need. NPD is not seen *per se* as being directly supported from networking. However, the case study analysis points to a *process* wherein compatible firms develop within clearly defined TOR individual strategies informed by the network. This strategy can be developed by the firms presenting ideas directly to the other members and can be assisted by external

facilitation if new thinking is required. Design and NPD are both problematic areas for West Midland small firms whether from a supply chain or entrepreneurial tradition and the low aspirations probably reflect the low baseline position. However, learning from others, sharing ideas and information and benchmarking (Ragatz et al, 1997) are all seen as key network benefits underpinning NPD strategies in the networking firms.

5.13.3 New Processes and Networking

Networking supporting New Processes is a clear benefit from the CSN where rapport is built up within a small group of SMEs and cross company teams are developed in areas such as Quality and ICT. Sustaining the initial activity is an issue. All case study companies say networking should not just be done by the MD, but how team members are then supported is unclear. (That they should be was agreed by network MD's during meetings). The Postal Questionnaire gave process improvements as a clear benefit of networking.

5.13.4 Learning from Others

This is seen as a key benefit and is enshrined in the TOR of both the CSN and OSN networks. The benefit of informal discussions about the business environment in a trusted forum seem clear. From the Postal Questionnaire it is seen as a key benefit even in non-networking companies. Lack of a trusted forum in which to exchange ideas from the Control Group was seen as a problem for these non-networking firms.

5.13.5 Information on Trends

Information on trends in the external environment can be related to the comments in the "NPD and networking" analysis. Information sharing within a network is seen as a key benefit, particularly within a fluid business environment whereby small firms in particular are at risk. The Case studies show the richness of information, which is exchanged from within the groups, supplemented by specific visits to key companies and other networks. Again, the quality and value of the exchanges can be seen to directly relate to the objectives of the group, its composition and degree of trust and equity of input. It is also seen as a benefit, from the Questionnaire, even to non networking small firms.

5.13.6 Sharing Ideas

Ideas are potentially a more productive benefit than "information" as discussion and evaluation and development are all suggested. Analysis of both the research data and cases suggests that firms see sharing ideas as a key benefit from networking. How this is fostered also seems clear within heterogeneous small groups, with high levels of trust, equity of input, similar and complimentary characteristics in terms of performance (the PI's), a need to explore new customer opportunities and external facilitation which sensitively supports this overall developmental process. Significantly, the outcomes from this are *not* predicated on a notion of the network as a brokerage – that is, becoming a legal entity to trade in its own right. From the Case Study analysis, this brokerage model of firms developing a common product may occur in the future, but the key benefits of networking within manufacturing firms are developed from discussions and then made reality with new and existing customers on a 1:1 basis *not collectively.* The CSN, initially, had "brokerage" as an

objective in its TOR. This was then revised as the possibility of a product for the group was seen as problematic. It was also seen as a constraint, taking up valuable time and resources on an "unnecessary" issue given the richness of the other benefits as highlighted in this analysis.

Significantly, from the Postal Questionnaire data analysis, Multiple Networking firms did not seem to gain a new or different range of benefits from this increased networking. Specifically, "Brokerage" as a group developing common products/services was not given as a benefit from the multiple networking firms. The PI's from the Case Study firms indicate compatibility of the firms as a group and suggest that heterogeneous networks are appropriate for developing new ideas and sharing information. The dynamic between entrepreneurial and collaborative behaviour also seems important. There seems a difference in style between the tradition of supply chain development and that of the owner-managed company, which is worthy of further exploration (the CSN and the OSN).

5.13.7 Benchmarking

Benchmarking is seen as a key benefit for the Single and Multiple categories from the Questionnaire responses. It was a feature at first in the CSN as it was done informally through the rotation of network meetings and the opportunity to visit network firms, but was not enshrined in the network objectives. Benchmarking in the OSN is seen as problematic – reflects a large company view of small firms and possibly doesn't credit the perceived "uniqueness" of the small firms in the network either. This needs to be further understood, as it falls outside of the hypothesis of this research.

5.13.8 Customer Strategy Supporting NPD

There is a strong association within the Case Study groups of small firms seeking to develop strategies with their customers. This of course can be done 1:1 and not necessarily through networking, but as a characteristic of network involvement it does seem important as part of a process for firms to develop new products. (I.e. firms not doing this and focussing on internal QCD issues solely, may not make good partnership workers in collaborative arrangements).

5.13.9 External Facilitation

Facilitation of network groups needs to be built within the needs expressed by the firms in their expectations of networking. Ownership of the network objectives should stay with the firms and not reside in the facilitator. Thus facilitation is a process weaving within the themes of the network participants. Facilitation supports Objective formulation and re-evaluation, helps the learning process by enabling discussions to take place and flow and supports rapport building to enable trust to become embedded It also allows for ideas to be formulated within the network to be then further developed. The facilitator is key in supporting the network in relationships with external stakeholders. Furthermore, the Postal Questionnaire supports the need for SME to SME networks and notes some examples such as Business Links whereby this has been successfully supported by an external facilitator.

5.13.10 New Sales Contacts

This is worthy of some exploration as it was a question within the Case Study firms and in the Postal Questionnaire and was not seen as being a direct benefit to the firms in either case. Why is this? Discussions on customer trends and marketing are both

seen as important benefits from networking. Perhaps "new sales contacts" implies meeting through networking another SME which will provide a direct sales link to another customer. The likelihood of this could be inferred by the conservative nature of the manufacturing small firms, which would probably not act in this way. It also smacks of serendipity and chance, which the firms perceive as being unlikely to happen within the network environment. This view would be supported by the Case Study experiences, but would need to be specifically examined in more detail, as it was not a core hypothesis of this research (although, as has been noted, it impacts on the NPD issue). The role of network broker – an individual responsible for the co-ordination of business opportunities – was not highlighted within the research, neither was the role of an area based facilitator for new sales contacts highlighted (both are roles identified through the literature). Further analysis is problematic as it falls outside the terms of this research.

5.13.11 Support for Training

Many policy initiatives are developed in the premise that small firms need more support in skills development, they find it hard to release key personnel and that training should be based on the needs of the individual small firm. It would seem reasonable; therefore to test whether training in NPD and in new processes (as two of the Hypotheses in this research) could be developed and then delivered within the Case Study networks. Analysis of the results suggests that firms find it hard to commit to a common training process given the different needs, stages of development and work commitments. (This was also supported by the lack of a correlation from the survey on this issue also).

However, where a joint approach worked in the Networks (in the Closed Strategic Network) was in the identification of common training needs arising from business needs, the identification of a trainer and for a network firm to then make a decision on how to proceed as an individual firm. The other notable example was again within the CSN and the support for marketing strategy from an external change agent supported and funded by the RDA as a "test case". The Network undertook a series of developmental sessions as a group over four periods working on their own strategies, which was then complimented by two further days in each firm by the consultants. Further work on the possible benefits of networking and training in general would be appropriate, but fall outside of the scope of this research.

5.13.12 Access to Funding Opportunities

This was not highlighted by the Case study firms or by the Postal Questionnaire as a benefit of networking. The CSN did indicate benefits in the mid-point as the network was co-ordinating activity with local and regional fund-holders, but this was not to directly fund individual companies rather at a policy level to better direct fund-holders to areas which the network members felt to be important. (Two members of the CSN are on the Advisory Board of the regional "Accelerate Programme", the strategic body for the automotive sector in the region). Further work on the links between funded projects and networking would appear appropriate, but falls outside the scope of this research. The facilitation required to achieve this stage demands that the small firms "own" their network Terms of Reference and move from informal to formal and have processes to ensure that the TOR are revisited at regular intervals. There seems to be a break point at stage two of the process for both NPD and new processes. This critical path seems common from the networks studied to date. The complexity of the interactions should be noted and underlines the difficulty of

previous studies in ascribing benefits to networks, probably by missing one of the sets of factors or failing to understand the links between sets of characteristics and variables. The research by defining characteristics and variables and the key stages, therefore, can be used as a route map for the small firm seeking to gain specific benefits from networking activity.

The need for a broker as a specific role has yet to emerge from the research. This needs to be further researched. The literature notes the lack of broker supported small firm networks in traditional firms and the research has not shown the need for these. The emerging trends in the analysis of the networks from the research indicates two distinct types, the ***Closed Strategic Network*** in the Vertical tradition and the ***Open Social Network*** in the Industrial District tradition. These ideas will be further developed in the network model proposals in Chapter Six and the conclusions in Chapter Seven, which will also make suggestions for Policy Makers on how they can support the networking process in small manufacturing firms.

6.0 NETWORK MODELS ARISING FROM THE RESEARCH

6.1 REFLECTIONS ON RESEARCH HYPOTHESES, NETWORK TYPOLOGIES, CHARACTERISTICS AND ANALYSIS

This chapter will firstly draw out the findings from the analysis of the networks and the Hypotheses, followed by comparisons with the literature. Conclusions on the Research methodology will next be made. New network forms arising from the research will then be described indicating stages of development. These stages will also be applied to other network types to test for applicability.

6.1.1 Discussion on research hypotheses, network typologies and characteristics

The research hypotheses incorporated the questions to be tested on the effect of networks on small manufacturing firms in respect of increasing a propensity for New Product Development, support for new processes and on the impact of facilitation within these processes. A *Closed Strategic Network* of firms in the automotive supply chain has emerged from the hypotheses with the characteristics of *heterogeneity*, being *horizontal* in nature with a small identifiable group of Directors from firms seeking *strategic* change. A set of *Performance Indicators* has been developed to test for compatibility within the network and these PI's have identified a common set of aspirant "world – class" standards in the networking SMEs. A set of *characteristics for networking* has also been identified which consist of a sense of common purpose, trust, compatibility, equity and a balance between entrepreneurial and collaborative behaviour within the firms. An *Open Social Network* of owner managed companies has been identified which again is *heterogeneous* in nature has a set of compatible *Performance Indicators*, is *open* in that the network membership

has both a core and peripheral group and has a more *social* approach to small firm development.

A Control Group of firms has been analysed and this group has engaged in sporadic, non-local and non-systematic networking. Statistical analysis of the 12 firms in the longitudinal group with data from three questionnaires administered over the research period has shown a *significant positive attitude* exhibited by the firms towards network participation and sharing of ideas and learning from others. The tests have shown that there is a significant association between customer strategy which supports New Product Development and developing links with other firms in partnerships, which strengthens as the firms engage in networking activities. The research findings and analysis support the original hypothesis on new processes as shown in Figure 21.

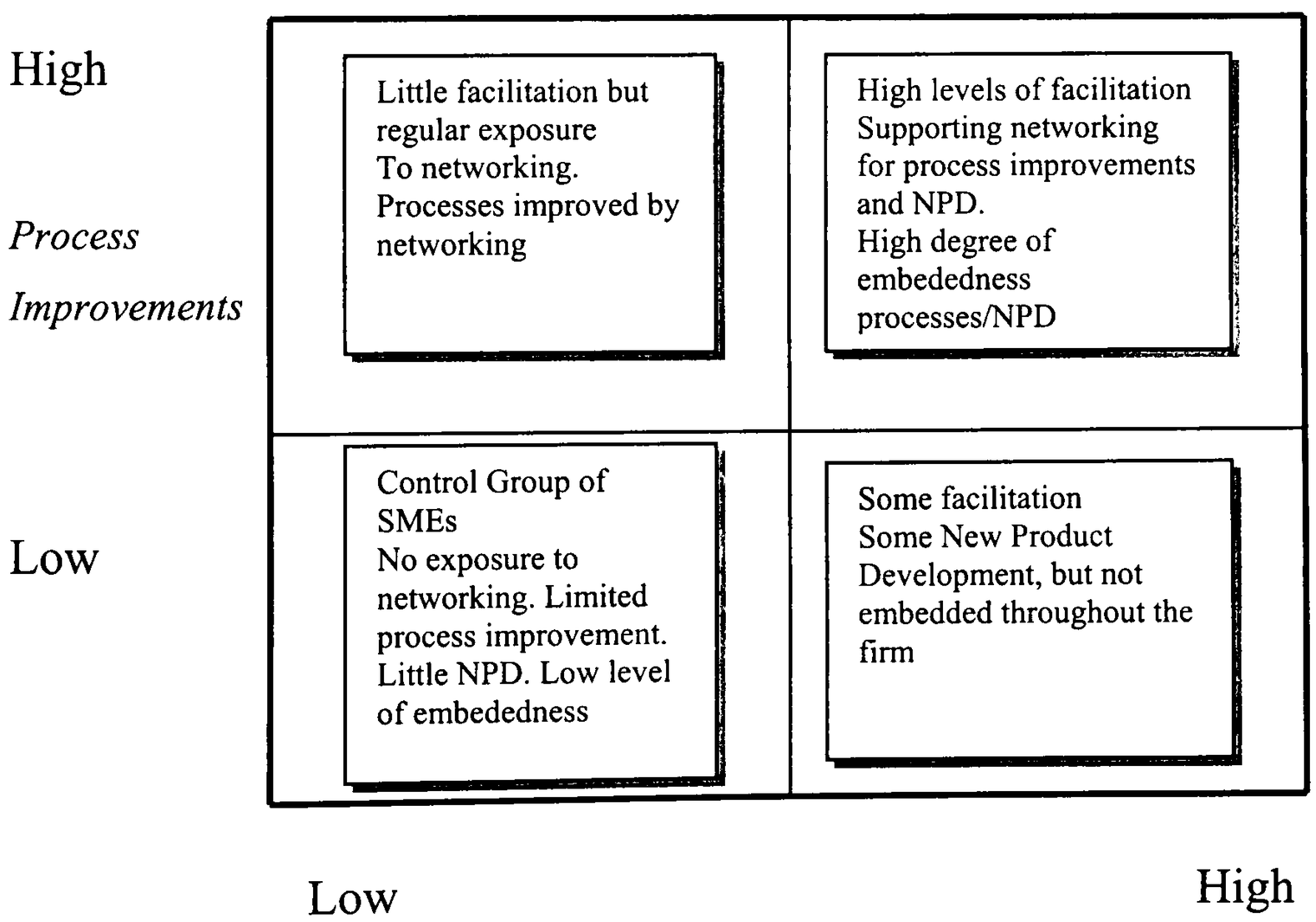


Figure 21: Hypothesis Representation at the start of the research

Furthermore, the compatibility of Performance Indicators within the network groups suggests that poorly performing SMEs or a group of SMEs at widely different stages

of performance would find effective networking problematic as a group. "Equity" would not be maintained in these circumstances, some firms would be "giving" more than "receiving" information and ideas.

The results and analysis confirms that networking supports the pre-conditions for partnerships with others in then developing new products. The research postulates that networking supports the processes, which lead to partnerships. Firms develop new processes within networks then develop their ideas with other firms external to the networks for customer orientated development. These relationships can then be sub-contractual in nature, although there is some evidence of alliances within Technical Partnerships.

From the responses, there was a strong positive attitude from the sampled firms to networks supporting learning from others, for sharing ideas, for providing information on trends, for benchmarking and for process improvements. This underpins the analysis from the Case Study firms, which were observed over a two-year period. The Questionnaire Analysis between Non-Networking firms and Multiple Networking Firms showed that there was a significant difference *attributable* to networking on learning from others and gaining information on trends.

6.1.2 Conclusions of the nature of networking from both the research and the Literature testing the hypotheses of NPD, New Processes and level of Facilitation

The networks from the Vertical tradition (Hines, 1994, Lamming, 1994), the Industrial District tradition (Piore and Sabel, 1984, Jarillo, 1988), the network as a brokerage. (Chaston, Inzerilli, 1990) and as a social dimension embedded in a unique cultural setting (Granoveter, 1985, Huggins, 2000). The research has identified a number of new ways of characterising small firm networks relating specifically to the hypotheses.

Type	New Product Focus	New Processes Focus	Facilitation Issues
Vertical Supply Chain Network	Customer focus Globalisation makes trust difficult	Customer focus QCD Internet auction for commodity suppliers	OEM led External agency led
Industrial District Network	SME focus High degree of trust Few examples in region	Lead/Hub SME facilitated De-coupling if under achieving	External Agency supported Broker essential Lead Hub/SME
Geographical/Area based Network	Potential for new ideas but area focus & serendipity	Potential for sharing information Cross sector new ideas	Externally facilitated
Common Product network (Homogenous)	Pooling of know how by SMEs Trust and market issues critical and problematic	Sharing of technical know how possible but trust problematic	Broker essential Internal SME leadership External Agency in support TOR
Thematic Network	Sharing of information No explicit focus	Best practice visits	External provider/expert focus Social element
Closed Strategic Network	High degree of Trust Heterogeneous group Diversification	Cross Company Teams Factory visits Benchmarking	Developmental Long term New members?
Open Social Network	Ideas sharing Marketing orientated Owner manager Heterogeneous Good degree of trust	Limited Business focus	Company driven Long term Social element "expert" for specific inputs

Table 50: Conclusions on network types and support of NPD and New Processes with the appropriate facilitation

Each of these network models has been analysed in Chapter Five which then leads to the concluding remarks on the two types observed during the research period, the CSN and the OSN.

6.2 DISCUSSION ON THE NETWORKING FORMS AT THE END OF THE RESEARCH PERIOD

Both the Closed Strategic Network and the Open Social Network have been identified as networking forms supporting NPD and new processes from within the research period. These will now be defined as network types and their characteristics further developed to enable them to be replicated within other situations and contexts. The existing key network typologies will next be listed to then show the emergence of the CSN and the OSN as types from these traditions.

6.2.1 Vertical Supply Chain Network Models

The Vertical network associated with a customer led supply chain network with a specific focus on a group of suppliers has not been successfully evidenced within the case study companies. It is ostensibly heterogeneous, but the participating firms may not be comfortable in the potential for competition, the customer has chosen the composition of the network and may have different motives than joint development. It may have a local context, but being product based, it is more likely to have a national focus given the current global nature of supply chains. The local nature of networking as a factor in trust building with small firms seems to be an important factor in network building arising from the research, which may not be a factor in the Vertical Supply Chain Model.

This type of network will have a "formal" context from the start; the network firms will be invited into an arrangement influenced, if not determined by the customer. The support for new processes, therefore, seems from the literature and from the Case Study firms, to be a likely outcome. Facilitation can be from the Customer or from a consultant working with the network, which can also be problematic in terms of trust and openness. The need for diversification by the participating firms can also be ambiguous within the context of the Terms of Reference for the network. That is, will the network be able to encourage diversification strategies in NPD with the participating firms, as this may not be seen as the best interests of either customer or supplier. The non- product orientated commodity focussed supplier will additionally have to weigh up the benefits of such networking as supply is increasingly based on global factors and cost issues.

The design-orientated supplier is similarly affected and needs to consider which customers it could become closer to in terms of design and development. From the Case Study analysis, SMEs are seeking to re-define their customer relationships on a 1:1 basis often with new customers as well as from their existing Vertical Supply Chain customer base. (This could be in the form of a Technical Partnership, Value Added Partnership, Joint Venture or an acquisition).

6.2.2 Industrial District Models

The literature notes the significance of Industrial District forms as a key method for small firms to gain critical mass through sharing of scarce resources and the sharing of information and coming together brokered as a unit to manufacture products. Evidence of these networks was hard to find at the start of the research and evidence has also been difficult to be established from within the region during the research.

The focus on a "hub" firm to lead a group of other firms within the context of a supply chain is relatively new for the small firms in the region emerging as they are from the vertical tradition or from the position of stand - alone enterprises in sub-contract relationships.

The research also suggests that the characteristics of trust, heterogeneity, formality, common Performance Indicators and cultural specificity all need to be aligned before small firms can begin to establish new networking and trading relationships. Unsurprisingly, there has been little evidence of demand for external facilitation in terms of Real Service Centres (such as can be found in Bologna) or specialist Brokers (as in the Danish Technical Institute system) within the case study firms or from the Questionnaires in support of the "broker" model.

6.2.3 Horizontal Network Models

At the start of the research, this type of network was identified as a network form horizontal in nature, social in aspect and open in its membership. It was also deemed as helpful for supporting the conditions of networking and led directly to the formation of the Closed Strategic Network as outlined in the research period. This networking form therefore, underpinned the process at the start of the research period. Small firms from the World Class Network constitute eight of the Case Study companies. This type of network seems very good at gathering together a group of small firms around a theme to then inform them of current trends share experiences and support best practice visits. It is less good at supporting a discursive element and for small firms to then share experiences and reflect on customer strategy, possibly with a facilitator working with the firms as individuals or in small groups. Process improvements were similarly developed outside of the network itself by undertaking

specific improvement projects around "QCD". The network alerted the participants of the need to undertake these improvements having an information sharing and consciousness-raising role in its Terms of Reference. Other notable examples of a successful Thematic Network as well as the World Class Network were also found in the research, notably the West Midlands Digital Network, supporting e-business in small firms.

6.3 A CRITIQUE OF THE CLOSED STRATEGIC NETWORK MODEL

The research has highlighted a number of distinct characteristics. Firstly the characteristic of the network being of a horizontal nature can be seen from the developments within the Vertical Supply Chain and the Thematic Network tradition. Within the CSN the network exists outside of a specific supply chain context. The members are known to each other and may share a common customer, but the relationship is not predicated on a specific customer's agenda, rather it comes from the needs of the firms. Furthermore, it has a local element in that the firms all in different supply chains are located in proximity to one another – they share the same economic infrastructures and environment as well as culture. The similarity in Performance Indicators also indicates a need to be seen as best in class and aspiring for excellence. A firm, which does not share these aspirations, would possibly have difficulties participating in the network. The network can also be said to be heterogeneous, in that the firms do not have a common product or service, rather sharing a common philosophy or set of values (the thematic element, which could cover World Class Manufacturing or a common value system).

