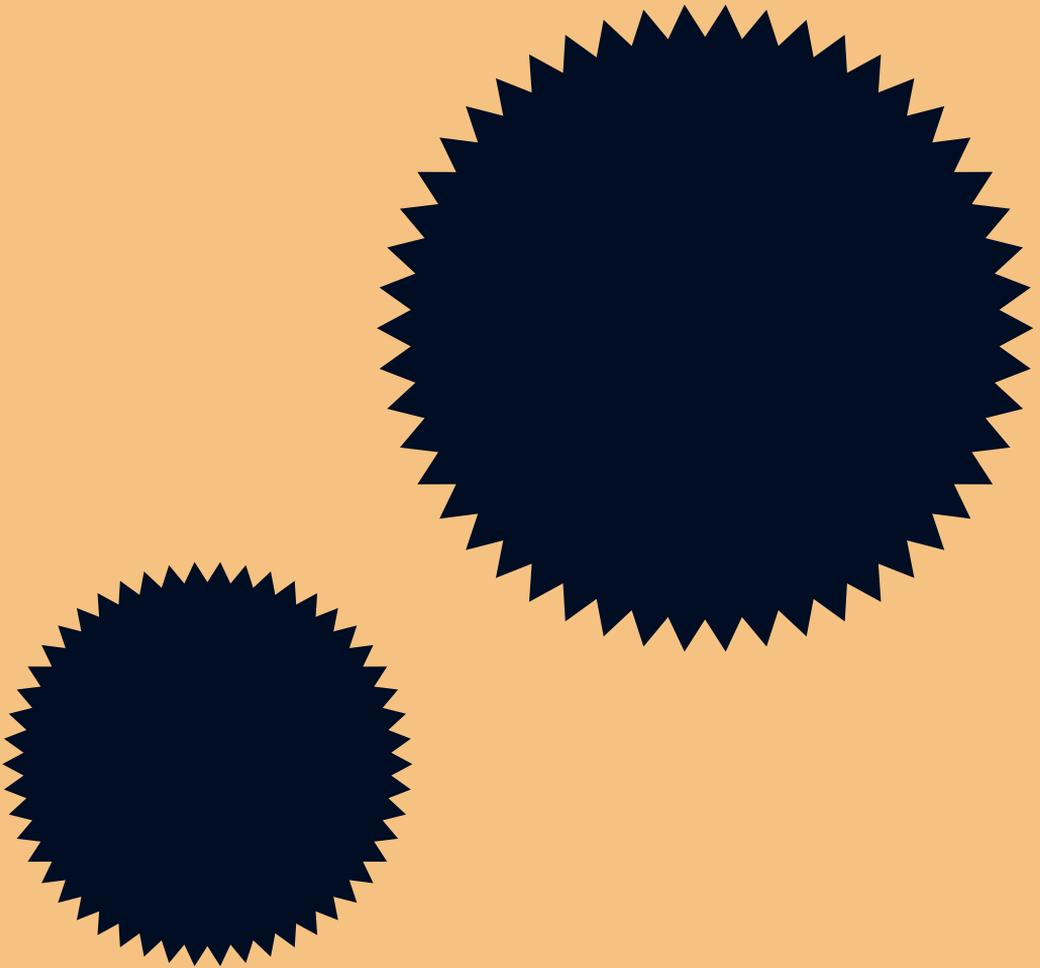


Innovation, Trade and Connectivity



About the Review

The Manchester Independent Economic Review provides a detailed and rigorous assessment of the current state and future potential of Manchester's economy. It contains a rich seam of evidence to inform the actions of public and private sector decision-makers so that Manchester can achieve long-term sustainable economic growth and boost the performance of the national economy.

Completely independent of local and national government, the Review is led by a panel of five prominent economists and business leaders:

*Sir Tom McKillop:
Chairman, Manchester Independent Economic Review*

*Diane Coyle:
Managing Director, Enlightenment Economics*

*Ed Glaeser:
Professor of Economics, Harvard University*

*Jonathan Kestenbaum:
Chief Executive, NESTA*

*Jim O'Neill:
Chief Economist and Head of Global Economic Research,
Goldman Sachs*

The Review Panel commissioned seven world-class organisations to work on seven strands of analysis which provide a deep and cutting-edge analysis of the economics of the Manchester City Region: the way businesses and people interact in terms of trade and skills, the causes and impact of innovation, how investment comes about and the effect it has, and why, despite all this economic activity and growth, stubborn pockets of deprivation still persist.

An ambitious agenda-setting report pulls together the seven strands of analysis, output from the comprehensive economic baseline study, as well as incorporating the extensive intelligence gathered from a year long consultation across the public, private and voluntary sector, which will be the foundation of an ambitious economic strategy so that the world-class research the Review has produced is used to drive Manchester's aspirations forward.

The Review has been funded by the Manchester Innovation Investment Fund, which is supported by both the Northwest Regional Development Agency and the National Endowment for Science Technology and Arts, separately by the Northwest Regional Development Agency, by the Learning and Skills Council and by the North West Improvement Network. The Review is also funded, supported and underwritten by the Association of Greater Manchester Authorities.

FOREWORD

Innovation is absolutely central to economic growth and prosperity in the long term.

This is not a matter of growth for its own sake, but rather the harnessing of human creativity to productive ends, with new products and services that will improve well-being. Cities and regions with a higher proportion of innovative businesses and individuals are those which prosper and whose inhabitants thrive.

This study by Volterra explores the scope of the links between firms in the Manchester City Region (MCR), to understand how well – or otherwise – innovations are spreading, using unique data. Effective innovation needs to be passed from firm to firm to drive the wider process of growth. Within a regional economy, the network of contacts between businesses, and specific individuals within them, is key to the speed with which innovations diffuse. It determines the innovative capacity of the region's economy. The research has sought to understand the structure of the network in the most productive industries within MCR.