Next comes the characteristic of formality of structure and Terms of Reference (TOR). This can be seen as a network being "Closed", a specific group of firms

meeting for a particular purpose for the specific benefit of the group, to "Open" wherein the firms constitute a wider more flexible membership system. From the analysis, the network supports the development of information exchange, idea development, cross company teams and customer development leading to evidence of New Product Development. The CSN has been sustained for two years. It has from the outset been SME driven, compatible with the supply chain culture of the small firms in that it does not threaten their separate interests and identities, is non-prescriptive, but is developmental. Ideas and information are exchanged freely as the key element in what the network is constituted to do.

External facilitation provides an enabling role, ownership of process decisions and outcomes reside in the network. The high level of trust has led to joint participation in marketing focused events commissioned by the network and as a focus for "testing out" new developmental ideas from the support infrastructures. This trust has been evidenced by the need to re-focus the Terms of Reference at the end of year two and being able to discuss participation in open and "blame" free manner.

The characteristics can be shown sequentially in Figure 22 which show a set of compatible features in the CSN, whereas, the Supply Chain and a Common Product Model can be seen to have some inherent difficulties in the way they are constructed. (These are highlighted in *Italics*). Problematic characteristics are shown in *italics*.

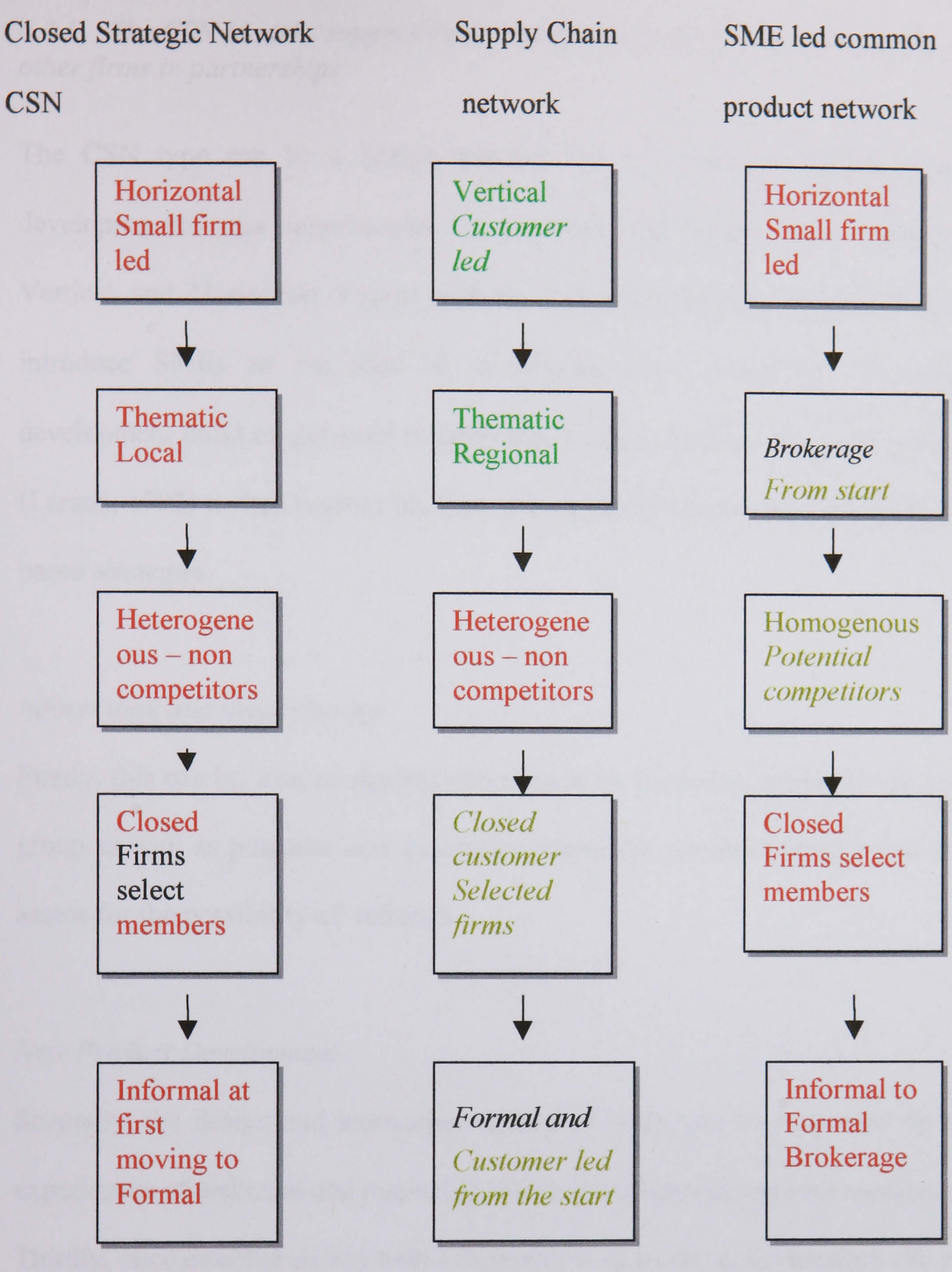


Figure 22: Comparing the characteristics of a CSN, a Vertical and Common Product network.

As can be seen, the CSN has a series of compatible characteristics, which lead to effective networking. There are other factors underpinning these, which are next discussed.

6.3.1 The CSN Model - supporting a customer strategy, which supports links with other firms in partnerships

The CSN type can be a bridge between the two network traditions aimed at developing business opportunities for the SME, the Supply Chain Network (both Vertical and Horizontal Types) and the Industrial District Model. A CSN can introduce SMEs to the idea of developing new customers. The phases in development build on personal relationships to then develop "rules and procedures" (Larson, 1992) to then support the firm in developing away from commodity product based strategies.

Information and ideas sharing

Firstly, this can be seen as sharing information on customers mutually known to the group as well as potential new customers whom the members discuss and then can assess for the possibility of referrals.

New Product Development

Secondly, the design and innovation aspects of NPD, can be supported by sharing experiences of technical and marketing information between network members.

Thirdly, once established and with a degree of trust in place, the network can embark on joint developmental activities (perhaps externally facilitated) which enable the network to consider the possibilities of new product development. Fourthly, the network can champion third party support for SME development through developing alternative mechanisms to placing World-Class small firms with new customers. Fifthly, the network can be then seen as an established entity which can be a vehicle for deeper insights into the external world and for reflection on the behaviour of the individual companies as they continue to strive to become World Class in established

and new markets. Lastly, brokerage may become an option if the network wishes to trade as an entity, but this seems unlikely given the development of the network type and unnecessary given the objectives of the individual firms competing globally against new entrants to local markets (Castells, 1997).

New Processes

A CSN can support new processes through the sharing of ideas. This can be done in a number of ways, through visits to each others premises, by best practice external visits and then through establishing cross company teams to share information on a topic or theme (i.e. ICT /QA). Once trust has been established, members of the network can in rotation support each other in company specific projects providing fresh insights into practice. Network members do need to have support to continue the networking process.

Facilitation in the CSN

Facilitation initially supports the group to become formal, if this is a desired outcome for the network – building on informal beginnings. It then supports the network in developing Terms of Reference, carrying out activities related to the TOR and evaluating outcomes. Specialist roles can be carried out in terms of a catalyst to challenge the network, an expert to provide insights into specialist areas and an information role to support the collective intelligence of the network. Facilitating the internal teams is an extra dimension, which requires a different set of skills perhaps than those needed with the managers.

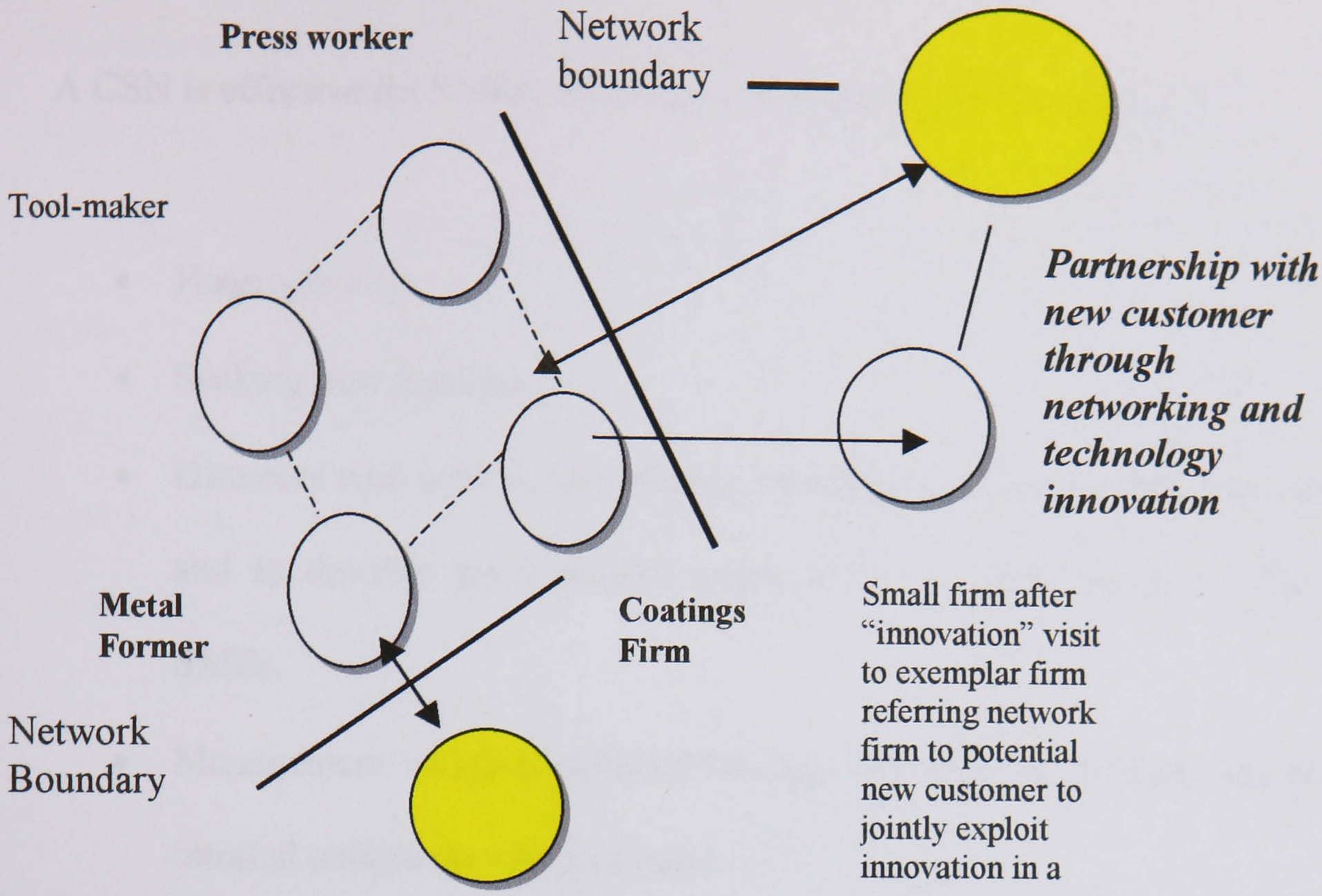


Figure 23: The development of the CSN supporting links with other companies to then enter into partnerships

Two firms directly benefiting through networking activity. One is a dyadic relationship within a Technical Partnership supporting a new product and the other through a best practice visit for the CSN, including three non CSN firms, whereby one of the three introduced the CSN firm to a customer to develop a technical relationship. This type of relationship can be seen as a strategic alliance which has been fostered through a networking process – that is – the firms have acquired the predisposition to collaborate through networking which has then manifested itself in selected alliances external to the network (Mowery et al, 1996).

6.3.2 Conclusions on the CSN

A CSN is effective for SMEs, which have the following characteristics:

- Heterogeneity.
- Seeking new markets.
- Directors who wish to learn from each other by sharing information and ideas and to develop good understanding within a small group of like-minded SMEs.
- Management which is outward looking and strategic in focus and has good internal culture on which to build.
- Has a desire to exploit external to the network those ideas developed and/or shared in the network.
- From the vertical supply chain tradition with a systemic approach to conducting its affairs.

6.4 A CRITIQUE OF THE OPEN SOCIAL NETWORK

The OSN has been successful in enabling small manufacturing firms to share business development strategies and reflect on practice. It has been less preoccupied with process improvement issues and has a "sceptical" stance on customer driven improvement policies. It is also heterogeneous in that a variety of small firms from different specialisms participate. It does not aspire to become "closed" and fluctuations in membership and has a both a "core" and a "periphery" of members.

6.4.1 The OSN, supporting learning and ideas sharing through networking

The network can be said to emerge from the Industrial District tradition in that it is horizontal, from an owner managed "craft" tradition of small firms. Historically, from the Case Study analysis, these firms have added capability through acquisition rather than through networking. The OSN firms have yet to show any inclination at all to move towards the Industrial District Model, which can be characterised as one firm having a co-ordinating role with a group of others within a product relationship with a customer.

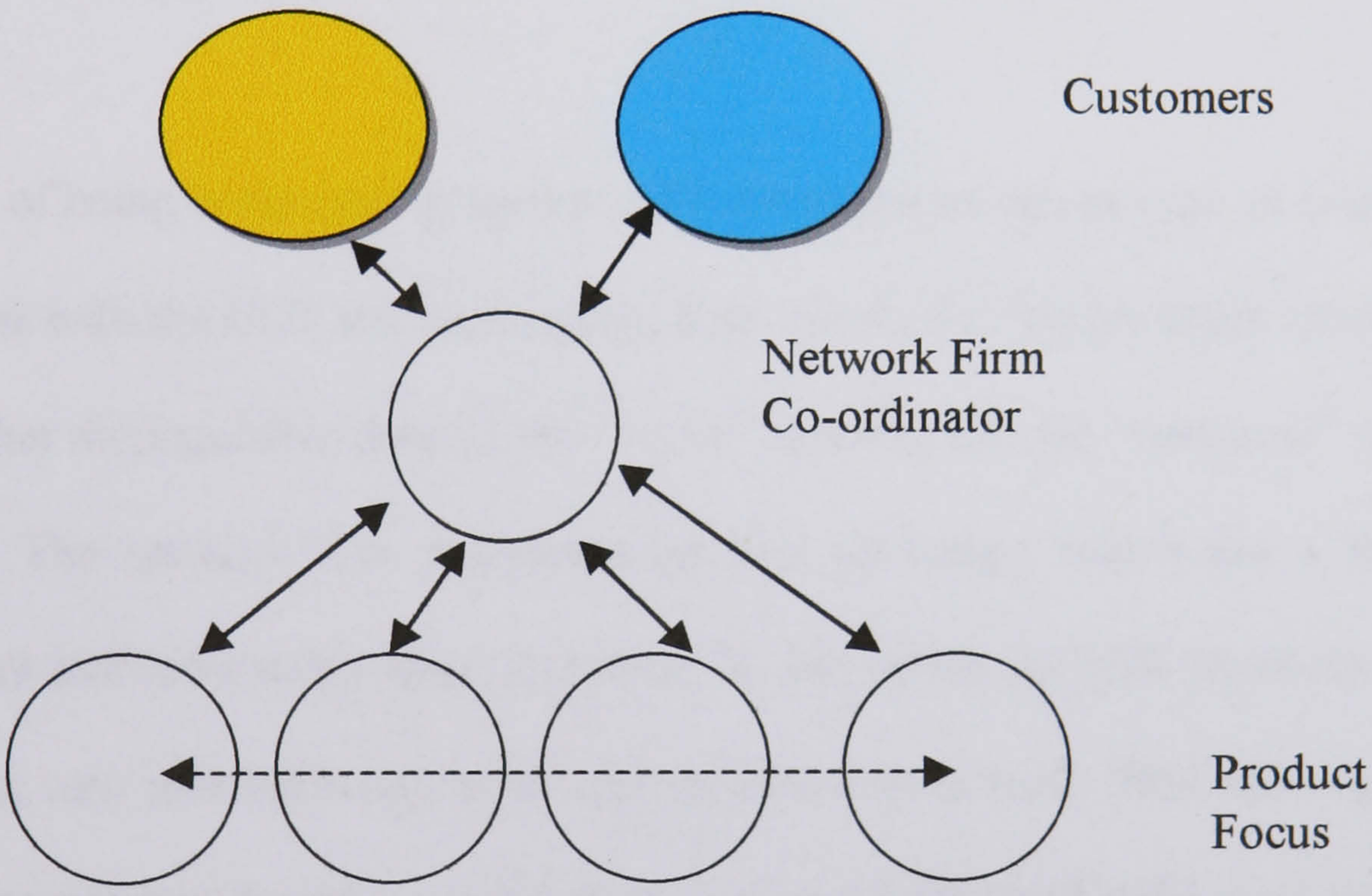
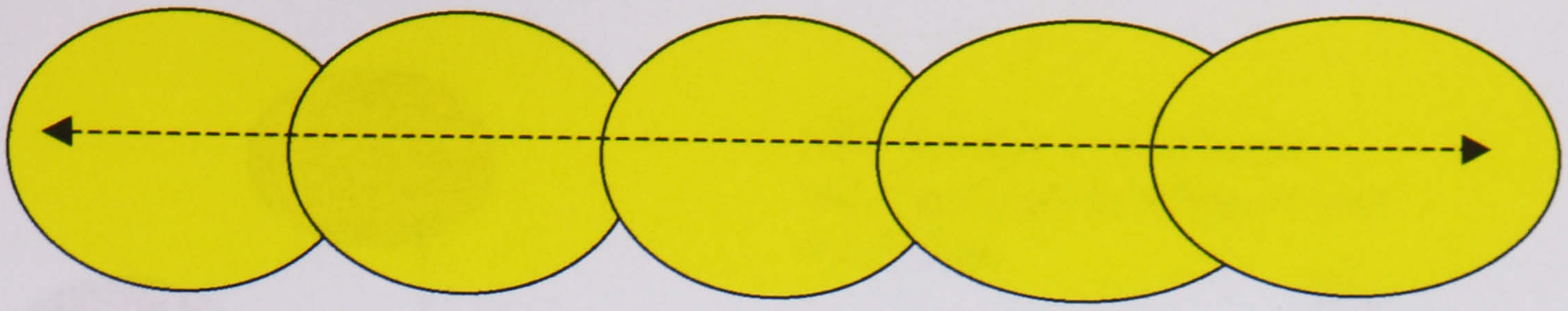


Figure 23: The Industrial District Model (after Jarillo, 1988, Inzerilli, 1990 Piore & Sabel, 1984)

The OSN, as in the District Network tradition, can be shown as a series of spheres rather than as a set of characteristics. The characteristics can be diagrammatically represented as the bottom layer of the classical Industrial District Model in Figure 23, but here the similarity ends. This characterisation implies a more "organic" structure, mirroring the typologies within the literature (from Rothwell, 1992, "egg of innovation" to Birchall and Lyons, 1995 "loosely coupled organic network typology").



Horizontal Non Competitors 5 – 10 core 5 – 10 periphery	Heterogeneous	Social	Local	Open - TOR SME driven Process facilitation

Figure 24: The Open Social Network (OSN)

The network emerging from the Industrial District tradition can thus be shown as a series of interlocking spheres.

The features of being horizontal in nature and heterogeneous can be seen as common characteristics with the CSN tradition arising from the vertical supply chain context. However, what distinguishes them is the "social" element and the "openness" of the constitution. The network type represents an idea exchange, which has a strong social element and informality also. It is open, in that within its TOR members may come and go, new members may enter and membership is more fluid and organic, probably representing a loosely coupled organic network (Birchall and Lyons, 1995). The network can be shown in Figure 25 with business relationships developed external to the network. This again mirrors the approach of the CSN with the small firms exploiting ideas developed in the network in a range of associations. Again, serendipity would be a factor if the firms had a common product focus. This has not ever been a focus for the network.