From this report, and others in the Manchester Independent Economic Review, it is becoming clear that the City Region is relatively specialised (compared to the national average) in some parts of Manufacturing and in Financial and Professional Services. These face a short-term threat due to the recession, and Financial Services will also undergo a longer-term post-crisis restructuring.

The report therefore confirms that MCR will face a period of great change in its industrial landscape going ahead, arising partly from its relative specialisation to date in Financial and Professional Services. Forward-thinking policy will need to consider ways of supporting emerging firms. The report's emphasis on diffusion of innovations sits well with findings from NESTA's research on absorptive capacity that innovation policy focused only on the production of new knowledge can miss an important source of competitive advantage.

MCR also has emerging strengths in the creative industries, which should continue to develop thanks to MediaCityUK, and also in the ICT Digital/Communications industries more broadly. There is an important presence in Life Sciences thanks to AstraZeneca in Macclesfield. The Engineering and Textiles sector has been in decline but remains important and its firms are moving towards high technology activities.

The primary research used to inform the network model was performed independently by Experian Business Strategies (EBS) and Burns Owen Partnership (BOP). The business survey covered over 1,500 firms in MCR across 25 industries, using telephone interviews with Chief Financial Officers, Finance Directors, Managing Directors and Site Managers. The survey asked about trade patterns, sales connections and innovation.

The qualitative research by BOP involved interviews with businesses, trade bodies and support agencies. This element of the research was designed to provide the study with real-world experience of innovation practices.

The focus of this research has been to establish the nature of the innovation process in the sectors that were identified as of particular interest. It has been informed by additional discussions and interviews with those engaged across Manchester as a whole. In particular, Manchester: Knowledge Capital provided an overview of their activities and impact, and the report by Zernike for the Manchester City South Partnership also provided important background.

A quantitative survey of social networking behaviour across the four sectors was also undertaken. This took the form of an online panel survey that was run three times over a period of ten weeks. All of this work is described in the report.

Using this descriptive research, Volterra has characterised the number of links firms have with each other, how able they are to generate innovations themselves, and how well they both transmit and absorb ideas in the network of firms in which they are embedded. This will include their suppliers and their customers.

One of the results of the research is that thanks to the relationship of trust, innovations spread more easily in a supply chain than amongst a group of competitors. Ideas are exchanged within this trusted group, passed directly from one to another. When it comes to a wider group of competing firms, innovations instead are copied, when they are observed sufficiently often.

The key results are:

- large numbers of firms in MCR identify themselves as having no trading links with other firms in the City Region (particularly in Engineering and Textiles, and the Creative/Digital/New Media and ICT sectors). They are well connected to firms outside the region, and these external links will be highly beneficial in increasing access to innovative ideas;
- however the lack of internal networks means the spread of these innovations within MCR will be limited. These firms are an important conduit for innovations from elsewhere but the flow to neighbouring firms within MCR is blocked. Their strong connections to firms outside the region means that creative businesses have good access to innovative ideas. But their lack of internal networks means the spread of these innovations within MCR is limited;
- these results suggest that there may be large and immediate payoffs to MCR's capacity to innovate if creative firms can be better integrated into supply chain networks in MCR. This result resonates with a strong theme in NESTA's research on the creative industries, namely that firms that do more business with creative businesses tend to be more product innovative: other things being equal, a business that spends twice as much as the average firm does on creative inputs (as a proportion of its gross output) is 25% more likely to have introduced a new product innovation;
- mimicking innovations introduced by competitors is a poor method for spreading new ideas. The results for MCR networks studied indicate that it takes a large number of firms to have adopted an innovation before others will follow suit, so this is a slow process;
- trading links are much more effective at spreading innovations quickly. An innovation can quickly cascade through almost two thirds of a network of firms connected by supply chains;
- the network of links between firms is vital for the degree of innovation in a sector or the region as a whole: no matter how good individual firms are at innovating, the wider economy could not realistically hope to produce the levels of innovative firms observed in the model as the result of the diffusion of a single innovation unless these firms are embedded in a network. Without such a network the innovative potential of a regional economy is limited;
- increasing the density of links increases the spread of an innovation. The strength of this increase varies between industries with Life Sciences and Financial and Professional Services seeing less sensitivity to the density of the network than the others;
- the greatest capacity to spread innovations within MCR is found in the Financial and Professional Services sector, followed by Creative/Digital/New Media and ICT; there is the lowest capacity in Life Sciences (explained partly by the prevalence of links external to MCR instead); and
- the lesson we draw from this is that innovation within an individual firm is only part of the story. Even firms with strong external networks, through which they gain access to innovations, only get part way to the ideal situation for MCR businesses as a whole. The capacity of the whole regional economy to innovate depends on links between firms within MCR. Without this kind of network, the innovative potential of MCR will remain limited.

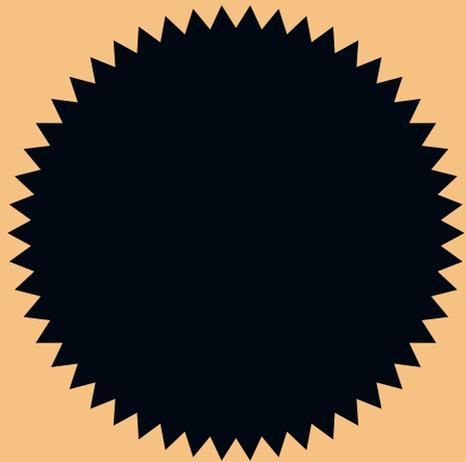
This points to some natural policy implications:

- there would be a big payoff in terms of MCR's capacity to innovate from incorporating the high proportion of firms with no trading links within the City Region. 'Just one link', to use the phrase from Volterra's report, would have a large impact on the diffusion of innovations, especially as many of these currently unlinked firms are a good source of innovations from outside MCR;
- this suggests the support of business networks targeted at these firms or sectors would be productive, although policy makers cannot directly affect trading links. This would be especially fruitful if it introduces large, possibly multinational, companies to local supply chains;
- the results indicate that supply chain relationships are the most effective way of spreading innovations; and relationships with direct competitors are relatively ineffective. This implies that sector-based networks – the conventional policymakers' approach to networking – do not in fact represent a useful route to building regional innovative capacity. Cross-sectoral groups will perform better, and we would recommend this approach;
- we would urge consideration of other routes as well. One example is NESTA's innovation voucher scheme to stimulate new relationships between creative and non-creative businesses, a potentially exciting new model by which public agencies can stimulate knowledge transfer and the diffusion of innovations in the innovation system; and
- finally, we agree with Volterra that there is an important role for MCR's universities that goes beyond the conventional thinking about spin-offs from university research. Spin-offs by their nature guard their innovations very closely, in order to make a financial return. The universities should not overlook their historic role as important social institutions where ideas can be exchanged freely. Their drive for commercialisation and short-term financial returns needs to be balanced with acting as a bridge connecting parts of MCR's community and enhancing the region's capacity to innovate.

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EXECUTIVE SUMMARY



This report summarises research undertaken to study the innovation performance and network of the Manchester City Region (MCR).

The project objective was to provide a more detailed understanding of MCR's innovation system by mapping innovation processes as networks of interaction that cut across institutional and sectoral boundaries, thus providing new insights into how business-driven innovation occurs at the City Region level.

Innovation is an essential driver of the economic success of any economy. To deliver effective long-term growth, innovation must spread across a wide range of firms, or other organisations, which can implement an innovation. Disconnected firms that are innovative but not sharing their innovations will have limited effect on the economy as a whole unless innovation can spread.

This project has focused on MCR, and so it is the spread of innovation across this regional economy, which is our main centre of interest.

This study begins with a comprehensive review of the literature around innovation networks. The review establishes their importance and notes that the future of understanding innovation networks lies in computer simulation and rigorous modelling.

We undertook a statistical analysis of employment concentrations in different industries in MCR. This analysis shows that MCR has a hybrid employment structure, with strength in Manufacturing and Financial and Professional Services. The Creative Industries are also emergent in MCR. This analysis, alongside the priorities of the City Region, has guided our choice of sectors for further detailed analysis.

Extensive primary consultation with businesses and other organisations across MCR was undertaken. This consultation process, undertaken by Burns Owen Partnership (BOP) and the survey data delivered by Experian Business Services (EBS), is used to construct a model of the innovation networks in place in MCR. The primary research provides data on trade and innovation linkages in the City Region's economy, and the patterns of innovation generation and absorption at the firm level. This data is the basis of a network model of MCR's innovation system.

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The model allows us to study the effectiveness of MCR's network structure in spreading innovation. The effectiveness with which a city-region's economy can spread innovation is key to driving long-term economic success. The study allows us to unearth the key drivers that allow innovation to spread within MCR. This result means that effective policy recommendations can be drawn, based on rigorous modelling and primary research.

We find that innovations spread across the network most effectively when firms engage in an 'exchange' behaviour. This is behaviour where firms or partners come together in collaborative relations.

We also find that additional linkages only increase the effectiveness of the network to a limited point. Crowded networks are not more effective.

Our research suggests that such relations occur more often where there is no competitive pressure between the collaborating firms. Enabling more effective cross sector fertilisation and encouraging collaboration and the exchange of information is worthwhile, if it can be achieved in a setting which creates specific and relevant linkages.

However, while networking activities, which are already being planned in any case, are necessary, they are unlikely to be sufficient. The exchange relationship may be fostered by such networks but it will require additional focus on specific links. We envisage an increased role for universities in facilitating such specific and effective linkages.

We also recommend an attempt to identify and link isolated firms into the regional network structure, to increase the local density and the potential efficiency of the network. This can be effective even if such firms are not obviously innovative.

Metrics should focus on the extent of connections to the external world that potential innovators have, the ability to identify such firms and organisations, and on the quality rather than the quantity of engagement.

This report is the summary of a research project undertaken by Volterra Consulting, the Burns Owen Partnership and with the assistance of Experian Business Services. It is supported by additional documents which detail the components of the study summarised here.

These can be downloaded at:
www.manchester-review.org.uk

1.0 INTRODUCTION

Understanding the innovation capacity of a regional economy is key to understanding its potential to create levels of productivity greater than its competitors.

However, the standard models of the firm or of macroeconomic growth do not address this very effectively. This is largely because innovation is fundamentally a disequilibrium phenomenon – it is about the constant adjustment towards a new equilibrium that is never reached, because further innovation is always occurring.

Innovation is a disturber and a re-adjuster, to both the firm and the economy. Since innovation is a dynamic process, analysis using comparative statics fails to capture the nature of the process.

Schumpeter pointed out long ago that “innovation...does not lend itself to description in terms of a theory of equilibrium” (Schumpeter, 1928)¹, and more recently Antonelli notes that “innovation is the distinctive element of a dynamic process which cannot be analysed with the equilibrium approach” (Antonelli, 2008).²

The approach taken in this study is based on the assertion that innovation occurs within the context of networks. The literature is widely agreed on this. Innovation can only be effective in driving widespread, long-term economic growth in a region when there is extensive take up of innovation.

An economy where innovations do not penetrate through to large numbers of firms cannot be as successful as one where innovation is spread across the network structure. Therefore understanding the process by which innovations spread and are taken up is essential.

Understanding the structure of the innovation network in place in a region opens the possibility for policy implications. Optimising the architecture of the network can allow the full innovative potential of a region to be realised.