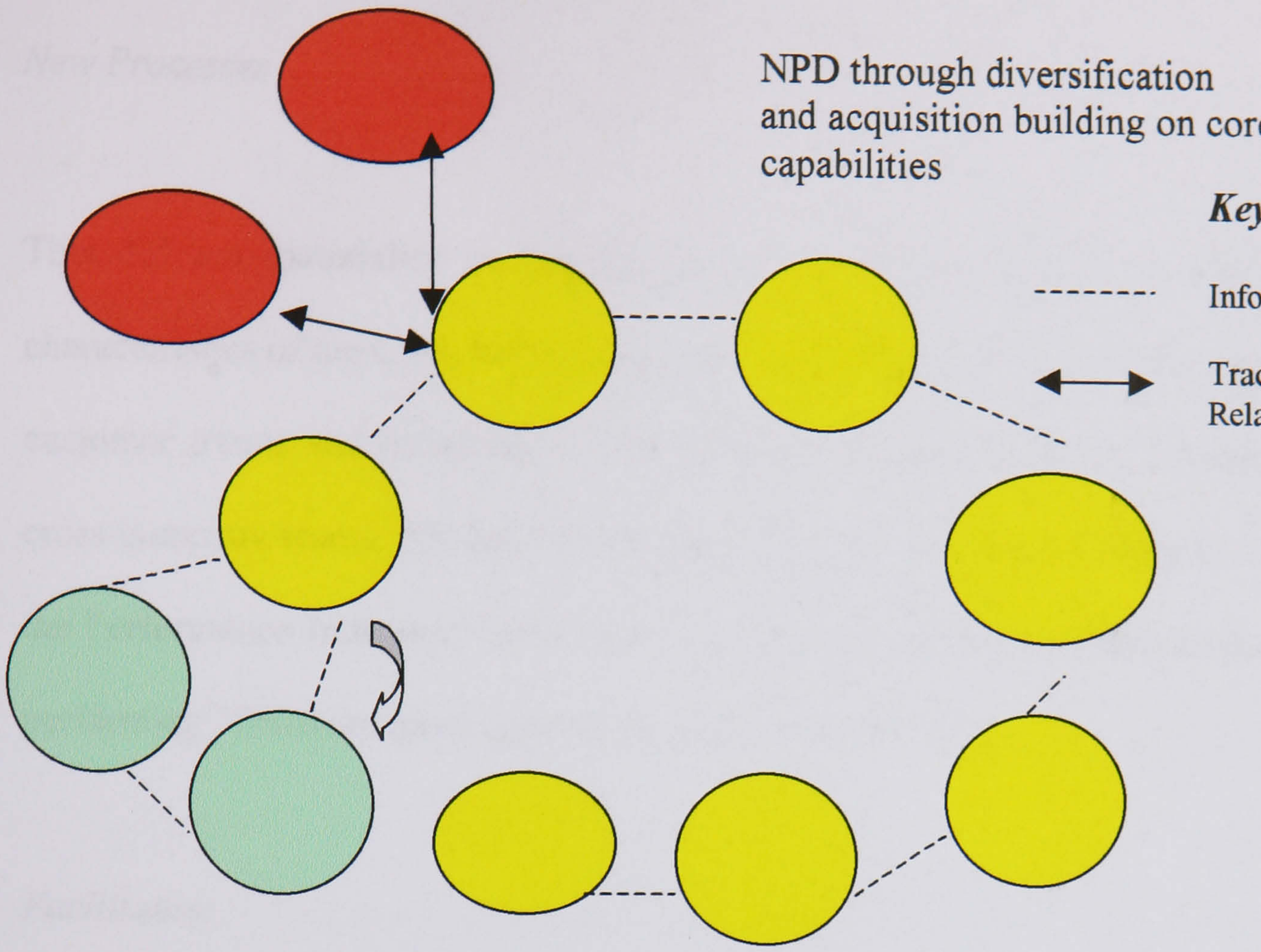


Figure 25: OSN small firm developments

The network acts as a place to articulate and reflect on strategy as a means to better understand the external customer environment. The company specific strategies are then supported by networking to act as a mechanism for reflection as the firms progress to develop their individual company plans.

Information and ideas sharing

The five characteristics are consistent with the support of networking which allows for information exchange and the discussion of ideas within a group of firms with common Performance Indicators, within a social arrangement, open to like-minded firms, in a given locality with Terms of Reference established by the firms themselves.

New Processes

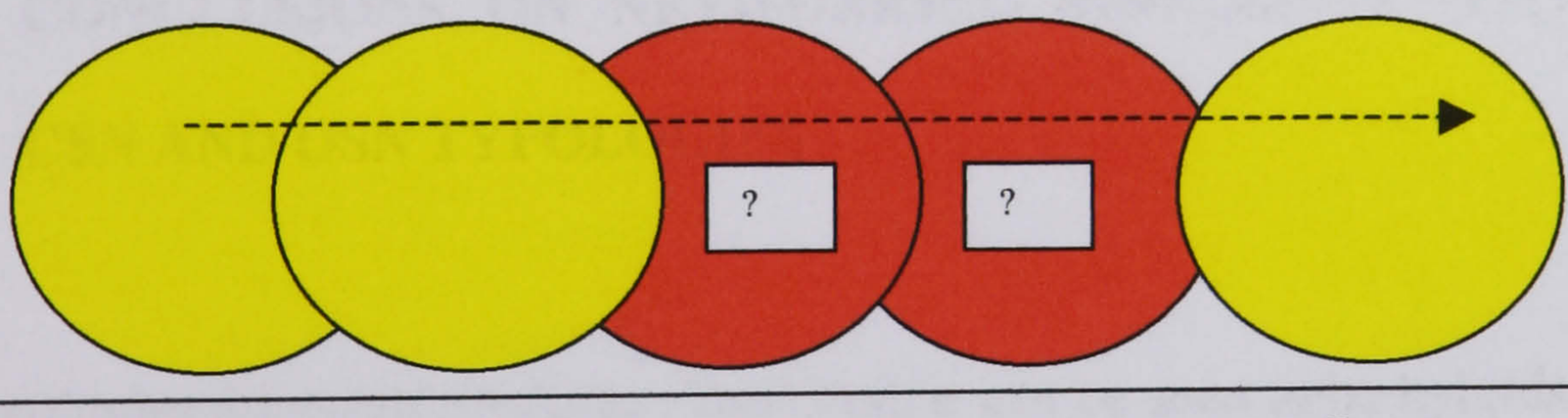
This did not materialise as strength in the OSN. The firms have many of the characteristics of the CSN, but the interactions remained focussed on the exchange of customer trends and information. The network did not pursue the development of cross company teams. All the interactions were with the owner manager. However, the Performance Indicators were all towards the top quartiles indicating that "better performing" firms are more inclined to network in this way.

Facilitation

The company specific strategies may well be supported by a specific facilitator from the OSN, depending on need and the rapport established with the individual and the firm. Again, as in the CSN, external facilitation on specific topics was pursued by the group members on an individual basis. Similarly, as in the CSN, specific events were suggested and then run by the network. (Sessions on Ownership Succession planned at the end of year two was an example of this). An example of how a horizontal, heterogeneous, district, formal and open network can be compared to the OSN.

The methodology which enables the OSN to be shown as five compatible circles can now be applied to a comparable network type to The OSN. The network, by enabling key characteristics to be made visible and identifiable, enables other networks to be analysed using the OSN process. The characteristic of a district boundary and the external and formal nature of the network can be seen as inhibiting factors. The "broker" role has yet to emerge from the research to date. It may well be needed if

the conditions for partnership forming cannot be made by the small firms themselves, but evidence from the research suggests that the businesses themselves will carry out this function. The facilitator role is therefore towards supporting the conditions for networking, rather than brokering business deals. Once the conditions for networking and sharing of ideas and information are in place new business opportunities will be pursued by the companies themselves in business arrangements external to the network. The characteristics can then be applied to the literature and to local practice to define other network models. For example, using the characteristics developed in the research for an Open Social Network, the "Business Group" model can be seen to be problematic. It has a distinct boundary, which excludes possible contributions and relies heavily on external brokerage to deliver benefits to the group, rather than the group being a focus for discussion and then developed outside by the firms as appropriate. It is heterogeneous which has been seen to be an important characteristic of the networks studied, but there is no explicit emphasis on standards (e.g. "World Class") or on sector. It also has the possibility of competitor pressure from within as the network is externally brokered.



Horizontal	Heterogeneous	*District*	*Formal*	Open
Non Competitors ?		*Boundary*	*TOR external*	*Broker*
Non sectoral		*for entry*	*emphasis*	*Led*

Brokerage emphasis from the start. Wide, even diverse, membership.

Figure 26: The Business Group Network illustrated by the characteristics developed through the research

6.4.2 Conclusions on the OSN

The conclusions on the OSN which can be addressed to other firms seeking change.

The OSN is appropriate for firms which:

- Have owner managers as MD's
- Seek an "open" forum to share and reflect upon strategy with an intent to develop change strategies for the firm
- Prefer a social element with less of systems approach more informal which supports information exchange and ideas sharing
- Share common Performance Indicators
- Prefer a focus on markets and strategy rather than production processes
- Prefer a network with a more fluid external boundary which allows others to join and then leave, where trust is fragile to resilient
- Seek a core group of like minded MD's with a periphery of less frequent network attendees who nevertheless bring specific insights into the network.

6.5 CONCLUSIONS ON NETWORKING PROCESSES WITHIN THE CSN AND OSN TYPOLOGIES

The typologies emerging from the Case Studies can be seen to be hybrids. The CSN emerging from the vertical supply chain tradition still sub-contractual in nature with elements of partnership in ideas sharing and information exchange but little evidence of partnerships for NPD (some implicit realisation that VAP's/Technical partnerships may arise).

The OSN with its similarities to the Industrial District tradition can also now be recognised as a type of network supporting ideas and information sharing. The quantitative analysis has indicated a significant difference attributable to networking between multiple and non networking firms in learning from others, in sharing ideas and gaining information on trends.

The different network types can be seen below in Table 51:

Type	New Product Focus	New Processes Focus	Appropriateness
Vertical Supply Chain Network	Specific Customer focus	Good for Customer focus QCD	Low risk, good for information gaining
Industrial District Network	Focus on a network developing a product/service	Commodity focus allowing for de-coupling	Unclear in the context of the WM region
Geographical/Area based Network	Potential for new ideas but area focus & serendipity	Potential for sharing information Cross sector new ideas	Good for info. Sharing and lobbying local agencies
Common Product network (Homogenous)	Critical, but extremely high degree of trust essential	Sharing of technical know how possible but trust problematic	An option to test JV's perhaps or develop tight sub-contracting as a group. Broker essential
Thematic Network	Sharing of information No explicit focus	Best practice visits	Excellent for gaining information. Low risk. Social element
Closed Strategic Network	SME Ideas generation Heterogeneous group High degree of Trust Diversification	Cross Company Teams Factory visits Benchmarking	Good for mature companies willing to come together over time. Serendipity of product focus
Open Social Network	Ideas sharing Marketing orientated Owner manager Heterogeneous Good degree of trust	Limited Business focus	Good for information/ideas exchange. Low risk Social setting

Table 51: Comparison with network types and support for new products and processes

The research period of two years has also suggested a progression from process issues towards focus on new products. The result to date does not however suggest evidence for the Industrial District Model with a lead firm in a co-ordinating role or the partnership model with small firm networks in vertical supply chains. A ladder of

adoption from new processes to NPD can be strongly suggested by the research. What still needs to be further studied is the time after two years and the capacity/ability of the network to continue to develop. The WCN, which was the original network for the research, is now five years old. There is an issue about systematically re-visiting the TOR to refresh objectives, which needs to be expressed in a more cyclical nature. However, a ladder of adoption is a good starting point.

6.5.1 Ladder of Adoption showing a three stage approach

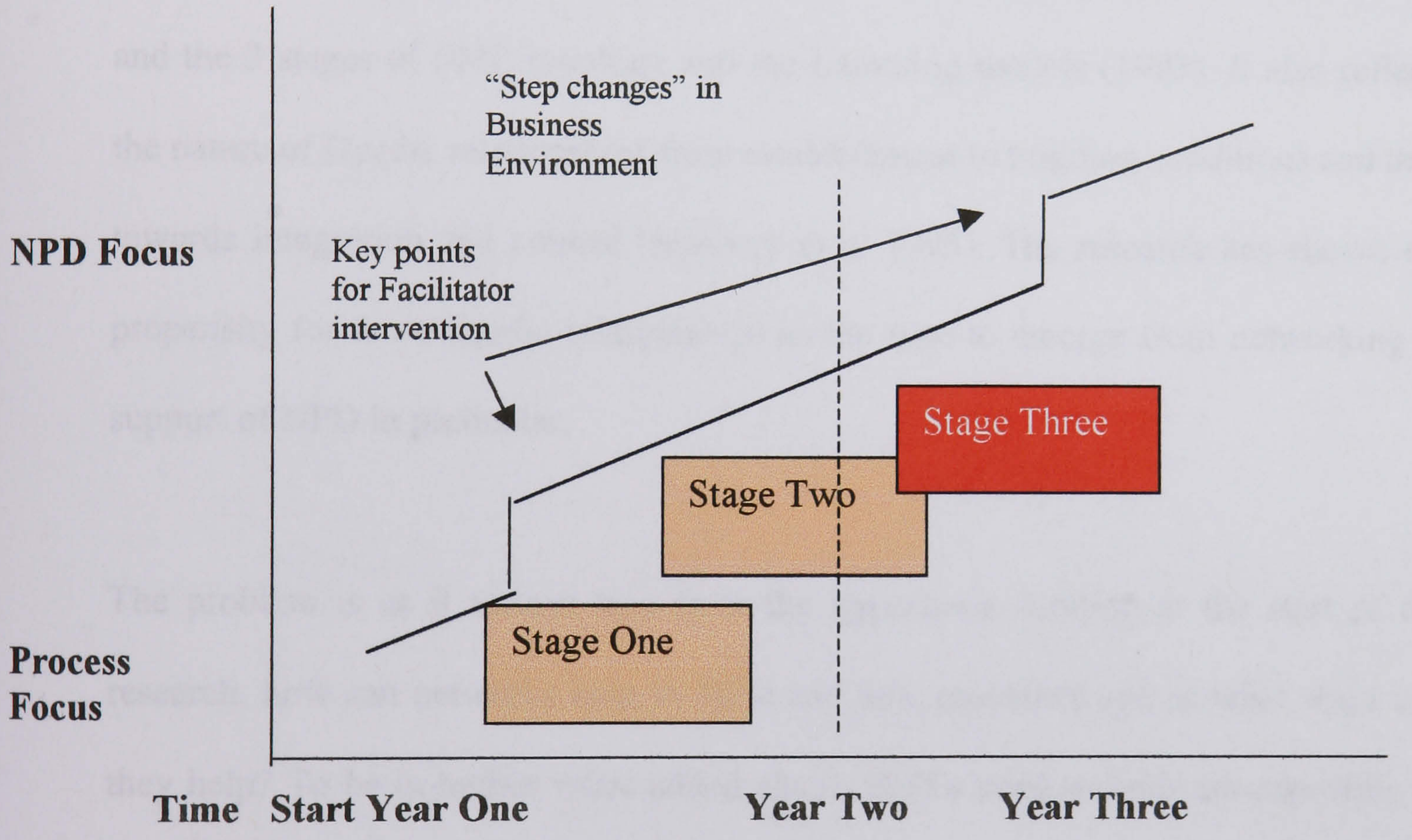


Figure 27: Ladder of adoption from new processes to new product focus

Step changes can be referenced from Scherer, 1986, Clarysse et al, 1988, Rothwell, 1992, Lamming, 1993, and MacNeill et al, 2001.

Stage One – Firms begin networking, sharing ideas and information informally establishing trust, fragile at first.

Stage Two – firms consolidate their networking becoming more formal, with TOR. Strategies discussed within the network and reflected upon. External input as both a catalyst and expert. Inter company teams arise and trust becomes resilient. Customer focus is essential.

Stage Three – firms build upon their experiences of networking by developing new relationships regionally and internationally in dyadic relationships within a supply chain tradition.

From the very start of the research the companies in the networks were all aware of the need to move from low value added component manufacture to higher value added components and then products. Some of them realise this is beyond them and are seeking to exit from commodity manufacturing into niche markets. Some, as has been seen, are building partnerships with new customers, some are exploiting technology and some are seeking to acquire new capability through buying another firm. This analysis builds upon the marketing strategies expounded by Fisher (1997) and the 3 stages of SME typology and the Lamming models (1993). It also reflects the nature of Dyadic relationships from establishment to building conditions and then towards integration and control (Mowery et al 1995). The research has shown the propensity for these dyadic relationships as the type to emerge from networking in support of NPD in particular.

The problem is as it always was from the hypothesis forming at the start of the research, how can networks help in NPD and new processes and in what ways can they help? To be in higher value added chains SMEs need to build up capability in delivering new products and ideas to customers. All the network companies showed excellent characteristics in terms of speed and responsiveness. CSN can be seen as a good example with the Winning Moves strategic training. All have poor links though with others to supply customers – so how can this capability be increased? The answer must lie in the sharing side of networks – the quantitative results show strong associations for networking and learning from others, sharing ideas, trends, benchmarking and process improvements. The results show that between non-networking and multiple networking firms there is a significant difference

attributable to network participation for learning from others, sharing ideas and gaining information on trends.

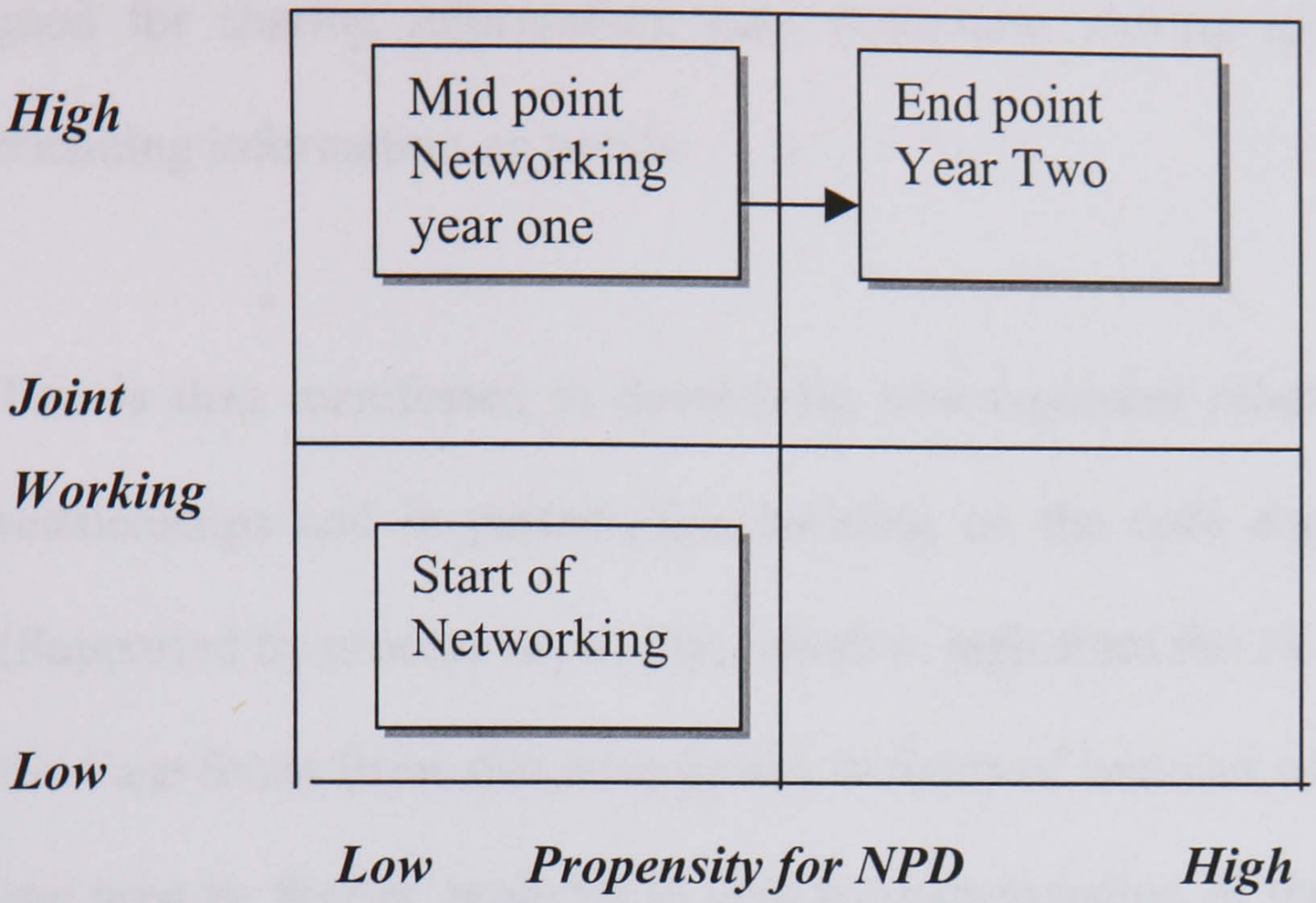


Figure 28: The development through the CSN and OSN network models for supporting NPD

This can be aligned with the AWM Model, shown first in Figure 1, which seeks to show a path of development for the region's SMEs. The Case Study firms can be aligned on this model as shown below:

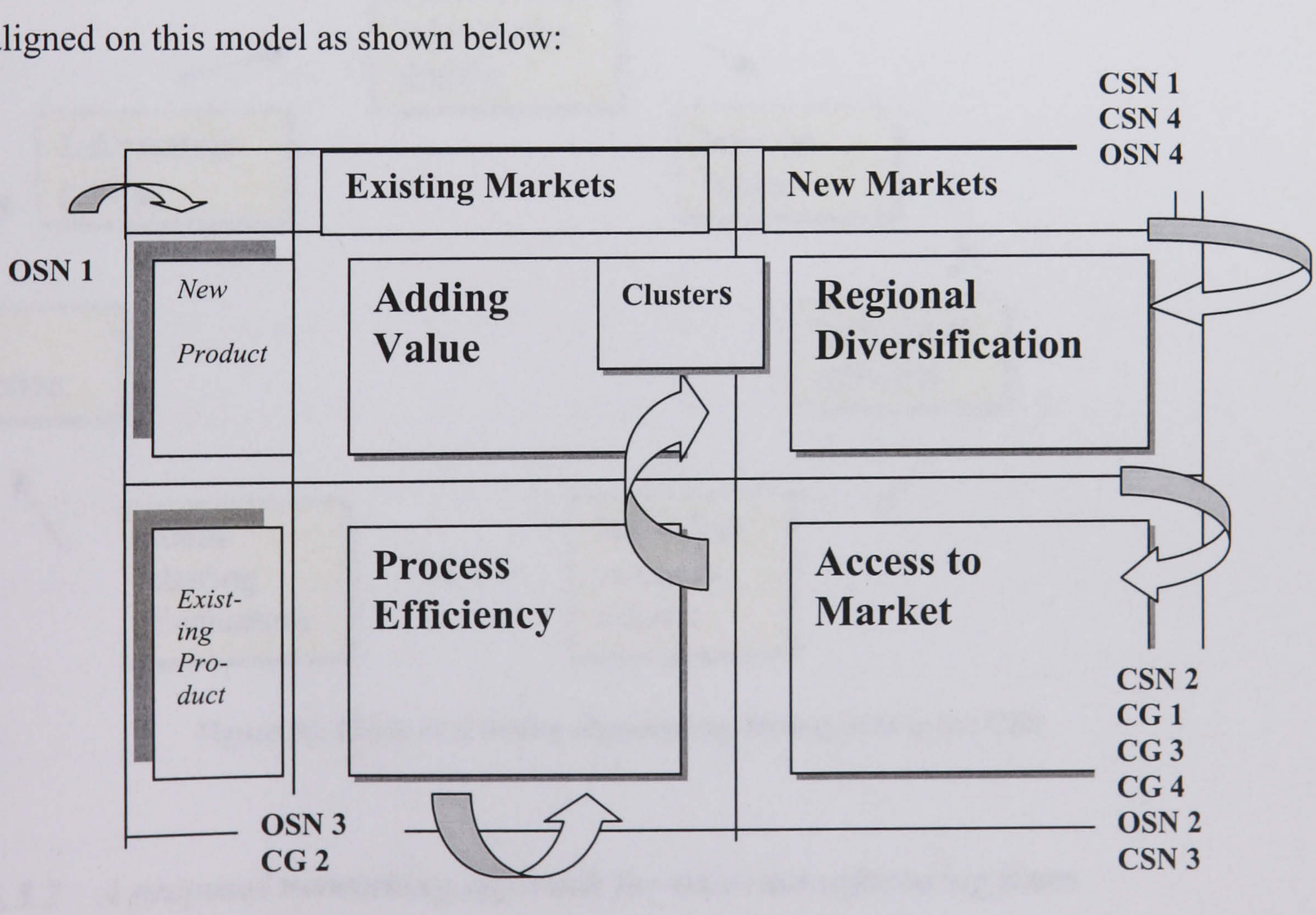


Figure 29: AWM's Clustering Policy in the West Midlands Region and position of Case Study SMEs at end of year two

The process of networking to enable the firms to re-position themselves is becoming clearer through the research results and subsequent analysis. Firms see networks as good for sharing information, new processes, sharing ideas, benchmarking and obtaining information on trends.

This is then manifested in developing new customer relationships in sub-contract relationships and in partnerships building on the core competences of the SME. (Supported by process capability, which is high from the PI analysis in the SMEs in the Case Study firms that have grown in terms of turnover and new customers). This can now be further explored to give an understanding of the stages of development and the characteristics needed to develop specific outcomes

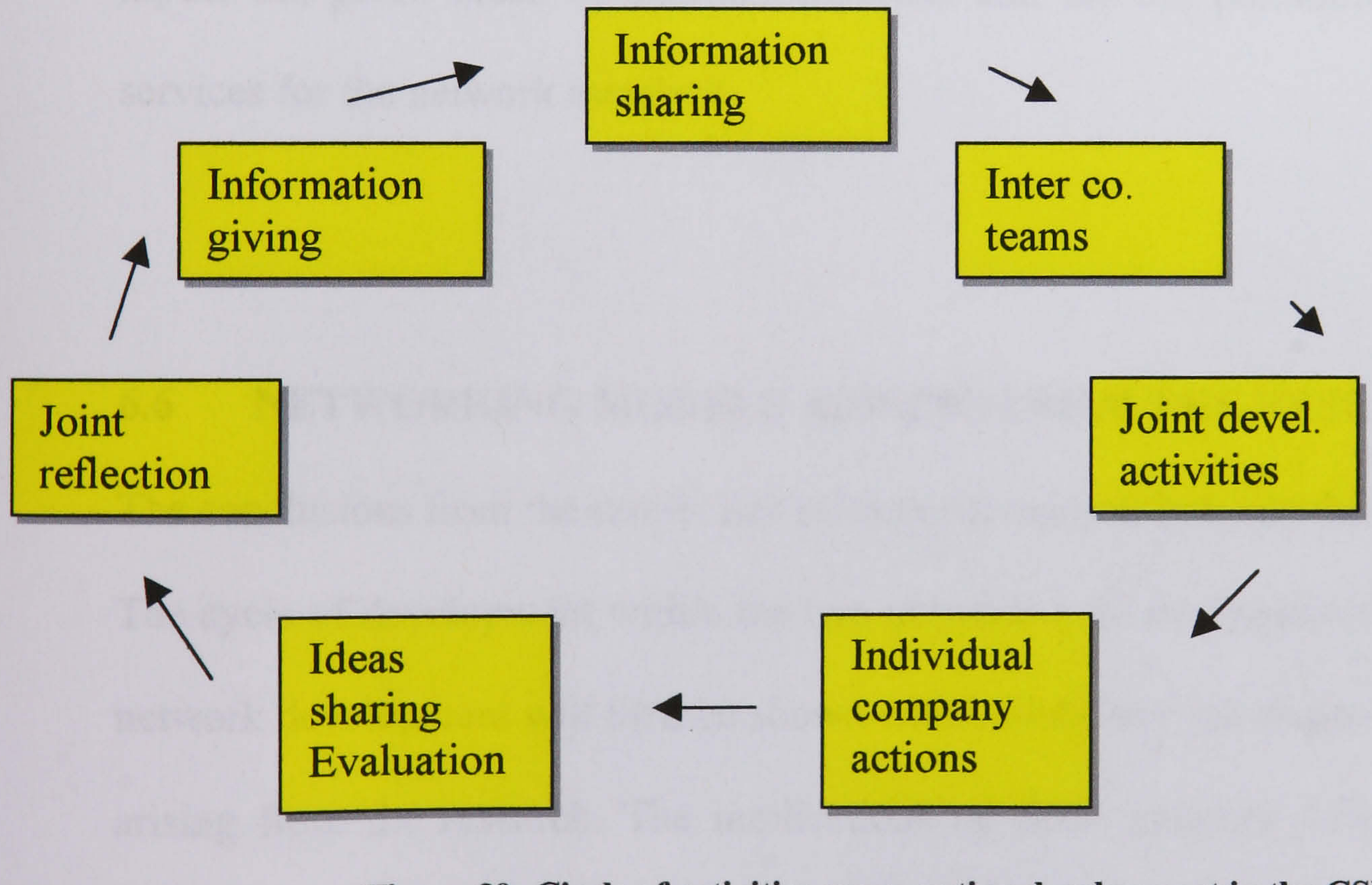


Figure 30: Circle of activities representing development in the CSN

6.5.2 A proposed networking approach for small manufacturing firms

Exactly what the system for the conditions to support a CSN is can now be described. It is important to note the complexity of the system; it has a number of

distinct elements and aspects would best be seen as conditional, that is, interrelated with the others. The degree of inter-relatedness can be strongly suggested within the research, although more needs to be done in terms of testing the system with other comparable networks before the links can be said to be absolutely necessary.

The system has a typology, has common Performance Indicators and key Characteristics. These three factors then combine to give attributes or benefits (learning from others, sharing ideas and customer strategy which supports NPD), which in turn leads to specific outcomes which address the initial research hypotheses for networks supporting a propensity for NPD and supporting new processes. Underpinning this system is a facilitation process, which has in itself distinct roles relating to direct support for the process of networking, for specific inputs on, given areas of external expertise and for the possibility of brokerage services for the network members.

6.6 NETWORKING MODELS ARISING FROM THE RESEARCH

The conclusions from the results and subsequent analysis can now be drawn together. The cycle of development within the two networks will be illustrated. The Model of network development will then be shown which illustrates the stages of development arising from the research. The implications on SME network policy will then be described, within the context of small firm support by both customers and business support agencies.

The conclusions will emphasise the importance of small firm networking for the sharing of ideas, information and trends, which can then be exploited in business

relationships external to the network. The need for customers of these small firms to work in partnership with SMEs, which are active "networkers", will be noted as being in the competitive interests of the customer as well as the small firm. Customers will also benefit from the new ideas and approaches, which the SMEs bring to business relationships from a wide perspective of manufacturing sectors.

6.6.1 The Development Cycle within a Small Firm Network

The importance of seeing networks as a mechanism to support SMEs in new processes and NPD to then compete globally will be emphasised. The network model therefore, fits within both the Vertical and Industrial traditions and has wider implications than solely to the context of the West Midlands region in the UK. The importance of facilitation will be emphasised and the different roles this needs to play in the stages of network development:

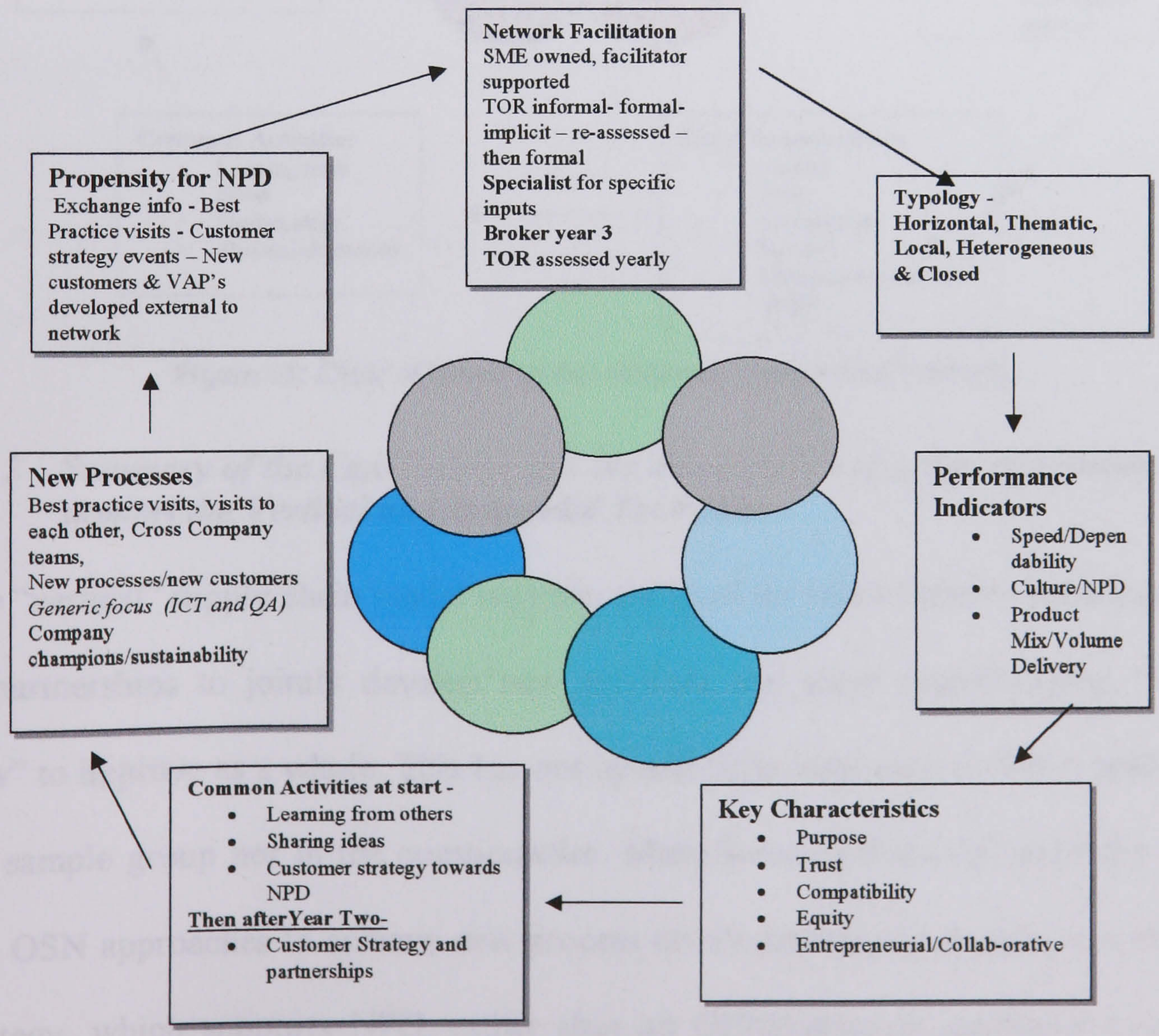


Figure 31: Cycle of Development within a Closed Strategic Network

The cyclical nature of the network process gives a clearer indication of the ongoing nature of network self-analysis and re-configuration to meet the needs of a dynamic business environment. The representation is designed to infer "movement and renewal" in the network. Firms need to be supported in seeking new ideas and ways of performing rather than being "too complacent" in their current strategies and practices (Miles and Snow, 1992).

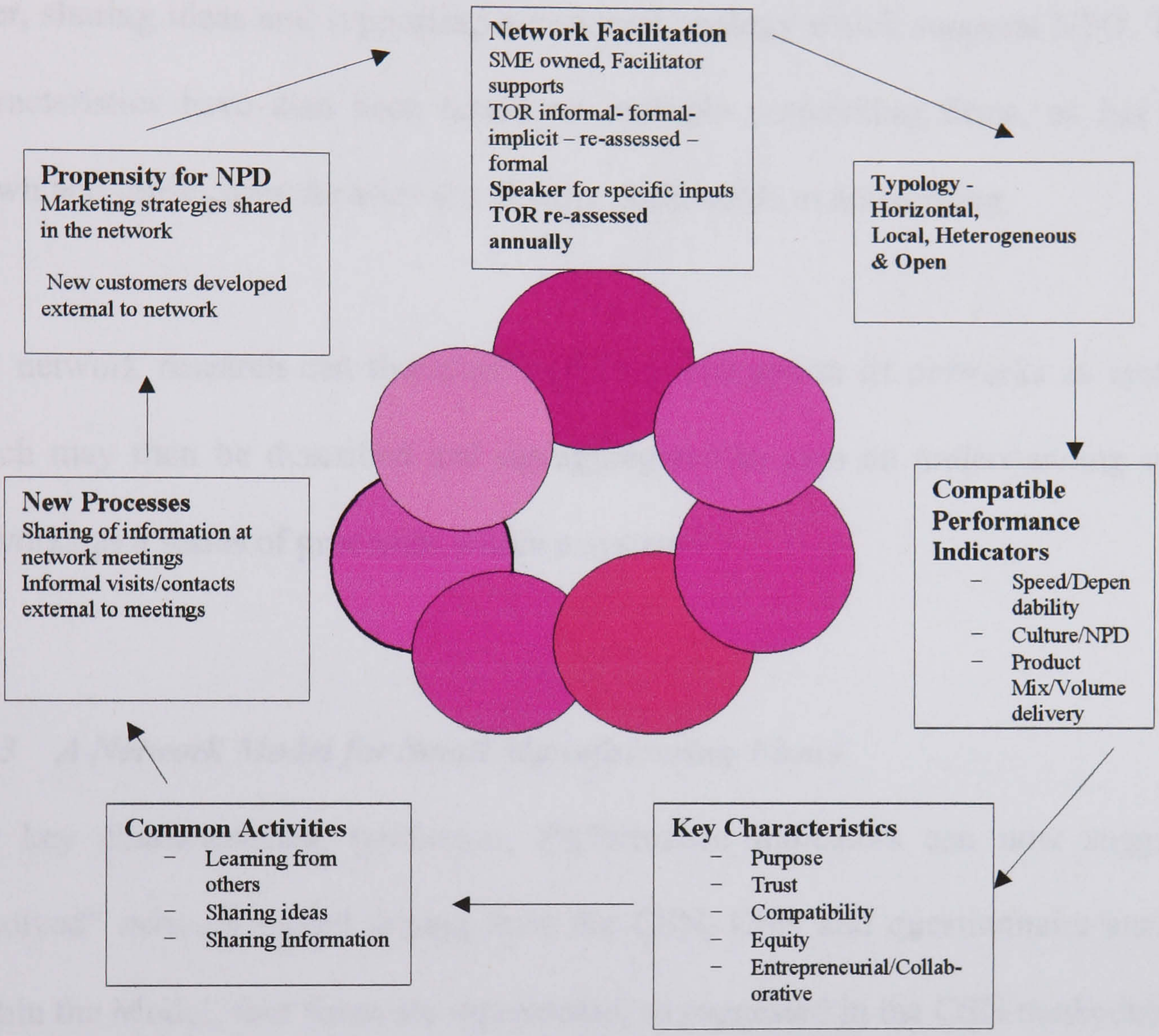


Figure 32: Cycle of Development within an Open Social Network

6.6.2 Summary of the Conclusions and the development of a type of network to support the Vertical and Industrial Traditions

The "vertical" supply chain model suggests the need for small firms to work together in partnerships to jointly develop new products and share manufacturing "know how" to improve as a whole. This has not by and large been easy to detect neither in the sample group nor in the questionnaire. Manufacturing firms favoured the CSN and OSN approaches to achieve new process developments and support a customer strategy, which supports NPD, rather than an OEM/customer supported network arrangement. Similarly, the hub and spoke Industrial District model of small firms

coming together in a brokerage to offer new products/ services was also not evidenced.

The research has therefore identified a set of network characteristics which ***if seen as a system*** can be said to support small manufacturing firms in learning from each other, sharing ideas and supporting a customer strategy which supports NPD. These characteristics have also been tested on multiple networking firms, as has been shown and these characteristics are directly attributable to networking.

The network research can therefore lead to a description of networks as systems, which may then be described and dis-aggregated to gain an understanding of the networks as a series of processes within a system.

6.6.3 A Network Model for Small Manufacturing Firms

The key characteristics, typologies, Performance Indicators can now suggest a "resolved" network model arising from the CSN, OSN and questionnaire analysis. Within the Model, four firms are represented, as suggested in the CSN methodology.

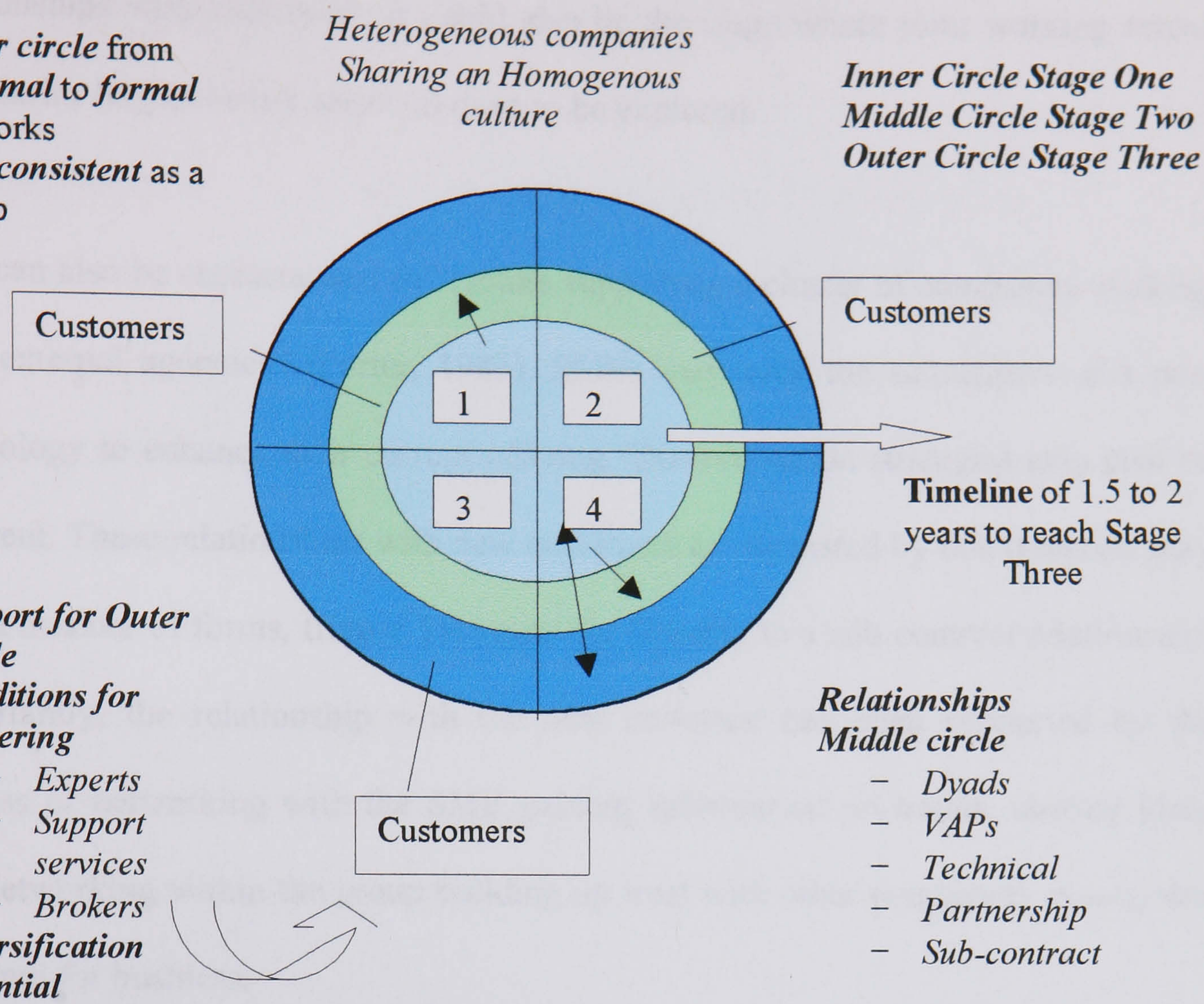


Figure 33: A Process Network Model for manufacturing SMEs

The *Inner Circle* represents **Stage One** of networking. Here small firms establish trust and share ideas with each other, possibly starting in a Thematic network. They will have or aspire to have a common high trend in Performance Indicators and will be heterogeneous as a group in terms of manufacturing activity but share a homogenous culture. The *Middle Circle* of activity, **Stage Two**, then sees these firms engage in more focused networking (like the CSN and OSN) to then share ideas, information, processes and learn from each other. They will have a customer strategy, which supports NPD and will be seeking links with other firms in partnerships to supply their customers. **Stage Three**, represented by the *Outer Circle*, is a further development of this trend in Stage Two whereby specialist support agencies support the firms in more technical or market orientated

relationships with customers. It could also be the stage where joint working across boundaries (regional and national) need to be explored.