1 Schumpeter, J. A. (1928) The instability of capitalism, Economic Journal.

2 Antonelli (2008) Localised Technological Change: Towards the economics of complexity, Routledge.

It is important to recognise that mapping this process in detail would be counterproductive since it is always fluid. It is the general features and the characteristics of the process and networks that can be analysed. This also means that policy levers are likely to lack precision even when most effective and it may be hard to identify exactly which intervention has the most effect.

Further research is needed to unpack such relative effectiveness and especially the timescales over which improved innovation networks might generate change. Each step on the innovation path takes time, which also varies with the type of innovation, and this is not yet well understood.

“Hilly [a textiles firm] source ideas for innovations from a variety of means, though many of these flow through the external links of the company’s network.

– their suppliers show them new developments and new innovations within the marketplace;

– they attend the major sports products exhibition conference in Munich (ISPO);

– they talk to end users – for example, every year Hilly go to the London Marathon to see what the runners are doing, and to find out what they might want;

In addition to these upstream and downstream linkages within the supply chain, Hilly has also extended their firm network and the routes by which they source innovation by developing links with the Higher Education sector and support agencies in the Northwest.”

BOP Consulting

INNOVATION

INNOVATION

This study addresses the dynamics of innovation in MCR, by considering the process by which a particular innovation might spread. To do this, we look at the networks by which organisations might discover and adopt innovations.

Firms are linked together through a myriad of relationships; they buy and sell to each other, enter joint-agreements and partnerships, employees leave one firm and join another, and so on. These relationships form a network structure between firms. Glückler notes that growth and innovation largely result from network dynamics, and this is the starting point this study takes (Glückler, 2007)³.

The literature is coming to see computer modelling as the next stage in understanding the innovation process and formulating policy recommendations to optimise this process. Ahrweiler, de Jong and Windrum note that “it is above all computer simulation which provides the necessary capacities to contribute here...simulation techniques facilitate many types of sensitivity analysis and can be used in...guiding the generation of future policy strategies”⁴.

This study draws a set of policy recommendations based on the survey work and formal modelling. These recommendations aim to advance those characteristics of inter-business networks that have been identified as critical if MCR is to release its untapped potential and allow the innovation of its businesses to be accessed by the wider regional economy.

³ Glückler, J. (2007) Economic geography and the evolution of networks, *Journal of Economic Geography*.

⁴ Ahrweiler, P., de Jong, S., and Windrum, P. (2002) Evaluating Innovation Networks, in: Pyka, A., and Küppers, G. *Innovation Networks: Theory and Practice*, Edward Elgar Publishing.

2.0 ON INNOVATION

Innovation is the deliverable realisation of an invention.

It is important not to treat technological improvement or invention as identical to innovation (Metcalfe, 2007)⁵. Metcalfe notes that even were technological advancement to end today, there would still remain a considerable amount of potential for innovation within an economy. Innovation is more than just invention; it can also involve the use of a better production process, a new service, or the changing of the network structure itself (Antonelli, 2008). Metcalfe tells us

“innovation requires access to and command of many more kinds of knowledge and capability that are summed up by the phrase ‘science and technology’”.

Innovation is the economic realisation of an invention and requires an understanding of consumer and user needs as well as knowledge of the market and organisation if it is to occur. Primarily for our purposes it is the application of new combinations of resources to the economic process. This definition takes economic in its broadest context of the provision of goods and services. This would include non-marketed goods in the public sector, for example, but would probably exclude innovation in family structures.

In the telephone survey carried out by Experian Business Services for this project, firms were asked whether or not they had engaged in a range of innovation creating activities over the three-year period 2005 to 2007. The results of this question are shown for each industry in Figures 1 to 4. These innovation indicators demonstrate that firms within MCR engage in a wide variety of activities that either raise innovation, or the capacity to innovate, and that no one activity dominates. For the purposes of this study they were combined into an index of innovation and the averages for the sectors are shown in Table 1.

The most relevant indicators of innovative outcomes should reflect the efficiency and effectiveness in producing, diffusing and exploiting economically useful knowledge (Lundvall, 1992)⁶. One measure of the success of an innovation, is the proportion of the total possible market the innovation has penetrated (Mansfield, 1961). We model the spread of an innovation through the market and, through seeing how far the innovation has penetrated, gain a metric that measures innovation.

⁵ Metcalfe, J. S. 2007 lecture delivered at University of Jena.

⁶ Lundvall, B. A. [1992] Explaining Inter-firm Cooperation and Innovation--Limits of the Transaction Cost Approach, in: Grabher G (ed.) The Embedded Firm: On the Socioeconomics of Industrial Networks, Routledge, London.

⁷ Ormerod, P. and Rosewell, B. [2008] Innovation, Diffusion and Agglomeration, forthcoming in Economics of Innovation and New Technology.

Table 1: Mean innovation index of each industry (0 low to 1 high)

Industry	Innovation Index
Creative/Digital/New Media and ICT	0.50
Financial & Professional Services	0.48
Life Sciences	0.29
Engineering & Textiles	0.51

Mansfield's work provides some stylised information regarding what levels of dissemination the model should be able to achieve. He found that the rate of market penetration of various successful heavy-machinery based innovations took 20 years or more for all major firms to adopt (Mansfield, 1961).

Consumer innovations are just as likely to be slow. Telephones were introduced in the 1930s, but even in the 1960s, not all households had them. To the present, Facebook may seem like a highly successful innovation but still reaches a relatively small proportion of the population and has by no means established that it is essential to business (or innovation).

A network model of the innovation process needs to capture those features that are relevant to the spread of innovation between firms. We estimate the number of links firms have with others, their own ability to generate innovations, and their abilities to both disseminate and absorb knowledge and innovation from the wider network of firms in which they are embedded.

The ability of an industry to have a high degree of innovation will be a function of various features of the network and the firms within it. The number of links within a network may have a positive or negative bearing on its amount of innovation (Ormerod and Rosewell, 2008)⁷ depending on the decision rule used by agents in deciding whether or not to adopt the innovation.