This can also be characterised as "factors supporting a cluster of companies working with external agencies" (Porter, 1985). SMEs may seek the acquisition of a new technology to enhance their current offering. Diversification strategies may also be apparent. These relationships with new customers as suggested by this research, may take a number of forms, from a Technical Partnership to a sub contract relationship. Importantly, the relationship with the new customer has been supported by the process of networking with the SME gaining information on trends, sharing ideas and networking within the group building up trust with other companies as a modus operandi for business.

6.7 THE NETWORK MODEL FOR MANUFACTURING SMEs AND COMPARISONS WITH THE LITERATURE ON CURRENT NETWORKING TRENDS

6.7.1 Trends in the supply chain literature

How does this model fit within the current literature on networks and clusters in the higher value added economy of 2002 in which the firms in this research will now compete? Competition is now between companies with customers distributed more widely than ever in terms of location with a move constantly to higher differentiated products to meet ever changing customer need (Lamming et al, 2000, Romano et al, 2000, Bennett and Smith, 2002). Networks need to be able to respond to this new order of global supply and information technology. Furthermore, support for vertically led supply chain networks by public policy organisations can also be said to be problematic. Humphries argues against publicly supported large firm networks "the long term interests of the locality may not always be supported by the protection

of that company" (Humphries, 1996). The model from this research does suggest clear ways for the traditional manufacturer with low experience of partnerships and previous lack of trust in sharing with others to compete in this environment.

In summary, the research shows that local horizontal networking in heterogeneous groups suggests learning can take place with sharing of ideas and practice. This can lead to developing customer strategies within network groups where trust can be established from fragile to resilient which can then lead new business external to the network through dyadic relationships. At the third stage of the model support will be required in terms of "related and supporting industries and factor conditions". (Porter, 1985) to assist the SME.

6.7.2 Trends in the Industrial District literature

Recent research on competitive conditions and competitive advantage for SMEs (Bennett and Smith, 2002) suggest that "there is almost no association between competitive environment … and the location within an area targeted for policy support". Bennett and Smith further state that "business strategy depends more on the firm differentiating itself from its competitors irrespective of its local market conditions". Furthermore, recent research (MacNeill et al, 2001) notes the importance of global markets and the ever - increasing threat of new entrant firms particularly to poorly differentiated local SMEs.

The development of the CSN and the OSN also reflect current thinking on "Communities of Practice", almost border-less organisations independent of local conditions but with characteristics similar to that espoused by the networks researched in Birmingham. These can be typified as People Networks, Knowledge

networks and Technology networks (Por, 1997) where People Networks are "productive conversations facilitated for continually creating" a knowledge network of ideas supported by technology. Thus the networks types found in the region although, not particularly IT aware, do have characteristics of some of the thinking to be found in Communities of Practice literature (Lave and Wenger, 1991, Wenger, 1997, Castells, 1997). This does, therefore, begin to address the issue of globalisation; the Internet and knowledge based enterprises building on the physically located clusters.

This research suggests that small firm networks *can* provide a focus for sharing of ideas and information (Scarborough, et al 1999) which can then be exploited in business relationships external to the network. That is, the network itself is not the competitive entity as a structure but a mechanism for supporting competitiveness in SMEs to then be able to make alliances wherever applicable to their business needs. In this sense it supports the need for SME support strategies to focus on SMEs as *individual entities* in terms of their business strategy rather than to force them into *local associations* to compete as a group. Networking is the underpinning methodology for ideas and information transfer between SMEs and to establish trust rather than business transactions inherently based on suspicion (Perrow, 1992, Sherrie et al, 1997).

The firms can then make individual decisions on strategy and alliances wherever the business case demands most likely at first in the sub-contract tradition of which they are most familiar. More problematic in the West Midlands region is the issue of "virtual clusters" of firms and the development of knowledge based strategies for SMEs to remain competitive. The literature is still under developed in this area

linking with networking and traditional firms (Romano et al, 2000, DTI 2001). The evidence from the research suggests a low take up of ICT generally by the SMEs in the case study groups and from the questionnaire group. There is some optimism in that if SMEs can become more customer orientated through networking the transforming effects of ICT will follow as the business need dictates (Poon and Swatman, 1997, Venkatraman, 1991). However, the pace of change in the external environment may be too fast for some of the firms to keep pace with.

The networking, to reach Stage Three of the proposed model, is not predicated on ICT to any great extent, but to sustain relationships in a dynamic marketplace. This can be through VAPs, Technical Partnerships, through Internet based auction activity or new sector diversification growth sectors, and a higher level of strategic ICT needs to be in place in the SMEs. Networks at stage three, therefore, may be a good environment for support agencies to interact with SMEs to discuss possible strategies to support customer development.

6.7.3 Conclusions on Facilitation in Networks

The research has borne out the initial hypothesis on Facilitation and New product Development and new processes. The Control Group had sporadic facilitation from a range of providers over the two years and did not see local networking as a valuable activity to pursue in practice. The firms espoused the importance of networking, but did not participate in a way to establish trust with other firms to gain benefits of idea exchange, information exchange or learning from each other. The Stage Two Model builds upon good internal processes towards then supporting NPD. The Case Study research and feedback from the Verification Seminar, suggests that firms need to

have a firm and solid basis of internal processes from which to then build external relationships with other firms.

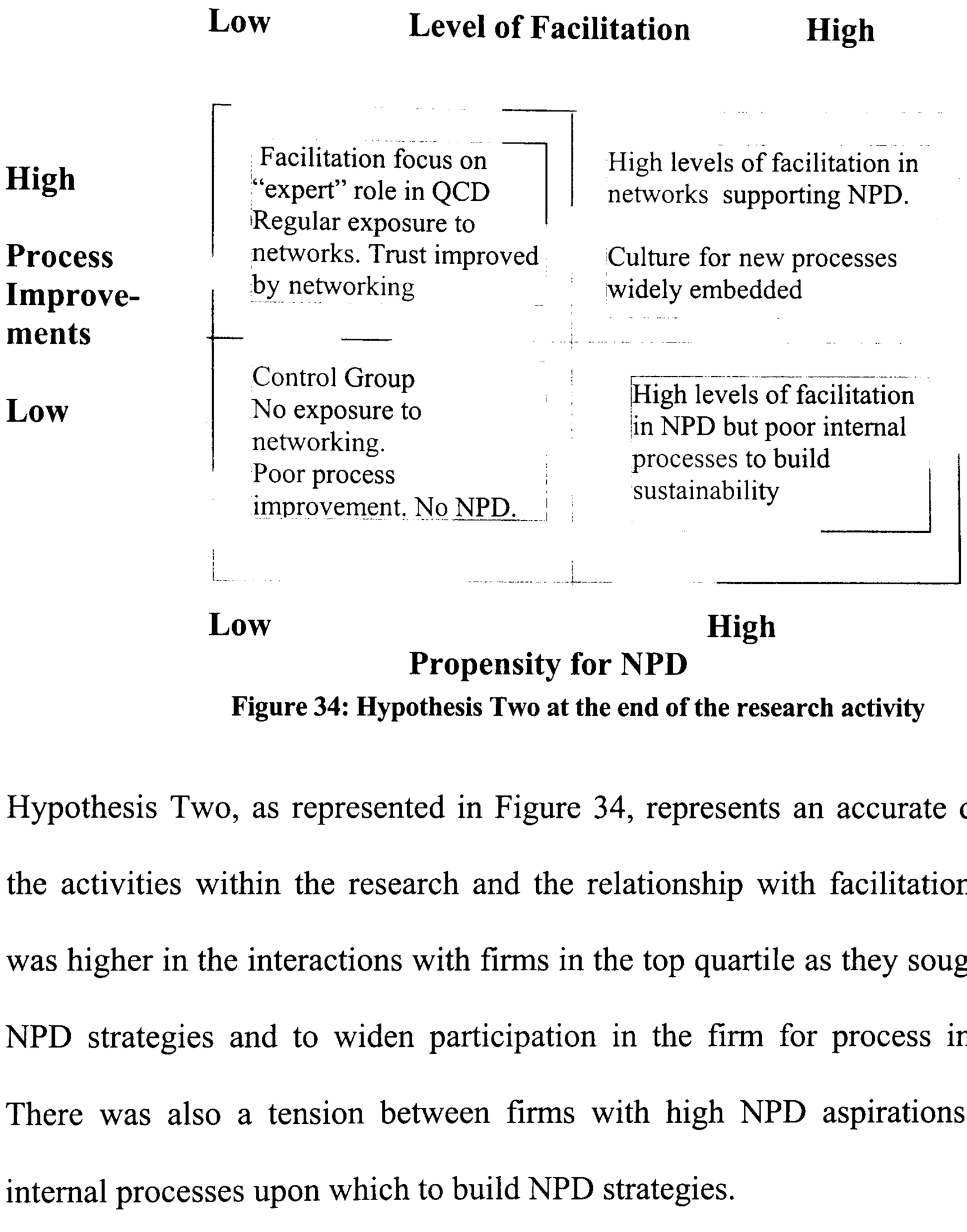


Figure 34: Hypothesis Two at the end of the research activity

Hypothesis Two, as represented in Figure 34, represents an accurate description of the activities within the research and the relationship with facilitation. Facilitation was higher in the interactions with firms in the top quartile as they sought to develop NPD strategies and to widen participation in the firm for process improvements. There was also a tension between firms with high NPD aspirations, but weaker internal processes upon which to build NPD strategies.

Another feature was that facilitation was more intense with the core group of the network as they sought to develop NPD strategies. This was so for both the CSN and the OSN. The CSN has in a network two firms with a higher propensity for change seeking more enhanced external relationships with external agencies. The OSN "core" of four firms has more regular and more intense reaction with the Facilitator than the middle core of companies. The outer core of infrequent sporadic attendees can be characterised as the Control Group. The outer ring, could also reflect the

unfocussed networking firm which does not benefit from more sustained interactions (typified by The Control Group firms and the multiple networking firms from the Postal Questionnaire).

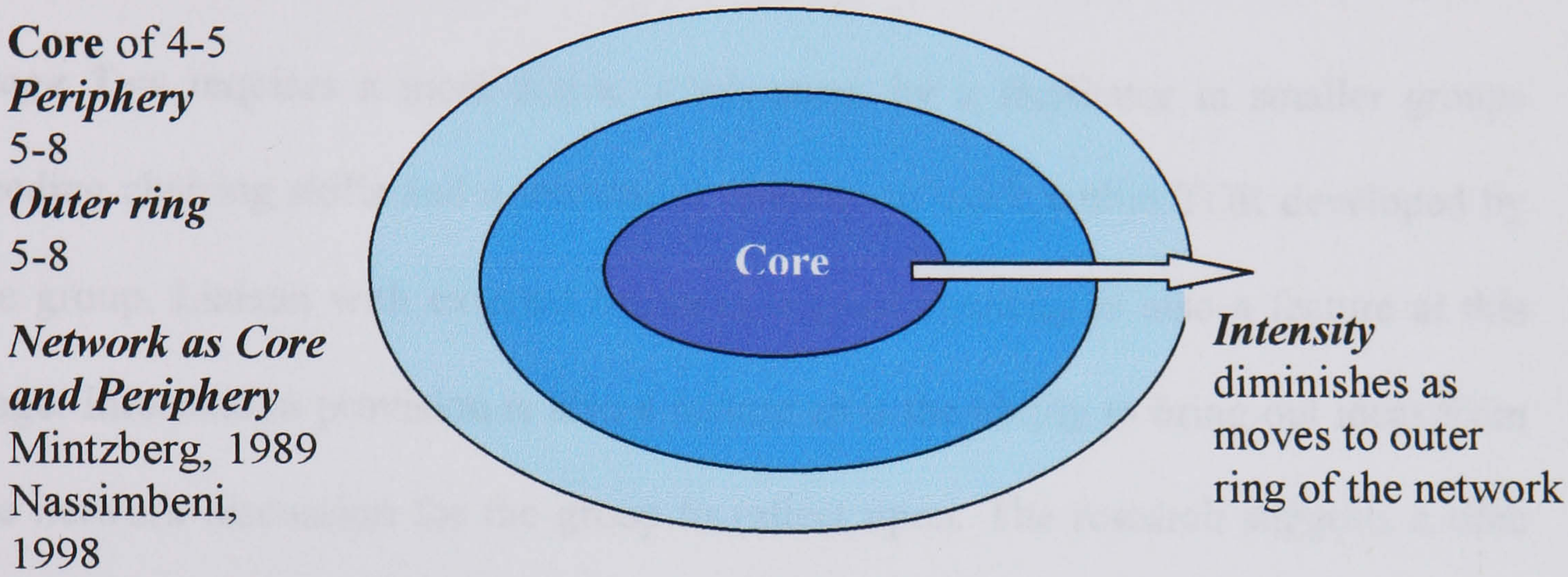


Figure 35: Illustration of intensity of facilitation in an OSN network

The issue of "intensity" of facilitation was in fact superseded by "Style" of facilitation. Facilitation within small firm networks is not given a great deal of coverage in the literature, even less so in the literature on manufacturing supply chains. From the Industrial District Tradition the emphasis is on brokerage roles, both as an individual in a role and as a group of facilitators as found in a Real Service Centre Model and the Danish Technological Institute Model (Chaston, 1995, Ratnatunga, 1997, Nassimbeni, 1998).

This research has shown a number of types of facilitator roles which are needed at various stages in the three-stage model and these are now described. The facilitation in ***Stage One*** consists of "information" giving and "co-ordination" within a wider heterogeneous network possibly based on a theme. This type of network has a social aspect and companies can meet informally, receive presentations on manufacturing issues and attend best practice visits. The companies will have a common trend in

Performance Indicators and will have manufacturing processes in place to sustain developmental activity. (If this is not so, then the network may take longer to become established). The facilitator here co-ordinates a schedule of events and is sensitive to the needs of the SMEs. A transnational element may be present in the form of a best practice visit to a "demonstrator" manufacturing site.

Stage Two requires a more active involvement by a facilitator in smaller groups needing chairing skills and a secretariat function to work within TOR developed by the group. Liaison with external business support agencies is also a feature at this stage. Information provision is also a feature as is the ability to bring out ideas from the network discussion for the group to reflect upon. The research suggests a time frame of between one and two years for the network to have the maturity to move to more developmental activities. Support for others in the company to participate in inter-company teams has been recognised as an additional role through the research. Another facilitator may well undertake this. (Noting the difference in a strategic and operational split between these roles which one facilitator may find hard to combine in one individual).

Stage Three sees these skills augmented by specialist support to individual members to enable exploitation of the ideas and opportunities discussed in the network. These opportunities may take the form of partnerships, which the firms may choose to pursue unaided. Networking involves the facilitator making linkages possible for the SMEs to then pursue as they see fit. A "catalytic" role is needed in all three stages in order to reflect on issues which the network need to address. This is complemented by the key role of facilitating discussion through building empathy with the group and having an understanding of the sector and cultural environment in which they are

situated. (Granoveter, 1985, Schein, 1988, Honey and Munford, 1992,Wenger, 1997).

The notion of a "core" in the network and a "periphery" (can also be seen as single and multiple networking) evidenced from the research also demands that the facilitator addresses changes in motivation within the network and the balance of interests at both ends. Highly pro-active SMEs will demand a different level of support to SMEs, which are more cautious and keeping both in the same network is a skill. Understanding the need for network re-configuration is also important, working within the circle of networking activity to always review progress and to refresh the TOR where necessary (Mowery et al, 1995, Pearn et al, 1995, Harland and Knight, 2001). Evidence for a "broker" role is difficult to establish from this research, that is to specifically support an SME network form, then pursue a new market as a group. This is significant as this role is a key part of the literature from the Industrial District tradition and is not supported by this research. However, other Facilitator Roles have been identified within the three-stage model in support of SME networking.

7.0 CONCLUSIONS AND CONTRIBUTION TO KNOWLEDGE

Networks are seen as a key factor in regional economic development. Globalisation and the shift in supply relationships away from the manufacturing "heartlands" has renewed interest in the impact of networking in support of "clusters" of companies in growth sectors. There is clearly also a need to better understand the local and global aspects involved in manufacturing and the diversification into higher added value products rather than commodity goods as a key policy dimension for SME support.

This study on small firm networks finds that SMEs make local connections within heterogeneous groups to share ideas and information and then develop new processes and products to then exploit externally within partnership or sub-contractual arrangements.

The research has provided a set of characteristics in terms of network composition and network process, which can be constructively applied to specific network situations to support both new process and new product outcomes. It has also identified facilitator roles in this process, which can support the SMEs in their networking journey and provides some answers to how SMEs can compete and remain competitive. The research should, therefore, make a significant contribution to the policy agenda on SME support for small firm networks.

7.1 CONCLUSIONS ON THE RESEARCH HYPOTHESES

The hypotheses were established at the start of the research to test the impact of networking on a small firm's ability to improve processes support a propensity for New Product Development and to assess the impact of facilitation on this process.

Would networks be a factor in supporting the competitiveness of individual firms? The evidence of support for new processes through networks was strong, but the impact on NPD was less clear.

7.1.2 Hypothesis One

The hypothesis set out to test whether "process improvements in manufacturing SMEs can be fostered by participation in network groups". The Case Study firms in the Closed Strategic Network had support for new processes as an objective in the development of cross company teams, common training programmes and visits to each other to share effective practice. The CSN arose from the firms' active involvement in the World Class Network, which had support for new processes as a key part of its activities. The network developed inter-company teams to share practices and ICT know how sharing was a key feature. The Open Social Network was less concerned with new processes from the outset. It is sceptical of "QCD" seeing it as of benefit to customers seeking to utilise new processes to cut costs in the supply chain. Despite the espoused sceptical view of the OSN on QCD, the use of Performance Indicators within the research clearly showed a common trend in performance between Speed/Dependability, Culture/Design and Innovation and Product Mix/Delivery with both networking groups. This suggests a common base line from which networking firms need to start to develop relationships wherein information and ideas can be shared.

From the Postal Questionnaire, a strong association was made with networking supporting new processes with the "Single and Multiple" networking firms. There was also a strong association with network participation and learning from others, sharing ideas, gaining information on trends and benchmarking (both single and

multiple networking firms). The evidence from the Case Studies and the wider survey is complimentary. The hypothesis can therefore, be said to be **proven.**

7.1.3 Hypothesis Two

The second hypothesis is that "levels of facilitation within the network process affect the ability of the SME to implement improvements." The notion of "intensity" of facilitation was seen as an early indicator to measure. The hypothesis on facilitation focussed less, however, on "intensity" and more on "style" of facilitation. These facilitation styles adapted from the literature on consultancy interventions in the context of 1:1 support, proved to be transferable to supporting SMEs in a networking context.

In terms of facilitation, the role of "broker" in terms of facilitating business opportunities for the networks as trading entities was initially envisaged from the literature. This did not transpire from the research. The research in fact established the key role of a "trusted" facilitator supporting the network with specialist support being sourced, to then enable specific outcomes to take place outside of the network. The networks were wary of external and unknown consultants but were entirely happy with external inputs invited by the group to give information and receive feedback on the support offered. Both the CSN and the OSN required consistent support within the roles outlined in Chapter Six (process, information, catalyst and liaison). In this sense the hypothesis is neither proven nor unproven – the issue is appropriateness and style of intervention, rather than intensity. More research needs to be undertaken in respect of gaining a better understanding of these facilitation roles within small firm networking.

7.1.4 Hypothesis Three

This hypothesis stated "participation in networks to foster process developments leads to a propensity in SMEs to New Product Development". This effective combination of characteristics within the typology of Closed Strategic Network and an Open Social Network have contributed to high levels of success in learning from others, sharing ideas and developing a customer strategy which supports NPD and new processes after a period of networking. The firms had common PI's in terms of internal processes and had an effective base line from which to then discuss process issues.

The research with the Cases Study firms reflected a strong desire for them to address NPD issues as trading conditions became more difficult with the impact of globalisation. This includes new entrants to local supply chains from low cost based manufacturers and the fluidity of supply chains in terms of development (higher value added products having a pan – European dimension). The emphasis on NPD consequently became a stronger feature in terms of hypothesis testing as the Directors participating in networks sought answers to future strategic positioning of their companies.

New product support was even more problematic at the start of the research. The hypothesis by stating "NPD" assumed a current situation with SMEs having a defined product capability to further develop. The network members did however, see themselves as product orientated (rather than component orientated) and this seems an important pre–requisite for active and sustained involvement in the two network types described in this research emerging from the hypotheses.

There was a strong association for networks to support sharing ideas, learning from others and for the firms to have a customer strategy supporting NPD. The importance of these factors has been verified in quantitative research with a representative sample of regional manufacturing firms. These factors have then over time, had a transforming effect supporting strong links between customer strategy and partnerships. That is, the participating firms have exhibited a strong correlation between customer strategy and the need to develop partnerships, which was not present at the start of the research.

Also, the research in the Case Studies found that there is a significant association between customer strategy, which supports NPD, and developing links with other firms in partnership to supply their customers. From the Vertical tradition, relationships are made external to the existing customer base through "dyads" which can be seen as either sub-contract or partnership in nature.

From the Industrial District tradition, the move towards a brokerage model is unproven – the firms have not engaged in networking to form business alliances, which then can be organised in a way to support the network as a trading entity. This has proven unhelpful as a methodology. Networking has rather supported exchanges of ideas and information, which then sees the benefits of partnerships outside of the network.

The artificiality of creating networks externally from a policy view point seems clear, the firms must themselves develop their own relationships and it would be fortuitous if these then led to direct trading relationships within the group. The research

suggests that, it is unhelpful to pursue external policy agendas, which seek to proscribe this process.

The development of a three-stage model arising from a cycle of network development with identifiable characteristics can be said to show the link between the Thematic and Horizontal forms to the Closed Strategic Network, **proving the hypothesis.**

7.2 REFLECTIONS ON THE RESEARCH METHODOLOGY

The methodology was specifically designed to enable deeper insights to be made into the workings of SME networks to then establish how networks can support the hypotheses (NPD, new processes and the impact of facilitation). The need to track groups of SMEs longitudinally over a two - year time scale was seen as essential to test out the hypotheses and seek to establish an understanding of the behaviour of the network participants.

The hypotheses reflected the concerns of the SMEs very well, particularly the issue of NPD. This made for active collaboration within the research process, which supported data collection, rapport building for insights with the researcher and a synergy with the research questions and the needs of the participating firm.

The importance of trust was also a key issue. The case study SMEs resented external support and research, which is conducted "on them" and not for them, or with them. The active participation of the researcher in facilitating the changes in the networks, which met the SMEs' objectives, was very important.

The issue of access to the networks was also a key factor in seeking to track the firms over a two-year period. This proved successful because the networks were seen as important by the firms to their individual business success. Access to the Control Group was, as was anticipated, perhaps a little less satisfactory. Access took place but not at a frequency as the networking firms. In this sense "intensity" of facilitation was necessarily "low". Two firms from the Control Group and one firm from the OSN were experiencing extreme challenges to their business and access proved difficult particularly in Year Two.

In terms of methodology, twelve firms proved appropriate as a group. Fewer and the validity of the approach may have been difficult, more and the researcher would need to have spent less time with the existing networks to service a wider number of individual firms and network relationships. This would need a high level of time and intensity of support.

7.2.1 Performance Indicators and Parametric Tests

The development of the Performance Indicators was seen as an important test to assess the SMEs as individual firms and to pinpoint particular issues, which needed to be addressed in the networks. This proved a helpful methodology to adopt, particularly the testing of the firms at three points in the research process. The collection and analysis of data utilising parametric tests at three points in the research was also important in providing verification for the case study results. The use of parametric tests, where the obtaining of a particular ratio by chance is low, proved to be an important underpinning and supportive methodology to the case study analysis.

7.2.2 The Iterative Research Process

In particular, the experience of data collection and analysis from the first questionnaire was critical in determining the type of questions to be administered within the postal questionnaire administered mid-way through year two. Reflections on the research throughout the networking process were an essential element of the methodology and the degree of iteration was a feature supported by the methodology. Lastly, the verification process of presenting the results at key SME related conferences, in publications and through the Verification Seminar; all gave fresh insights into the research and supported its final conclusions.

7.3 CONTRIBUTION TO THE BODY OF KNOWLEDGE

The research has shown that networks can support SMEs in learning from others, in sharing ideas, gaining information on trends in benchmarking and in process improvements. The research should, therefore, make a significant contribution to the policy agenda on SME support for small firm networks.

7.3.1 Network Typology and Classification

Two new network types have been identified from the research to add to the body of knowledge on small firm networks. A ***Closed Strategic Network*** has been identified as a form within the Supply Chain Tradition. This is a closed, horizontal, thematic network of heterogeneous firms within a locality. An ***Open Social Network*** has also been identified as a form within the Industrial District Tradition. The typology is of a horizontal, local, heterogeneous and open network. Additionally, by classifying networks in this way, the research has provided a new set of criteria, which can be

applied across a number of networking contexts to better understand networking forms. These are Horizontal, Vertical and Thematic, Homogenous/Heterogeneous, Open/Closed, Local/Regional and Formal/Informal

7.3.2 Network Characteristics

A set of network characteristics have been identified and then tested. These consist of "Purpose", "Trust", "Compatibility", "Equity" and a continuum along "Entrepreneurial and Collaborative" behaviour. Specific Performance Indicators for networking have also been identified and tested in the research. These consist of Speed and Dependability, Innovation and Culture and Responsiveness and Product Mix. Prior to the research, both the Characteristics and Performance Indicators were incomplete and untested. The research has also identified the facilitation processes in support of these Characteristics and Performance Indicators in support of new processes and NPD.

7.3.3 Development of a Three Phase Model for small firm networking

These Characteristics and Performance Indicators have been drawn out to support a "three phase model" in support of NPD. This starts from a sharing of information and ideas in larger networks, to smaller specific networks and then to the development of partnerships beyond the information and ideas sharing network to developing new business opportunities. Manufacturing firms can develop techniques and ideas in local networks to then exploit beyond a sector or geographical area in support of new products.

This is a new network model, with characteristics and processes which, can also be applied to both the Vertical Supply Chain and Industrial District traditions and

beyond. Guidelines for applying this Model to the development of SME Networks can be seen in Appendix Three.

7.4 THE NEED FOR FURTHER RESEARCH

7.4.1 On-going research into the two network typologies

The definition of purpose to enable the Terms of Reference to develop, is itself an iterative process, a journey. Networking is a dynamic process and would seem to require a re-appraisal of objectives at least every year. The use of the fragile /resilient axis in establishing relationships with SMEs sharing a homogenous culture for sustained networking seems to be a key factor. The issue of compatibility within the networks seems key: heterogeneous product groups seem to work best, but there needs to be more work done with Homogenous SME Groups to further test the SME Model posited here. Equity, levels of involvement, perception of worth and commitment to the group need also to be continuously reviewed.

The nature of the dynamic between entrepreneurship and collaboration and the balance between SME self interest and collaboration to develop capabilities with others also needs more study. Specifically, research is now needed into the nature of partnership arrangements arising from networking and the implications for the SME. There is a particular need to examine the effectiveness of the model and characteristics in support of networking for SMEs seeking to move from "commodity" manufacturing to New Product Development strategies.

7.4.2 The potential for transferring the Model to other small firm contexts

The possibility to address other manufacturing networks using the typologies and characteristics is an area, which needs more research. This could be within the region in terms of manufacturing networks and other types of sector groups as well as beyond the region in similar sets of conditions. The "beyond region" transfer and testing of the hypotheses may be particularly useful in situations where the Vertical Supply Chain Model is undergoing change and re-focus and in Industrial District situations where SMEs are seeking to re-position into higher value added product areas.

The transfer of know how within and between networking companies is also of interest. The research notes the importance of the transfer within companies following the initial deliberations of the Directors at the network meetings. There needs to be more work undertaken to establish the needs of key employees within SMEs relating to their network participation in the networks identified within the research.

7.4.3 The impact of networking to support ICT development within manufacturing SMEs

The importance of ICT adoption to SMEs is critical in terms of both internal efficiency and external business development. Stage Three of the model suggests a key role for intermediaries in supporting individual SMEs in appropriate use of ICT to support their strategy. There would, from the research be an appropriate role for networks to provide a dissemination/information role to focus on both opportunities and threats posed by ICT to SMEs.

SMEs at Stage Three of the Model may need support for experiments within and between companies to test out ICT applications. Presently from the research there is little indication of a desire to use the Internet as a way to discuss and share ideas between network members. There are some indications that SME customer links with ICT are seen as more useful, particularly underpinning partnership arrangements with customers. The general trends in ICT adoption within the SMEs also supports the research findings, discussion within the network followed by exploitation outside on a 1:1 basis then reflection on activities within the network.

7.4.4 Facilitation roles in support of SME networking

More research is needed in the field of SME networking, particularly relating to manufacturing SME networks and the development of partnership or "dyadic" relationships arising from horizontal networking. Additionally, research into facilitation methodologies within these manufacturing firms in partnerships is needed. However, the key need is to better understand the dynamic in the low take-up of ICT, which is increasingly important in all three hypotheses. For new processes and the effective transfer of data within supply relationships, for NPD and the use of ICT for design and access to new markets and for SME facilitation and the development of discursive methods and techniques to connect SMEs to information, ideas and support structures. A Networking Guide for facilitators is planned as an outcome from this research to underpin both the characteristics and the Model to enable more effective support of SMEs from business support organisations and Higher Education establishments in particular. An outline of this is shown as Appendix Three.

REFERENCES

Advantage West Midlands, (1999) *Regional Economic Strategy*: AWM, Birmingham www.advantagewm.co.uk (accessed 13/4/02).

Advantage West Midlands, (2001) *Agenda for action*: AWM Birmingham.

Advantage West Midlands, (2002) *The e-Business Strategy of the West Midlands:* AWM , Birmingham.

Ahuja, G., (2000) *The duality of collaborative inducements and opportunities in the formation of inter firm linkages*: Strategic Management Journal Vol. 21 no. 10-11.

Aldo, R., Passiante, G and Elia, V., (2000) *New sources of clustering in the digital economy*: Journal of Small Business and Enterprise Development, Vol. 8, No. 1.

Al-Harbi, A.C. and Kamal, M., (2001) *Application of the AHP in project management*: International Journal of Project Management. Vol.19.

Andrieux, T and Kay J.M., (1997) *Manufacturing change in UK automotive companies: Drivers and constraints*, Third International Symposium on Logistics, University of Padua, Italy.

Appiah-Adu, K. and Singh, S., (1998) *Customer orientation and performance: a study of SMEs*: Management Decision: Vol.36, No 6.

Arias, J.T.G., (1995) *Do networks really foster innovation*? Management Decision, Vol.33, Issue 9.

Argyris, C., and Schon, D., (1996) *Organizational learning Vol. 2:*Addison Wesley, New York.

Auster, E.R., (1994) *Macro and strategic perspectives on inter organisational linkages : A comparative analysis and review with suggestions for reorientation*: Advances in Strategic Management, Vol. 10 B, 1994.

Bagnasco, A. and Sabel, C.F., (1995), *Small and Medium Enterprises*: St Martin's Press, New York.

Bennett, R.J. and Smith, C., (2002) *Competitive conditions, competitive advantage and the location of SMEs*: Journal of Small Business and Enterprise Development, Vol. 9., Number 1.

Birchall, D. and Lyons, L., (1995) *Creating Tomorrows Organisations*: Pitman, London.

Birmingham Economic Information Service (2001) *Birmingham Economic Review 2001*: Birmingham City Council. www.birminghameconomy.org.uk. Accessed 13/4/02.

Borch, D.J and Arthur, M.B., (1995) *Strategic networks among small firms, implications for strategy research methodology:* Journal of Management Studies. Vol.32. No. 4 July.

Brusco, S., (1990) *The idea of the industrial district: its genesis:* in Pyke et al Industrial Districts and inter-firm co-operation in Italy. International Institute for Labour Studies, Geneva, 1997.

Burns, N., (1996) *The Significance of Small Firms*: in Burns, N. and Dewhurst, J., *Small Business and Entrepreneurship*, 2nd Edition, Macmillan Press, London.

Carrie, A., (1999) *Integrated clusters – the future basis of competition*: International Journal of Agile Management Systems, Vol.1, Number 1.

Castells, M., (1997) *The rise of the network society*: Blackwell, London.

Cegile, G and Dini, M., (1999) *SME Cluster and Network Development in Developing Countries:* The Experience of UNIDO, International conference on Building a Modern and Effective Development Service industry for Small Enterprises, Rio de Janeiro, 2-5 March, 1999.
http://www.unido.org/userfiles/PuffK/PSD_TWP2.pdf

Chaston, I., (1995) *The Danish Technological Institute SME sector networking model implementing broker competences*: Journal of European Training, Vol.19.Issue1.

Chetty and Sylvie., (1996) *The case study method for research in small and medium sized firms*: International Small Business Journal, Oct - Dec Issue.

Chiesa, V. Coughlan, P. and Voss, C.A., (1996) *The Development of a Technical Innovation Audit:* Journal of Product Innovation Management, No 13 pp105-136.

Clark and Fujimoto., (1991) *Functionally organised product development performance:* Boston, Harvard University Press.

Clark, K.B. and Wheelwright, S.C., (1992) *Revolutionizing Product Development*: New York, Free Press.

CORDIS: *SME Specific Measures*: http://www.cordis.lu/sme/home.html (Accessed on 14/4/02).

Cox, A., (1997) *Business Success: A Way of Thinking about Strategy, Critical Supply Chain Assets and Operational Best Practice:* Earlsgate Press, Boston, UK.

Clarysse, B., Uytterhaegen, M.and Van Dierdonck, R., (1998) *Inside the Black Box of Innovation: Strategic differences between SMEs*: Conference Proceedings on Technology Transfer in Small Firms, Commonwealth Institute, The Teaching Company Directorate, UK.

Coolican, H., and (1996) *Introduction to research methods and statistics in psychology*: Hodder and Stoughton, London.

Curran, J., and Blackburn, R., (1995) *Small firms and local economic networks*: Paul Chapman, London.

Curran, J, Blackburn, R and Kitching, J., (1995) *Small business networking and networks: a literature review, policy survey and research agenda*: Small Business Research Centre Kingston University.

Curran, J., Blackburn, R., et al., (1996) *Small Firms and Workforce Training:* Kingston University. Proceedings of the 19th ISBA Conference, Birmingham.

DTI, (1998) *Supporting the Knowledge Driven Economy*: White Paper on Competitiveness, DTI, London.

DTI, (1999) *Competitiveness - our partnership with business UK*. DTI, London.

DTI, (2001) *Business clusters in the UK, a first assessment*: DTI, London URN 01/573.

DTI – Automotive Directorate, (2001) *Statistics on vehicle production*: www.autoindustry.co.uk (accessed 14/3/02) Birmingham.

Dean, J., Holmes, S. and Smith, S (1997) *Understanding business networks, evidence from the manufacturing and service sectors in Australia*: Journal of Small Business management, Jan 1997, Vol. 35. No.1.

Deloitte and Touche, BCT Ltd., (2001) *The Accelerate Report*: Chamber House, Birmingham.

De Toni, A., Nassimbeni, G., (1995) *Supply networks, genesis, stability and logistics implications: A comparative analysis of two districts*: Omega, Vol. 23 pp.403.

Deshpande, R., Farley, J. and Webster, F., (1997) *Corporate Culture; Customer Orientation and Innovativeness in Japanese Firms; A Quadrant Analysis:* Journal of Marketing, Vol. 57, 1997, pp 23-37.

Dickson, K.E and Hadjimanolis, A., (1998) *Innovation and Networking amongst small manufacturing firms in Cyprus*: International Journal of Entrepreneurial Behaviour and Research, Vol. 4, No. 1.

Dixon, N.M., (2000) *Common Knowledge: how companies thrive by sharing what they know*: Harvard Business School Press, Boston, Massachusetts, USA.

Dore, R., (1983) *Goodwill and the Spirit of Market Capitalism*: *British Journal of Sociology No. 34, pp459.*

Dromgoole, T, Gorman, L, Delany, E and Coughlan, P, (2001) *An Action Learning Network of MNC Subsidiaries:* In: What *Really* Matters in Operations Management, Papers from the European Operation Management Association, 8th Annual Conference, Bath (UK), June 3-5, 2001 (Volume 1).

Drucker, P., (1999) *Innovation and Entrepreneurship*: London, Butterworth-Heinemann.

Dyer, J.H., (1996) *Specialised Supplier Networks as a Source of Competitive Advantage: Evidence from the Automotive Industry*: Strategic Management Journal, Vol.17, No 4, pp271-291.

Eisenhardt, K.M., (1989) *Building theories from case study research*: Academy of Management Review, Vol. 14. No. 4.

Era (2000) *21st Century Regions*: The Mezzanine, Elizabeth House, London.

European Commission, (1997) *Green Paper on Innovation*: European Commission, Brussels.

Fan, I-S., (1997) *Concurrent Engineering in aerospace extended enterprises:* Proceedings of the 4th International Conference on Concurrent Enterprising, ICE '97, The University of Nottingham, UK.

Finegold., D, in Hendry et al (2001): *Creating self sustaining , high skill ecosystems* : Oxford Review of Economic Policy Vol. 15, No.1 1999, pp. 60-81.

Fisher, M.L., (1997) *What is the right Supply Chain for your Product? Harvard Business Review: Vol. 75.*

Fombrun, C.J. (1982) *Strategies for network research in organisations*: Academy of Management Review Vol. 7. No. 2.

Fuchs P.H., (2000) *Strategic Integration Competing in the age of Capabilities*: California Management Review Vol. 42 No 3, Spring.

Fujimoto, T,. (1997) *The Japanese Automobile Supplier System Framework, Facts and Reinterpretation:* Keynote Lecture 3rd International Symposium on Logistics, Padua, pp3-50.

Gibb, A,. (1997) *Small Firms Training and Competitiveness, Building on the Small Business as a Learning Organisation*: International Small Business Journal Vol. 15, Issue 3, April/June 1997 pp 13-29.

Ghosh, B.C., Liang, T. W., Meng T. T, and Chan, B., (2001) *The key success factors, distinctive capabilities, and strategic thrusts of top SMEs in Singapore*: Journal of Business Research, Vol. 51.

Giordano, L, (1992) *Beyond Taylorism, computerisation and the new industrial relations*: Macmillan Press, Basingstoke.

Granoveter, M., (1985) *Economic action and social structure, the problem of embededness*: American Journal of Sociology, Vol. 91.

Green and d'Oliveria., (1982) *Learning to use statistical tests in psychology: a student guide*: OU Press Milton Keynes.

Gundlach, G.T., (1993) *Ethical and Legal foundations of Relational Marketing Exchanges*: Journal of Marketing, Vol.57, No. 4.

Gummeson, E., (1988) *Qualitative Methods in Management Research*: London, Chartwell.

Gundlach,G.T., (1993) *Ethical and legal foundations of relational marketing exchanges*: Journal of Marketing, Vol 57. No. 4.

Harding, S.J., (1996) *Coaching for managers in SMEs:* Proceedings of the 19th ISBA Conference, Birmingham.

Harding, S.J. and Pawar, K.S., (2001) *Know -how share and transfer in SME networks: a contingent approach*: Pending Publication.

Harland, C.M. and Knight, L.A., (2001) *Supply network strategy – role and competency requirements*: International Journal of Operations and Production Management. Vol. 21., No. 4 Chap 6 facilitation.

Hawkins, R. and Prencipe, A. (2000) *Business to business e-commerce in the UK , a synthesis of sector reports by the DTI:* UK Business On-Line, www.ukonline.gov.uk. Accessed 14/4/02.

Hendry, C, Brown, J., Ganter H-D and Hillard, S., (2001) *Industry Clusters as a location for technology transfer and innovation*: Journal of Industry and HE.

Hill, T., (1993) *Manufacturing Strategy*: Macmillan, London.

Hines, P., (1994) *Creating World Class Suppliers*: unlocking mutual competitive advantage. Pitman, London.

Hines, P and Rich, N., (1998) *Outsourcing competitive advantage: the use of supplier associations*: International Journal of Physical Distribution & Logistics Management, Vol. 28, No. 7.

Hines, P.A, Lamming, R.C., Jones D.T., Cousins, P.D., Rich, N., (2000) *Value stream management*: Financial Times, Prentice Hall, London.

Honey, P. and Munford., (1992) in Cockman et al: *Client Centred Consulting*: New York, McGraw Hill.

Hogan, J., (1996) *The Best Practice Network*: Proceedings of the *1996 ISBA* Conference, Birmingham.

Huggins, R., (2000) *The success and failure of policy implanted inter firm network initiatives: motivations, processes and structure:* Entrepreneurship and Regional Development, No12.