The propensity of individual firms to innovate, disseminate innovation and absorb innovation will all be important determinants of an industry's innovative potential. For individual firms these abilities are comprised of a bundle of behaviours, for example, the decision to innovate will involve consideration of wider costs and the variety of potential benefits that are implicit in the willingness of a firm to adopt an innovation.

Network theory aims to simplify these by binding them into single factors. The result is a simple, tractable, dynamic that can provide a wealth of insight into complex systems – such as those which typically exist within an innovation ecosystem.

It is important to note that there is a distinction between the final take up of an innovation and the usual definition of an equilibrium. Equilibrium is not the same as outcome. The definition of an equilibrium means that any disturbance away from it will be corrected back to the starting point.

Modelling such systems will produce a large number of solutions, each with a different level of take-up. The average outcome of all these solutions does not mean that a disturbance will produce only a temporary variation. Any change can produce a quite different outcome.

In economics, the concept also carries the sense that it is the solution of the system in which a maximum has been reached and there are no more moves that will improve the result. Then, any move away will be out of equilibrium and the move back will improve the result. In modelling such systems it is enough to characterise the final solution that the system will reach.

“Innovation is deemed as essential to PricewaterhouseCooper’s growth. The consultancy market is highly dynamic and in constant churn, with intense competition for contracts. This competition drives innovation, because the work is finite, so firms are competing for a limited pool of work. In this highly competitive context, innovation is vital to market distinction and differentiation.”

BOP Consulting

In dynamic network systems, no such stability is implied. Even where individuals are the same and motivated in the same way, the outcome of the system is entirely different depending on the exact interaction of the agents and the order in which they take place. The final outcome need not be a stable one.

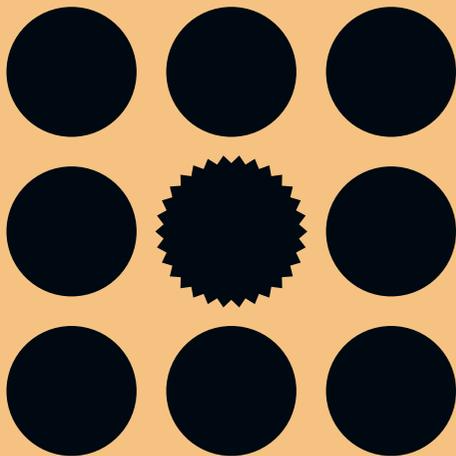


Figure 1: Distribution of innovation activities in Creative/Digital/New Media and ICT /Communications

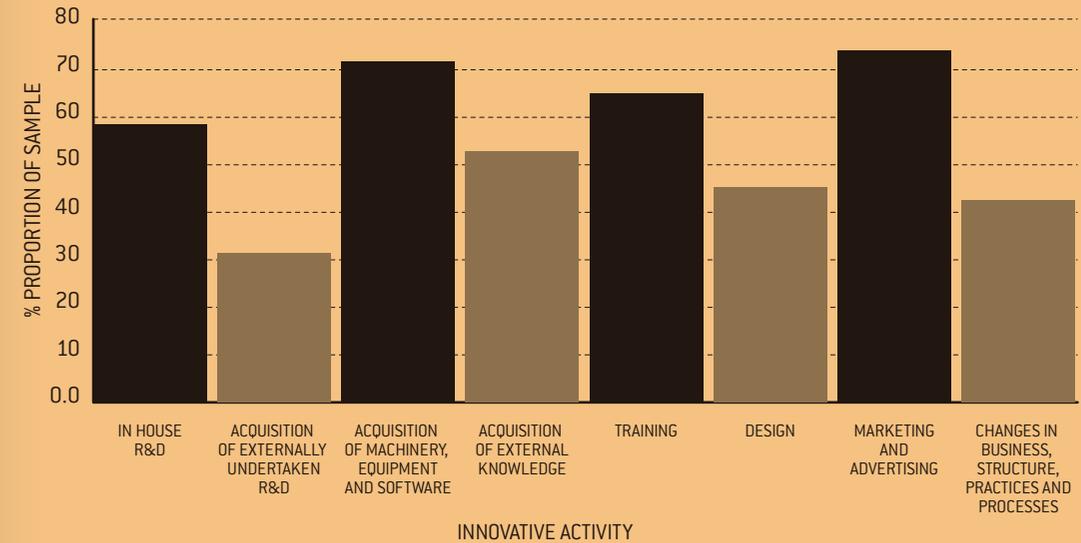


Figure 2: Distribution of innovation activities in Financial & Professional Services