Humphries, C., (1996) *The territorialisation of public policies: the role of public governance and funding. Networks of Enterprises and Local Development*: OECD, 1996, 239 – 254.

ISO (2002) www.iso.org Accessed 15/4/02

Inzerilli, G., (1990) *The Italian Alternative: flexible organisations and social management:* International Studies of Management and Organisation, Vol. 20 1990/91.

Jarillo, J.C., (1988) *On strategic networks*: Strategic Management Journal, Vol.19.

Johnston, E and Lawrence, P.R., (1988) *Value Added Partnerships*: Harvard Business Review Vol. 66, No 4 pp 94 – 101.

KPMG, (1998) *The West Midlands Automotive supply chain, development study*: Birmingham and Solihull TEC, KPMG and WMDA.

Keeble, D. and Wilkinson, F., (1999) *Collective learning and knowledge development in the evolution of regional clusters of high technology SMEs in Europe*: Special edition *Regional Studies,* Cambridge.

Kelleher, M., Van Heijst, G., Kruizinga, E., Haldane, A. and Van Der Wal, C., (2001) *KALIF, To share is to multiply*: CIIT/Learning Futures, Utrecht The Netherlands and Abersychan, UK.

Kidd, P., (1994) *Agile manufacturing – forging new frontiers*: Addison Wesley, Reading, M.A.

Kolb, D.A., (1984) *Experiential Learning*: New Jersey, Prentice Hall.

Kotler, P., Armstrong, G., Saunders, J. and Wong,V., (1999) Principles *of Marketing*: Second European Edition, Prentice Hall, Europe.

Lamming,R.C., (1993) *Beyond partnerships: Strategies for Innovation and Lean Supply* : Prentice Hall.

Lamming, R.C., (1994) *A review of the relationships between vehicle manufacturers and suppliers*: London, DTI, S.M.M.T.

Lamming, R.C., Johnsen, T., Zheng, J and Harland, C., (2000) *An initial classification of supply networks* : International Journal of Operations and Production Management. Vol. 20 No.6.

Larson, A., (1992) *Network dyads in entrepreneurial settings. A study of the governance of exchange relationships*: Administrative Science Quarterly. Pp.76 – 104.

Lave, J and Wenger, E., (1991) *Situated learning: legitimate peripheral participation*: Cambridge University Press.

Lorenzoni, G. and Baden-Fuller, C., (1995) *Creating a strategic centre to manage a web of partners*: California Management Review 1995, Vol. 37, No. 3.

Lucas, E., (2000) *Creating a give and take culture*: Professional Manager Vol. 9., Issue 3, pp11-13.

MacNeill, S., Srbljanin, A. and Bentley, G., (2001) *Developments in the Automotive Industry, 2000 - 2015: University of Birmingham*, Centre for Urban and Regional Studies.

McDonald, F and Vertova, G., (2001) *Geographical concentration and competitiveness in the EU*: European Business Review, Vol.13, No. 3.

McIvor, R.T., Humphreys, P.K, McAleer., (1998) *European car makers and their suppliers changes at the interface* : European Business Review, Vol. 98, Issue 2.

Midlands Excellence Awards (2001) *Conditions and rationale*: www.midlandsexcellence.org.uk.

Mitra, J. and Formica, P., (1997) *Innovation and Economic Development - University-Enterprise partnerships in action*: Dublin, Oak Tree Press.

Mezgar and Kovacs, I., (1999) *PLENT: A European Project on SME Co-operation*: Human Systems Management, Vol 18, No 3.

Miles, R.E. and Snow, C.C., (1982) *Causes of failure in network organisations*: Academy of Management Review. Vol.7, No 2 pp 280 – 291.

Mintzberg, H., (1989) *Mintzberg on Management*: London, Macmillan.

Morgan, G.A., Griego, O.V., Gloeckner., G.W. and Mahwah, N.J., (2000) *SPSS for Windows – an introduction to use and interpretations in research*: London, Lawrence Erlbaum Assocs.

Mowery, D.C., Oxley, J.E. and Silverman, B.S., (1996), *Strategic alliances and inter-firm knowledge transfer:* Strategic Management Journal, Vol. 17. pp 77-91.

Mumford, A., (1995) *Learning in Action*: Industrial and Commercial training, Vol. 27, No 8.

Nassimbeni, G., (1998) *Network structures and co-ordination mechanisms –A taxonomy*: International Journal of Operations and Production Management, Vol.18 Issue6.

New, S. and Metropoulous, I., (1995) *Strategic networks, morphology, epistemology and praxis:* International Journal of Operations and Production Management. Vol.13 issue 11.

Nonaka, I., (1991) *The knowledge creating company*: Harvard Business Review, December.

OECD - Organisation for Economic Co-operation and Development – (2000) *Enhancing the competitiveness of SMEs in the global economy: Strategies and Policies;* Workshop 1 – *Enhancing the competitiveness of SMEs through networks:* In: Conference for Ministers responsible for SMEs and Industry Ministers, Bologna,

Italy,14-15June,2000.
http://www.oecd.org/dsti/sti/industry/smes/act/Bologna/ws1.pdf.. (Accessed on 15/08/2001).

Ohno, T., (1988) *Toyota Production System: Beyond large scale production*: Productivity Press, Cambridge MA.

Oliver, N. & Wilson, B., (1992) *The Japanisation of British Industry, New Developments in the 1990':* Oxford, Blackwell.

Oliver, N., Jones D.T., et al., (1994): *Worldwide manufacturing Competitiveness Study: The Second Lean Enterprise Report*: Andersen Consulting, London.

Oughton, C. and De Poris, L., (1997) *The West Midlands Regional Innovation Strategy (RIS) – Preliminary analysis of survey firms:* AWM and University of Birmingham.

Pandza, K., Fulder,T and Polajnar, A., (2001) *Developing capabilities in networks and chains. Conference Proceedings*: What really matters in Operations Management. Euroma 2001, University of Bath, UK.

Pearn, M., Roderick, C. and Mulrooney, C., (1995) *Learning Organisations in practice*: McGraw Hill, London.

Perrow, C. (1992) *Small firm networks*: in *networks and organisations, structure form and action*: Nohria, N., and Eccles, R.G .eds. Harvard Business School Press. pp 445 – 470.

Piore, M.J., and Sabel, C.F., (1984) *The Second Industrial Divide: Possibilities for Prosperity*: Basic Books, New York.

Poon, S. and Swatman P. M. C., (1997) *Small business use of the internet, findings from Australian case studies:* International marketing Review, vol. 11, issue 5.

Porter, M., (1985) *Competitive Advantage, Creating and Sustaining Superior performance:* Free press, New York.

Post, G., Hop L. and Van Aken, J.E., (2001) *Indicators for Establishing SME product development networks*: Journal of Scientific and Industrial Research, Vol. 60, No 3, 2001.

Por, G., (1997) *Designing knowledge ecosystems for communities of practice*: Paper presented at the Conference for Advancing Organisational Capability via Knowledge Management, Los Angeles, September 1997. www.knowledgeecology.com

Prahalad, C.L, and Hamel, G., (1990) *The core competences of the corporation*: Harvard Business Review, Vol. 90, No. 3 79 – 91.

Ragatz, G & Handfield, R & Scannell, T., (1997*) Success factors for integrating suppliers into new product development*: Journal of Product Innovation Management 14, pp190-202.

Ratnatunga, S., Garrett, A., Hastie, P., Raymond, P. and Ward, A., (1997) *Cluster Strategy in North Tyneside, The Real Service Centre*: Howard House, North Shields, Tyne and Wear. www.tag.co.uk/ntyne.

Ring, P.S., (1997) *Processes facilitating reliance on trust in inter-firm networks, in the formation of inter-organisational networks*: in M.Ebers ed. Oxford University Press, Oxford.

Robertson, M., Swan, J., and Newell, S., (1996) *The role of networks in the diffusion of technological innovation*: Journal of Management Studies, May, pp.35.

Rogers, R.E and McIntire, R.H., (1983) *Organisations and management theory*. John Wiley and Sons.

Romano, A., Passiante, G. and Elia, V., (2000) *New sources of clustering in the digital economy*: Journal of Small Business and Enterprise Development, Volume 8, No.1.

Rosenfeld. S. A., (1996) *Does co-operation enhance competitiveness? Assessing the impact of inter-firm collaboration:* Research Policy 25, issue 2. Pp. 247-263.

Rothwell, R. and Zegveld, W., (1982) *Innovation in the small and medium sized firm.*

Rothwell, R., (1992) *Successful Industrial innovation: critical factors in the 1990's*: R&D Management Vol.22 Issue 3, July. Pp. 221-239.

Sandras, W A., (1989) *Just -In -Time, making it happen*: Oliver Wight Publications.

Scarborough, H & Swan, J and Preston, P., (1999) *Knowledge management: A literature review: Issues in people management*. London: Institute of Personal Development.

Schein, E., (1988) *Process Consultancy, Volumes One and Two*: Addison Wesley, London.

Scherer, F.M., (1986*)* *Innovation and Growth, Schumpeterian Perspectives:* Cambridge Mass., MIT Press.

Schon, D., (1984) *Educating the reflective practitioner*: London, Josey Bass.

Schonberger., (1991) *Building a chain of customers linking business functions to create the World Class Company: Free* Press New York.

Semlinger, K., (1995) *Industrial policy and small-firm co-operation in Baden-Wurttemberg*: in Bagnasco and Sabel, *Small and Medium Enterprises*: New York, St Martin's Press.

Senge, P.M., (1990) *The Fifth Discipline: The art and practice of the Learning Organisation*: New York, Doubleday.

Sharp, J.M., Bolton, S., and Williams, A., (1997) *Achieving new product success in SMEs:* Proceedings of IMC 14, pp 387-373. Research Institute for Design, Manufacture and Marketing, University of Salford.

Sherrie. E., Human, K. and Provan, G., (1997) *An emergent theory of structure and outcomes in small firm strategic manufacturing networks:* Academy of Management Journal, Mississippi State Press.

Slack, N., Chambers, S., Harland, C., Harrison, A. and Johnston, R., (1995) *Operations Management*: Pitman Publishing, London.

Storey, J. (1994) *New Wave Manufacturing Strategies*: Paul Chapman, London.

Storey, D.J., (1994) *Understanding the small business sector*: Routledge, London.

Thomas, R.J., (1993) N*ew Product Development: managing and forecasting for strategic success*: The Portable MBA Series, John Wiley & Sons, Inc.

Triglia, C., (1995) *A tale of two districts: work and politics in the Third Italy*: In Bagnasco, A. and Sabel, C.F.,(1995), *Small and Medium Enterprises*: St Martin's Press, New York.

Twiss, B., (1995) *Managing Technological Innovation*: Fourth edition, Pitman, London.

Tidd, J. Bessant, J and Pavitt, K., (1997), *Managing Innovation*: Wiley, London.

Venkatraman, N., (1991) *IT-Induced Business Reconfiguration*: in Scott Morton M (Ed) The Corporation of the future, MIT press, Cambridge, Mass, USA.

Wasti, S.N and Liker, J.K., (1997) *Risky business or competitive power supplier involvement in Japanese product design:* Journal of Product Innovation management, Vol. 14, no.5 pp.337 – 355.

Wenger, J., (1998) *Communities of Practice: Learning, meaning and identity: Cambridge* University Press, Cambridge.

West Midlands Learning and Skills (2000), Creating advantage through learning and skills, LSC, Birmingham.

Willax, P., (1999) *Ideas abound for starting a new business*: Long Island Business News, Aug-Sept.

Williamson, O. E., (1991) *Comparative economic organisation: the analysis of discrete structural alternatives*: Administrative Science Quarterly, Vol. 36.

Winfield, I and Hay, A (1997) Toyota's supply chain: changing employee relations. Employee Relations, Vol. 19. No. 5.

Womack, J.P., Jones, D.T. and Roos, D., (1990) *The Machine that changed the World :* Rawson Assocs. New York.

Yin, R.K., (1994) *Case Study research design and methods*: Sage Second edition, London.

Zeitlin, J (1995) *Why are there no industrial districts in the United Kingdom?* In Bannasco A. and Sabel , C.F., *Small and Medium Enterprises:* St Martin's Press, New York.

Zeffane. R., (1997) *Inter organisational alliance and networking dynamics, processes and technology*:. Leadership and Organisation Development Journal, Vol.15., Issue 7.

Zipkin, P., (1991) *Does manufacturing need a JIT revolution?* Harvard Business Review, Jan-Feb pp 40- 52.

APPENDICES

APPENDIX ONE – NETWORK QUESTIONNAIRE, CASE STUDY FIRMS

QUESTIONNAIRE
NETWORKS AND SMALL FIRMS

THE UNIVERSITY OF NOTTINGHAM AND THE UNIVERSITY OF CENTRAL ENGLAND

GENERAL INFORMATION

Company Name

tel no

Fax

E-mail

Web

Address

Main business activity carried out on this site _____

Please state number of full time employees ☐

What was the total annual sales turnover of the company last year? ☐

What % was export? ☐

What is your anticipated percentage turnover in growth this year? ☐

1 SPEED

These questions refer to your current "average" performance. Please put a circle around the figure which best relates to your company now.

1.1Order to despatch time

1	2	3	4	5
Unacceptable		satisfactory	totally acceptable	

1.2 Efficiency of planning processes

1	2	3	4	5
weak		satisfactory		excellent

1.3 Efficiency of scheduling

1	2	3	4	5
weak		satisfactory		excellent

Number of Stock turns per annum State ☐

2 DEPENDABILITY

2.1 We are able to satisfy our customer schedule

50% or less	50-60%	60-70%	70-80%	80%+

2.2 Average downtime on machines and equipment (availability/readiness not capacity)

As a % of hours per working week

More than 20%	15-20	10-15	5-10	Less than 5

2.3 Number of orders delivered late

More than 30% 25-30% 15-20% 10-15% Less than10%

2.4 "The company feels that planned maintenance is important to anticipate the need for repairs"

1 2 3 4 5

Disagree Strongly Agree Strongly

2.5 How well do you carry out planned maintenance?

1 2 3 4 5

Poorly Very well

2.6 "Investment in new plant and equipment is an important element of this company's strategy"

1 2 3 4 5

Disagree Strongly Agree Strongly

3 RESPONSIVENESS to Customers

There are three aspects to this in the Questionnaire; *responsiveness in innovation and design, responsiveness in product mix and responsiveness in timing of supply.*

3.1Responsiveness in Innovation and Design

We have a clear customer strategy which supports new product development

1 2 3 4 5

Disagree Strongly Agree Strongly

3.2 "Product portfolio - we measure the relative position of our products in terms of lifecycle"

Never	sometimes	bi-annually	annually	monthly

3.3 "The ability to support the customer's design process is important to us"

1	2	3	4	5
Low				High

3.4 "I think it important to move towards systems supply and not solely component manufacture"

1	2	3	4	5
Disagree				Agree strongly

3.5 "We have many links with other firms in partnerships to supply our customers"

1	2	3	4	5
Low				High

3.6 "Links with external design/CAD systems are important in our design process"

1	2	3	4	5
Low				High

RESPONSIVENESS - Product Mix

3.7 We have a clear customer strategy which supports product mix

1	2	3	4	5
Disagree strongly				Agree

3.8 Tool changeover times, % time lost?

More than 15%	10-15%	5-10%	less than 5%

3.9 "Benchmarking is important for us to establish the range of products offered by our competitors"

1	2	3	4	5

Disagree strongly Agree strongly

RESPONSIVENESS Volume and/or delivery

3.10 How well do you respond to customer requirements?

1 2 3 4 5

Poorly Extremely well

3.11 We have systems to support "rush orders"

Within the schedule Use now Future

3.12 State percentage of your customer communication through the following technologies (total = 100%)

Facsimile

Telephone

Post

E-mail

EDI

ISDN

Internet

Extranet

3.13 How effective are your systems in dealing with the need for variations in demand ?

1 2 3 4 5

Poor Excellent

3.14 We have effective systems in place to vary our capacity at short notice

1 2 3 4 5

Disagree Strongly Agree strongly

3.15 What is your spare capacity in the machines in the company?

10% 15% 20% 30% 35%

At what point do you need to sub-contract?

Please state policy

4 QUALITY

4.1 The company has an effective quality system which meets customer requirements

1 2 3 4 5

Disagree Strongly Agree

4.2 The company deals with quality problems

1 2 3 4 5

Poorly Extremely Well

4.2 Customers feel our Current systems are effective

1 2 3 4 5

Disagree strongly Agree Strongly

4.3 On average, the company can design and produce products to meet the customer's specification

1 2 3 4 5

Disagree Strongly Agree Strongly

5 COST

5.1 What is your Gross Profit? (Difference between sale price and bought in materials before overheads)

Less than 20% 20-25 25-35 35-45 45+

5.2 Profit measured against average benchmark of your sector

1 2 3 4 5

Compares poorly Compares extremely well

6 COMMUNICATION, EDUCATION AND TRAINING

6.1 The company has a training plan to meet

its needs now future

6.2 "It's OK to question a manager in this company if something isn't happening"

1 2 3 4 5

Disagree Agree

6.3 "Networking should only be done by the MD"

1 2 3 4 5

Disagree Agree

6.4 Ideas from the shop floor are accepted and implemented

1 2 3 4 5

Disagree Agree

6.5 People here are adaptable to change

1 2 3 4 5

Disagree Strongly Agree strongly

6.6 New ideas are implemented here

1 2 3 4 5

Hardly ever Always

6.7 People are moved around within the workplace

1 2 3 4 5

Not at all Frequently

7 NETWORKING

7.1 How do you think Networking will help you?

Rank in order of importance (1= low, 5 = high)

Learn from others
Get new sales contacts
Benchmark against other companies
Help pick up trends
Help in training
Share ideas
Help in improving processes
Help in improving new products
Collaborate with other firms
Get access to funding opportunities

APPENDIX TWO- VIEWS OF SMEs INVOLVED IN NETWORKING

Introduction

The purpose of this Appendix on the network results is to draw together the results and contextualise them in the development of six of the firms. This allows for the voice of the individual Managing Director to be represented supporting the results of the network development and the development of the individual firms within these networking arrangements. The reader can therefore, sample representative views whilst reading from the main body of the text.

CSN 1

The MD of CSN is in some ways a paradox, he needs to develop new relationships to replace automotive customers, but can be closed in his thinking and exclude potential connections, as will be illustrated. At the start of the research period CSN1 were grounded in a process tradition. The performance Indicator results shows their high performance in terms of "Speed and Dependability", although they are in the mid - range of scores for "Innovation/Design and Culture". They had participated in many of the key initiatives to improve processes and quality supported by the regional "Accelerate" Programme, including the World Class Network, Society of Motor Manufacturer and Traders improvement "master classes" and a range of UCE supported TQM projects. The firm are registered to ISO 9000 and EN 4000 and have the Investors in People Standard.

They also participate in a range of University supported programmes to support ICT. Because of this high profile, the MD is well known within the business support organisations in the region and is often asked to comment on policy and developmental issues, which relate to the sector.

Despite the clear quality and performance enjoyed by the company, the winds of globalisation were beginning to blow in early 1999 and several key accounts were either at risk or subject to stringent cost down pressures. Growth was static and in fact dropped to a negative position in late 1999, which coincided with the start of the research and the question "What can the World Class Network do for you?" which was part of the hypothesis forming process.

The company were dismayed because this question asked by another colleague prior to the researcher had led to another initiative based on process driven objectives, just at the time when NPD and new customers was considered the critical issue and which was not then reflected in the support to CSN1.

The firm also realises their own weakness in this area – they had grown within stable supply chain relationships and had seen partnerships with second tier firms as key. Now they were confronted with new circumstances where new skills in customer development and marketing and expertise were essential.

Networking for CSN therefore was highly appropriate and timely. The company had a distrust of marketing consultants and felt that the best way to develop was in relationships with a small group of trusted fellow traveller SMEs.
CSN 1 was the key to the establishment of the Network. The firm pressed for clear TOR for the group and also led the discussions with the "Accelerate Team" as a

specialist funding group within the business support infrastructure in the region to tell them of the need for such networks (policy) and to secure funds (operational). CSN 1 also were the most open to have discussions with consultancy groups offering insights into possible new configurations for suppliers (Tomorrow's Company and the Inter Company Productivity Group, www.icpg.co.uk) and were critical in establishing the pattern of behaviour and commitment for the network.

Mapping of company participation also shows that CSN1 actively encouraged 3 of its managers to develop their own networking activities, which is not at all common in the firms researched (although all say that Networking should not be just done by the MD).

On the down side, the MD could be cautious " He wants to know every single minute detail before he commits himself... why not get stuck in and see what comes out the other end?" (MD of CSN4 7/2/01). The MD of CSN 1 didn't like the OSN feeling it to be "too disparate a group" (Qu'irre 24/7/01) feeling more at home within the CSN.

In terms of making events happen CSN 1 were catalytic. The ICPG involvement was only really taken up by CSN 1 and this led to the 3M visit by the Network with CG2 and CG4 also attending with another invited non network company. It was this invitee which subsequently provided the key link for CSN 1 to Dupont for the coating of powder coating onto plastic, a process now unique to CSN1 and a key outcome for innovation.