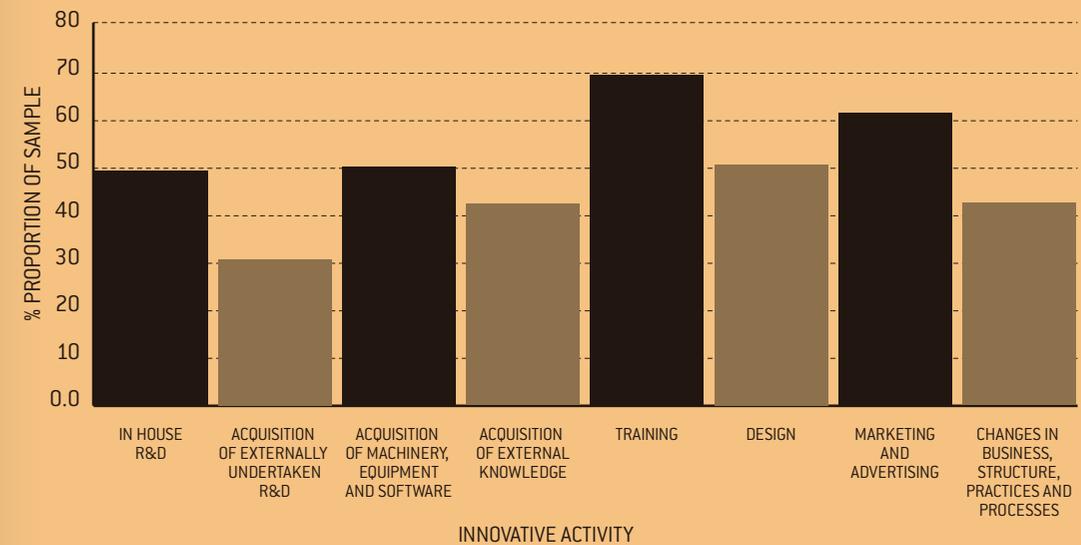


Figure 3: Distribution of innovation activities in Life Sciences

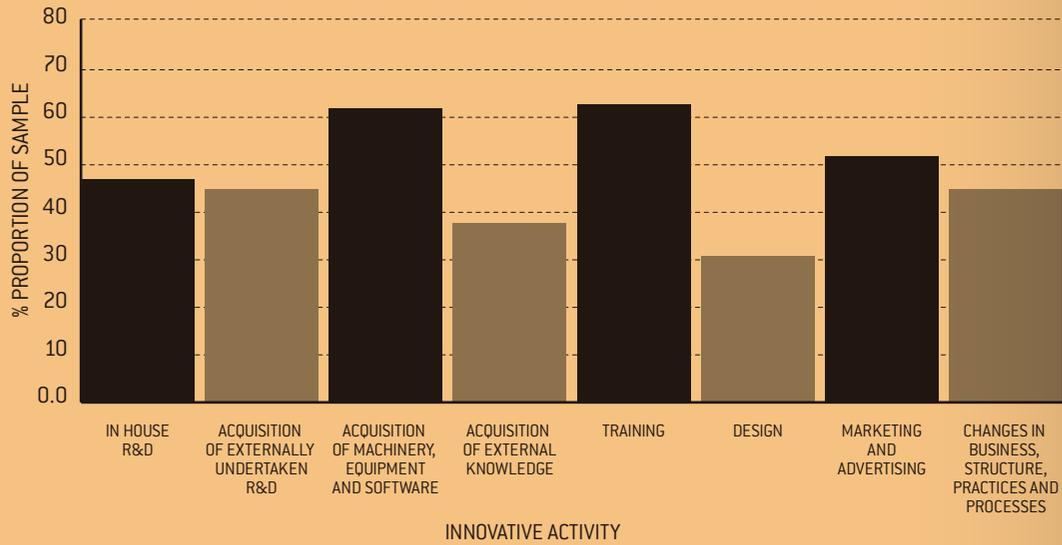
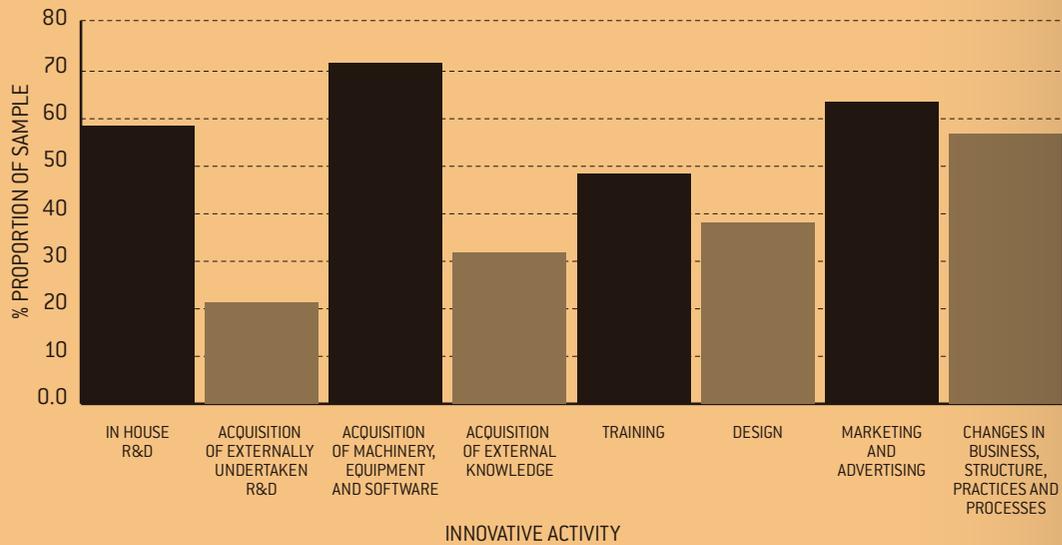


Figure 4: Distribution of innovation activities in Engineering and Textiles



3.0 THE NETWORK MODEL

Until an innovation is taken up by a range of firms in the regional economy, it cannot be effective in driving economic growth on a large scale.

Innovations must penetrate the network structure if they are to deliver strong economic outcomes. The recent report by Zernike⁸ for the Manchester City South Partnership concludes that the most innovative regions and cities have higher levels of networking, collaboration and interaction.

Figure 5 outlines the approach used to model the adoption of a single innovation across a network.

The network modelled is a proximal supply-chain network, not a sales network. It is a network of connection between firms at the supply stage.

The model takes an initial innovation to be exogenous (external to the system) and it is taken up by one agent/organisation at the outset. The characteristics of the agents are governed by their willingness to innovate, their desire to keep innovation to themselves, and their willingness to share innovations with others.

The innovating agent will be connected to other agents via the network structure, and at the next step of the model the innovation will be passed on, according to the extent to which agents discover the innovation and their willingness to

take it up. At further steps of the model, further agents may be able to discover and take up the innovation, until eventually no further take up occurs.