CSN 1 also led the move towards developing inter-company teams within the network with a key link with CSN4 on ICT and links to West Midlands Digital, www.wmdigital.org a specific "e-business" network. CSN 1 was also the force behind the establishment of the "mechanism" within the CSN whereby SMEs (CSN plus the plastic injection moulding SME which made the Dupont link possible) develop their profiles, which are then matched with the requirements of potential new customers. (This is a pilot project funded through Advantage West Midlands arising directly from the CSN).

The company were the most in favour of the idea of "step change" events facilitated by Winning Moves Consultants for the CSN. Again, this was a pilot project for the Accelerate Project to establish how both network objectives and individual SME objectives can be developed as a matter of strategy for the programme. Lessons will then be disseminated to the wider West Midlands (Accelerate is an established strategic programme some four years old with an annual budget of £10,000,000 specifically to support the automotive sector).

The network experiences of CSN1 mirrored the situation of SMEs faced with having to develop new relationships to secure new business within supply chains as well as maintaining high levels of quality, responsiveness and speed. The need to develop trust within a group as well as to show leadership within the network and to lobby the business support agencies remained throughout key activities for the MD of CSN1.
He was the advocate of the "mechanism" which he saw as more in keeping with the supply chain sub-contractual culture than the more ambitious "brokerage" model which demands a more radical approach to collaboration, which he saw as being difficult to achieve. This tension between CSN 1 and CSN4 far from leading to a rift

in the network helped the firms to see new possibilities and make decisions for what best suited their particular circumstances, thus building on the results from the quantitative data analysis with the benefits to small firms from networking of information and idea sharing.

CSN 4

CSN 4 is a relatively new firm, founded in 1972, with its origins in the metal shaping industry, initially manipulating radiators to fit household bay windows from fairly basic premises in a Birmingham residential suburb. It has since 1995 re-located to a new site in the Aston area. Since the move the firm has developed extensively in laser cutting and metal shaping technologies mainly for the specialist automotive sector such as Morgan Cars and Bentley. It has also diversified into the food industry by manufacturing food shoots for Ishida Ltd. a large Japanese inward investment company in the food sector.

CSN 4 has begun to explore new materials and discussed the use of plastics with CG4 and have during the research period, developed capability in titanium. CSN 4 have a high skills base and the MD is confident the company can make "anything out of a flat piece of metal". The technology is seen as complimentary to the skills base of the firm rather than a substitute for skilled people. This added value in the process is seen as critical for the retention of automotive business in particular given the fluidity in the marketplace in the research period. The MD admits speed and dependability have been low in the company but that they are seeking to address this by implementing continuous improvement techniques on the shop floor. (A recent example, is the moving of the CAD personnel who programme the CNC cutting profilers to the shop floor from the design office area).

CSN4's culture is personified in the MD who now spends 90% of his time on developing the company's business. This means that the company has adopted a culture of people taking responsibility for thinking of improvements to their processes and also to implementing them. Networking is therefore a key strategic activity for the MD and he has been a leading advocate in the CSN for change. It was CSN 4, which proposed the brokerage idea for the four firms to work collaboratively on a common product, an idea that failed at the time to meet the needs of the other three MD's. CSN 4 have also been involved in a Supply Chain Improvement Programme ("SCIP") with Morgan cars as an example of a vertical network which was not a success in the opinion of CSN 4, mainly because of the apparent lack of commitment of other suppliers to the network.

They have also been prominent in the development of the idea of "Technical Partnerships" whereby 2-3 supplier firms link together to supply/quote for work to a key customer. These Technical Partnerships have involved CSN 4 with Alcoa Ltd for design and MIRA for testing in one project where CSN 4 are the manufacturer and in another partnership to quote for MG wherein CSN 4 provide expertise in bonding to a panel manufacturer and a French composites company. These partnerships are seen by the MD of CSN 4 as being a key method to win sustainable business. Significantly, CSN 4 can see a brokerage role for itself in these technical partnership transactions.

CSN 4 is also keen to offer its know how itself as a service and a consultancy function is being considered as an option to add to the company portfolio. Technology itself is also a key driver for new business. As well as new materials (plastics, metals and ceramics) the company is in discussions with the DDA in Malvern to investigate possible synergies arising from the need to commercialise existing inventions – CSN 4 as the innovator and catalyst. The MD feels that to network well *externally*, the *internal* processes also need to be in place to allow employees to share information and ideas. Companies which are too busy "fire-fighting" to find time to reflect internally, will find it even harder to reflect externally with other SMEs in networks. This was his key learning point made by CSN 4 at the Verification Seminar in March 2002.

CSN 4 is a regular attendee of the World Class Network and has a wide range of participants in the network events. It was the last of the firms to be suggested as a potential member of the CSN network by the other three firms, arising from a trip to Stuttgart attended by all four. The MD is relatively young and is sceptical of "governmental initiatives". He, however, is a key thinker in the network suggesting the more demanding network activities to be undertaken. These have included the "broker" idea and the use of an Intranet for the CSN, both ideas, which have been seen as difficult to adopt by the other three. However, the company has maintained its support for the network and enjoys the exchange of ideas, which take place in the meetings. The MD does become frustrated with the "conservative attitude" of some of the other members and the way they see CSN 4 as somewhat anomalous to their own situations. "You may have lots of work today, but its only a matter of time then you'll be like us", was said on a number of occasions in meetings by the others to CSN 4.

The MD is undeterred by this and sees a friendly challenge in proving them wrong! CSN4 has also been successful in introducing other members of the organisation to the networking activities, notably in the field of ICT. This has lead to the idea of an intranet being introduced firstly as a network proposal and then the same idea further worked up as a customer proposal (Morgan cars). A good 1:1 relationship has been established with the ICT manager in CSN1 which although in its early stages has already produced an n ICT strategy for the network. CSN4 through an idea sparked off by a visit to CG4, also instigated the idea of developing consultancy type expert relationships with key managers in their dealings with customers. In terms of Performance Indicators, CSN4 has featured well in the "design/culture for change" areas but less so in the "reliability and speed" axis, which bears out the thrust of its attitude to manufacturing, to be focussed on delivering engineering based high value solutions to its customers as the key differentiating feature.

In conclusion, CSN 4 has been an active member of the network and has participated fully in the exchange of ideas. The relationship with the researcher has also developed from the initial meetings to a close working relationship with regular contact for exchange of information and ideas between meetings. The MD is a key catalyst for the future direction of the CSN and has a strong leadership role in the group. CSN 4 are the high growth example in the CSN, it is perhaps significant that this is still largely unrecognised by the other three.

OSN 1

OSN 1 has been a key firm in the establishment of the network. The MD was a manger in a corporate firm and came into OSN through his wife's family 15 years ago. He sees the need for other owner managers to come together and discuss strategy and distrusts consultants.

The company has been a regular attendee of the OSN since inception and was the key voice in Florence when the future direction was being planned. It relies on acquiring new expertise through buying other businesses and customer lists (it has done so twice in the last ten years). It does have a presence on the Web and utilises this as a catalogue to show to potential customers the firm's capabilities.

OSN1 has a core business in medals and regalia, which is steady but not growing and relies on "specials" one –off contracts to see it through into profitability. It has a high level of customer contact in overseas markets and reflects the trend in many of the networking firms to share and discuss ideas to then be exploited with customer's external to the network. It enjoys the social aspects of the network as well as the sharing of strategy with a trusted group of non-competitor firms. The MD of OSN 1 is key to the cohesion of the group. He has good relationships with the group members and facilitators and is instrumental in determining the future direction of the network's activities.

OSN 4

OSN 4 has also been a regular network member through the ADAPT Club and then the OSN. The company has seen a decline in its core business of stationery products in the early 1990's and accordingly focussed on presswork activity as a third tier supplier in the automotive sector. This work at the start of the research was also then under threat through imminent second tier de-selection. The Managing Director of OSN 4 had to make some difficult choices in terms of business development.

The core OSN 4 business was presswork, stationery products and clocks, calendars and security boxes. The focus in all three was on process improvements to develop better customer relationships and acquisition and re-location within OSN 4 of another complimentary company, to acquire a new customer base in support of the existing business. The risk to OSN 4 was in that although the customer base was good and steady (not automotive, which was in freefall) the products were all old fashioned and old.

OSN 4 had a number of support mechanisms to call upon. Strategy was developed in 1:1 meetings with mentors (2-3 were used by the MD in this respect, including the Researcher). The MD was also a member of an Action Learning Group consisting of a range of firms from a range of business and commercial sectors with different perspectives to give him personal and strategic support. The AL group acted as a sounding board for determining and checking out the key points of the strategy over a period of 6 sessions. The OSN itself was used to then present the strategy and underpinning business rationale at a specific session on 21/2/01 titled, "Innovation and the SME". This presentation was then also made to PostGraduate Students at the University of Warwick to get more feedback from a large company audience.

The MD was also a Director of the Newtown Business Group a forum for local firms to discuss issues, during this period, but the discussions were mainly on local "hygiene" issues rather than business development of the members. The company ceased to be a director of the Network mid way through year one of the research period. The strategy adopted from these interactions and discussions was to focus on two new joint venture businesses that the owner had begun at the start of the research period. These were a company designing, making and then servicing precision parts for the automotive racing industry (Lotus are a key customer) as well as focussing on manufacturing components for the Marine Accessory business (stainless steel consumables).

The second JV was in the office and bar/restaurant furniture market making bespoke ranges of fittings for a wide range of clients. Issues for OSN 4 which were raised in the network discussions relate to the role the MD needs to play across such a wide range of businesses and supply chains.

This led to discussions on role (still on-going) and the MD acting as a financial support to the two MD's in the JV's who clearly have the business contacts within the specific sectors. A weakness, is that the MD of OSN 4 is stretched across a range of business sectors, supply chains and production facilities. Role definition in this is critically important and the MD finds the OSN useful in exploring ideas in an open and supportive framework.

Some of the issues, which made these changes important are also re-emerging in the new sectors (issues of "cost down" in Lotus for example) There are, however, synergies, between the stationery business and the furniture business in terms of processes (metal forming) and customers. The range and connectivity issues for OSN 4 also make the utilisation of ICT important. The company has yet to embrace ICT strategically, although it now has a networked PC system in place and a website reflecting the diversity in the company has been commissioned supported by a contact made in the network.

CG 4

CG4 has many interesting characteristics. It was chosen as part of the CG because of its infrequent and sporadic attendance at network meetings. This was coupled with a belief that other SMEs locally could not provide the quality or compatibility of experiences of the manufacturing environment which CG4 saws itself in which in effect became an inhibiting factor in local networking. The perception is that CG4 was giving a good deal but not getting much back – which soon becomes a self-perpetuating cycle. " He did his talk and then sat there at the end…he didn't make the effort to come and talk to us".

CG4 is admired by companies in the CSN " I benchmark my company against CG4" was said by CSN1. CG4 was also presented with a commercial proposition by CSN4 for making a plastic radiator grill - which CG4 saw as not possible – but no other follow up took place ("We can't do this with you… but are there any other areas where we might collaborate?" could have been a constructive reply, but a reply which CG4 failed to make). CG4 was considered as an associate member of CSN but again, this was not pursued. CG4, however, did attend the 3M visit and on return implemented an idea it saw at 3M – an "ideas" room where engineers were

encouraged to systematically raise and review new ideas for the business. The MD of CG 4 also represented the Birmingham SMEs at the ICPG conference in Jersey, although again, local dissemination was not seen as a priority.

The MD feels his own managers lack some of his own entrepreneurial spirit, they can manage customer relationships very well in existing supply chain relationships, but seem to lack the ability to develop into new areas. As the existing supply chain work is becoming problematic, this represents a considerable challenge for CG 4 to overcome. To date, local networking has not been seen as being able to significantly support this process.

CG 2

The Managing Director of CG 2 is a dynamic and highly personable individual who was widely networked at the start of the research. CG 2 focus on induction heat treatment a specialist finishing service to customers in the automotive sector. His turnover at the start was £250,000, which he wanted to raise to £400,000, mainly through "me getting involved in networks". The MD felt his core business was "customer service" with new product development in terms of diversification (manufacturing stainless steel security sheds for lock ups for the Middle East was seen as an option).

Marketing of existing services was also seen as important and the MD was keen to see how a web site could help. (Contact via *Cheapside Business Group*). In terms of technology, the company benefited from the *Autolean Project* within University of Wolverhampton, which supported a personal computer in CG 2. The MD was also instrumental in establishing a *technical network* of small metal finishing firms which was specifically set up to develop software applications for the sector with a consultant as the enabler. CG 2 is a founder member of the *World Class Network* and an advocate of small firms learning from each other. He is particularly keen on learning from company visits and benefited greatly from the Stuttgart visit arranged by Professor Hogan for the WCN (interestingly, this is where 3 of the CSN also forged their close personal ties which enabled the early CSN to take place). CG 2 were keen to further develop the *"Agenda 2000"* methodologies particularly around cause and effect issues. This was to be supported by an external trainer/mentor from a centre established in a press-working company.

However, there are many external pressures also on the company particularly relating to quality, environmental and health and safety standards (ISO 14001 and ISO 9000). The MD was heavily reliant on external consultants to help him in this respect. (At least five, from one-person consultancies to large operations such as Industry Forum and the Society of Motor Manufacturers and Traders). The company is constrained by its small size in seeking to achieve all of the above – 9 employees. The above description of activities also suggests a commitment to a wide range of activities and support networks and it was a key reason for choosing the firm as part of the Control Group.

By the mid point of the research the company had acquired a cold forging company, supported the 3M visit, further developed in the software network, participated in the Tomorrow's company sessions and had some initial discussions with the CSN.

The link with the Cold Forger was interesting – it was sudden and in some ways surprising. The company now shared premises with this firm, which reduced overheads, but in terms of business synergy this was unclear, particularly as the cold forging sector had been in decline for some time in the region. CG 2 had also networked hugely and in an unfocussed way almost a *"serial networker"*. The result was that of lack of clarity of purpose and the networking was sporadic. (The CSN did not pursue his request to meet them, even after the 3 M visit where CG2 performed well and broke the ice at difficult moments when CSN1 was attempting to make a business case, which was not well received by 3M at the time).

By the end point of the research, the business environment for CG 2 was looking distinctly gloomy. The turnover remained at £250,000, but CG 2 now had only 6 employees. Any drop in turnover and the company was no longer viable, "If it (turnover) gets worse we will go bust". The cold forging company had proved to be a distraction and the MD was seeking a way to part company from them as tenants. Synergy was poor and in fact was becoming a drain on CG2's time. The great difficulty in tracking the MD down to complete the final Questionnaire was itself indicative of a company and individual under extreme pressure. The developmental activity at the start of the research had not progressed very well. CG 2 is still very much subject to the call of its customers, always with spare capacity to meet customer requirements, a cost, which he has to meet in quiet periods. In terms of design, CG2 feels it important to be involved in customer design processes, but is never asked to do so – which is disappointing given the initial views on partnerships and establishing "customer service" as the core business. The need to combine turned parts and induction hardening in one process forseen at the start by CG3 also represents more of a threat than an opportunity. It certainly needs to be incorporated into the strategy of CG2 but this comes across as aspirational rather than practical.

By the end point the WCN was the only remaining network, which it was participating in, the others had all been dropped because of the pressure of maintaining the business. The WCN itself was seen as problematic as its attendance was poor and the SMEs were not involved in the "decisions on what should happen". CG2 lamented the passing of JH and his energy and enthusiasm. The need for facilitation was seen as critical by CG 2 and the skills of SW the facilitator in the Technical Network were especially mentioned. CG 2 himself needed mentors and support and found the Profit through People Programme which developed a learning set of most value to him. This network was heterogeneous and drawn together through a common experience sharing with each other insights into company performance (Closed, Strategic, Heterogeneous, *Cross Sectoral*, Horizontal and based on the theme of mutual improvement. NB the cross-sectoral factor differentiates this from the CSN).

The MD still attends regular sessions held by the Profit through People Network in Birmingham despite the fact that the project re-located to Worcester. In conclusion, CG2 proved to be a good case study for the research. It has common characteristics, but key differences in terms of capability to maintain manufacturing within the environment of 2001. CG2 was in a "decline" from the mid-point, with MD attention spent increasingly on fire fighting and not on developing the business. The strategy for the company seemed unclear from the start and the MD was unable to pursue an incremental strategy

APPENDIX THREE SME NETWORK GUIDE

Networks – Spoilt for choice?

Networks can be useful to develop your company into new areas of work.
They are good for sharing with other small

Firms for

- Exchange of Information
- Sharing Ideas
- Developing new processes
- Finding out about what is happening in the marketplace.

But there are many types of network and each can have certain qualities. You may also feel "networked out" and unsure of the benefits to you or your company. So, how can you tell which one is appropriate to meet your needs?

This guide gives an overview of some of the main types you will find and suggests how they can be of help. Network Contact names can be obtained by contacting the author.

Supply chain networks

Good for developing links with existing customers on a new product basis. Not so good for learning from other firms unless directly involved with you on the project. Suits companies used to operating to customer requirements of QCD.

Broker led Network

This is where one firm acts as the lead in representing a group of likeminded small firms seeking to come together for a common purpose. This could be to act as a consortium for a marketing event and when advanced could even be as a separate entity to then obtain and deliver products/services to customers. Good for firms which can work in this way, but needs to be carefully set up with the possibility of exit if circumstances change.

Area based networks

Good for acting as a consortium to receive information from business support agencies. Could have a number of sectors so sometimes hard to make links between other firms. Coming together for commodity buying as a group is also possible, but can also be done now on a 1:1 basis.

Common product network

Good for developing an idea or coming together to meet a customer need which could not be done as single firms. Particularly true with the coming of more global supply chains and the need to compete on "added value".

Drawbacks are in the high degree of trust you need to have to enter this type of direct business development network – lots to gain but also to lose unless trust is really well established.

Thematic Network

These can be around a particular business theme such as World Class Standards or E-business. Up to date information on manufacturing trends for you and your team. They are good for establishing trust with other companies at a really low risk threshold. Can also be good for factory visits and sharing information with others in your company and of course in other firms also.

Closed Strategic Network

Small group of like-minded firms coming together to share ideas on a regular basis. Different types of manufacturing process within the group so possibility of competition is small. Members also selected by the group and a formal TOR set by the group determine what the network will do.
Members tend to share common characteristics (i.e. wish to change, aspire to World Class Standards). Good for new processes such as cross company teams and coming together to think of business ideas, which can then be taken up outside of the group. Also has a visit element to other firms outside the network. Can also be rotated so members visit each other regularly.

Open Social Network

Best suited for owner managed firms and "entrepreneurs".
Less emphasis on QCD, more on the owner manager and how he/she can juggle all the necessary issues and still come out on top! Strong social element allowing firms to get to understand success factors and get good insights into strategy as well as relaxing with like minded small firms. Core of networkers and outer ring dipping in for specific events. So..... To summarise all of the above in a table:

Type	*New Product Focus*	*New Processes Focus*	*Appropriateness*
Vertical Supply Chain Network	Specific Customer focus	Good for Customer focus QCD	Low risk, good for information gaining
Industrial District Network	Focus on a network developing a	Firms supported by a broker and a lead SME	Not many so far in the WM region.

	product/service	for exchange of practices	High level of trust if broker involved
Geographical/Area based Network	Potential for new ideas but area focus and cross sector does depend on who shows up!	Potential for sharing information Cross sector new ideas	Good for information sharing and lobbying local agencies. Trust if a broker is involved
Common Product network	Excellent for developing new ideas but extremely high degree of trust essential to make for effective transfer	Sharing of technical know how possible Need to have clear Terms of Reference for transfer to take place in new products	Broker essential to liaise between the firms. Legal entity needed at some stage. Exit may be difficult
Thematic Network	Sharing of information Focus on a current theme	Best practice visits Inputs on processes from external speakers valuable	Excellent for gaining information. Low risk. Social element, but "deeper" understanding may not be gained
Closed Strategic Network	SME Ideas generation Group made from different industry types High degree of Trust Diversification into new areas	Cross Company Teams Factory visits Benchmarking	Good for mature companies willing to come together over time. Group members develop ideas to then develop outside the network
Open Social Network	Ideas sharing Marketing orientated Owner manager Different industry types Good degree of trust, but limited in depth of discussion	Limited. MD focus makes exchange of personnel in terms of visits to each other problematic	Good for information /ideas exchange. Low risk . Social setting. Needs to be also supported between networks to build on discussions for business benefits

"Fine, but can I do this on my own?"

Networking is a complex process: People meeting and sharing ideas in a business context needs to be facilitated in some way.

The facilitator may be the chair of the network and also arrange to get minutes done and make links for you between meetings. There may be the need for a catalyst as a facilitator also to prompt you to consider new ideas. There is an information giving role also as well as a visits and events role

Some networks which are directly designed to get new business for the network firms will also have the need for a "broker" who will represent them externally as well as support decision making on the direction the network wishes to take.

You need to decide on the network for you and to then see how your facilitator performs these roles. If you decide to start form scratch then choice of facilitator is very important at the start to ensure you can meet the objectives you want to pursue. You may well have a regular facilitator and call upon others for specialist inputs when you need them.

Partnerships with other firms

Developing ideas from networking can be done as separate business relationships with another firm. This gives you the chance to judge who best to partner with. It could be a company in another region or part of Europe. The collaboration skills you have developed in the local network will give you the skills you will need to make and then sustain new business relationships as you seek to expand

Steve Harding
Birmingham Interaction, Unit 3 Level 2, Millennium Point