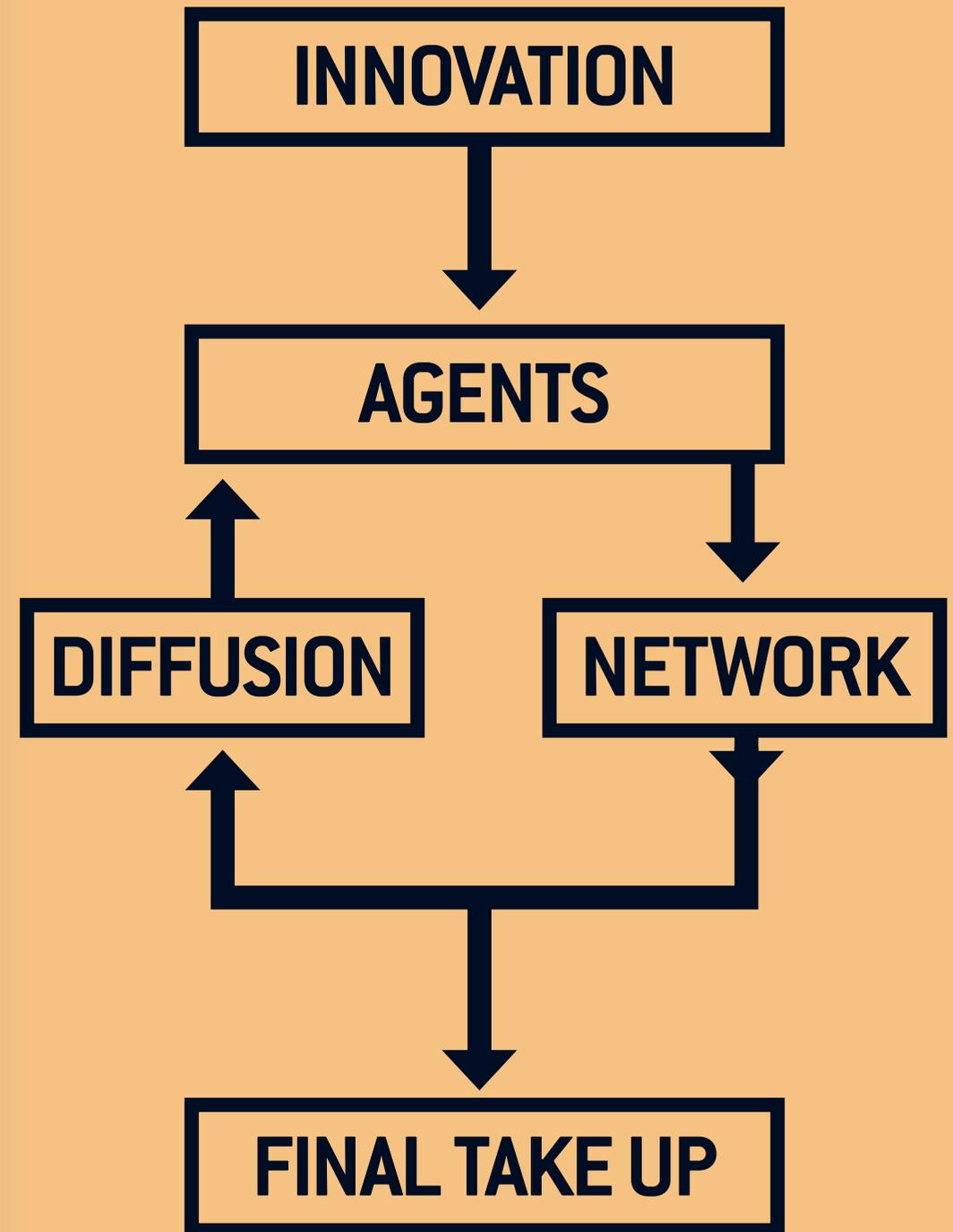
We define two different methods by which innovation may be passed on via the network linkages. The first is a direct relationship between two partners, while the second is a group relationship. The methods in the model capture the economic pressures on firms, within a city region's economy, to innovate.

“The protection of innovation in Engineering & Textiles was a mixture of formal and informal processes. Companies do use patent, copyright and trademark protection. But getting a product to market first and establishing brand recognition was also seen as key to protecting innovations. Other informal means, such as the complexity of the design and manufacture process (e.g. ‘we try to make it as complicated as possible’), were also used to try and prevent mimicking.”

BOP Consulting

⁸ Zernike (UK) Innovation Networks Study for Manchester City South Partnership, November 2008.

Figure 5: Model overview



First, an organisation with an innovation will provide it to another firm only if its level of secrecy, or the propensity of a firm to try to retain the benefits of its innovations, is less than the absorptive capacity, or the degree to which a firm actively engages in activities which enable it to identify and adopt new innovations, of the firms it is linked with.

This method of adopting an innovation represents a mutual relationship or exchange between firms and implies a degree of trust or collaboration. It is probable that this relationship is more likely to exist with customers, suppliers or third parties than with competitors. It is a relationship characteristic of the drive towards supply chain efficiency.

This mechanism models firm's assessments of the costs and benefits of adopting an innovation. For example, Manchester Science Park has concluded that effective linkages must be carefully fostered and that part of their role is to reduce the amount of noise in communication of potential linkages, so as to maximise effectiveness and optimise serendipity⁹.

“Partnership with other businesses is a key factor for the companies in the Financial Professional Services sector interviewed for this research. For The Co-operative, this occurs in the form of brand development, distribution and technology development. Partners are regional, national and international. Other instances highlight the use of outsource providers, although interviewees express the importance of matching the ethics and quality standards of outsource providers with those of your own company if the relationship is to work.”

BOP Consulting

The second method for spreading an innovation we describe as a mimicking behaviour. Here, if a firm looks at the spectrum of organisations to which it is linked, and finds that the proportion that have adopted an innovation is higher than their own personal threshold, they will mimic their behaviour and adopt the innovation. In some circumstances this threshold may be very high and only when all, or nearly all, of the firms an organisation has relationships with have taken up an innovation, will they be persuaded to do the same.

For other organisations relatively few businesses may have to have the same innovation before they adopt it. This mechanism represents a mimicking behaviour. This may occur even when a firm may not fully understand the reasons and benefits of an innovation, but relies on observing that other businesses have adopted it. This behaviour is more likely to be a response to competitor behaviour. Indeed, there is an economic pressure on firms not to fall behind their competitors in their use of innovative practice, and the mimicking mechanism captures this.

There is a growing body of literature which indicates that a range of macro consumer behaviour, for example the take up of bank accounts by unemployed people¹⁰ and the binge drinking behaviour of young adults in the UK¹¹, can be explained by mimetic decision making mechanisms.

Overall, the outcome of a single run of the model is a time series of the take up of the innovation by the firms in the model. This figure gives a quantified measure of the ability of the network structure to support the spread of innovation.

⁹ Discussion with Jane Davies, CEO, Manchester Science Park.

¹⁰ "Volterra Consulting Ltd (2006) The Spread and Containment of Behaviours Across Social Networks, prepared for the Financial Services Authority."

¹¹ Ormerod, P. and Wiltshire, G. (2008) 'Binge' drinking in the UK: a Social Phenomenon; and Nature News (23 June 2008)"

4.0 STATISTICAL ANALYSIS

The statistical analysis provides a backdrop to the network model, providing a historical context to the performance of the region's industries and identifying industries of interest to be taken forward to the modelling stage.

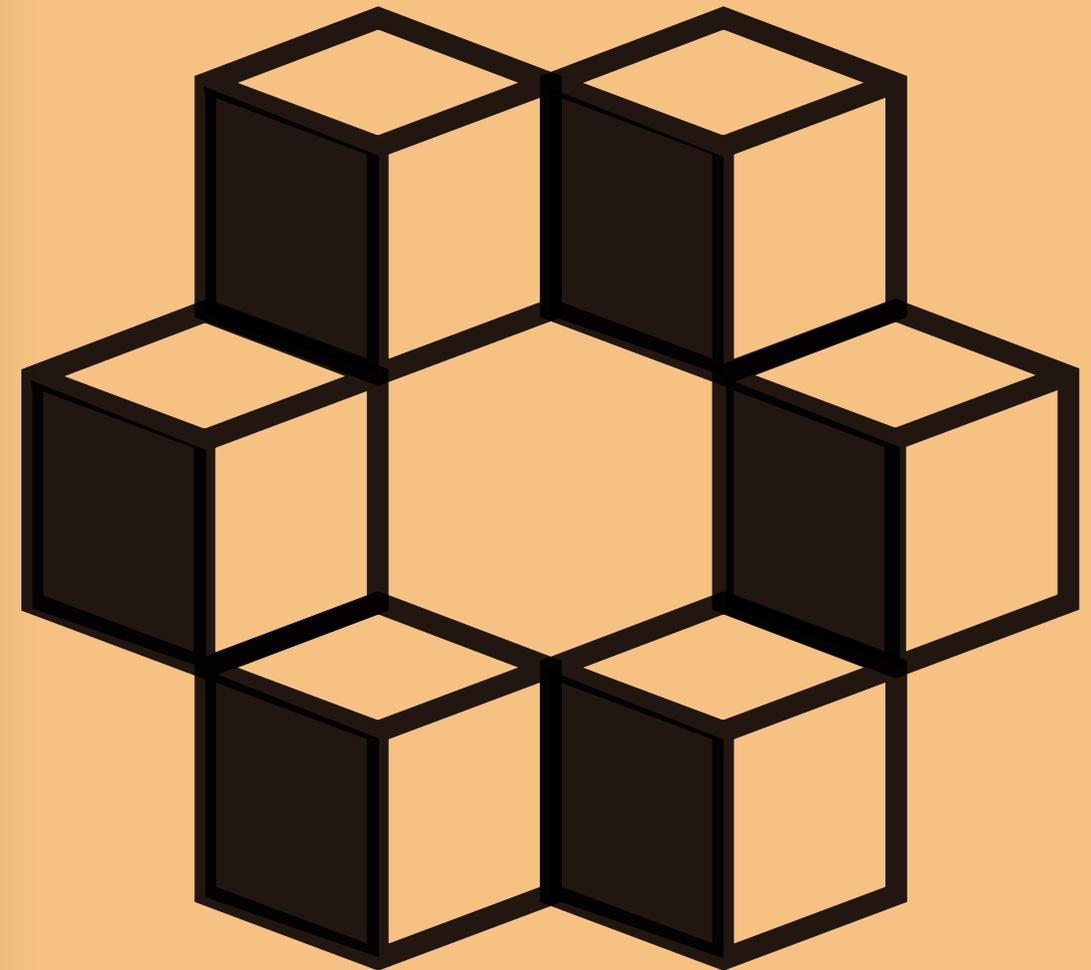
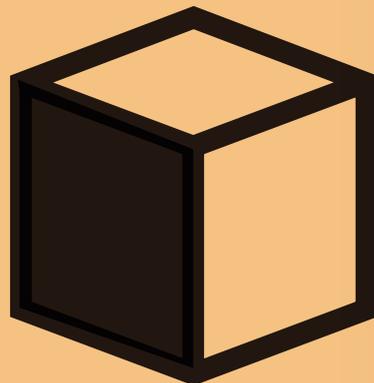
The analysis presented here builds a picture of how successful different sectors have been and where the industries taken forward to the modelling stage sit within the broader economy. The statistical analysis is performed over two time periods; the short-term of 2003 to 2006, over which a more detailed analysis can be performed using key sectors, and a longer-term of 1984 to 2006 which uses broad industrial groups.

The analysis uses employment data to measure the comparative employment advantage in MCR. An area (be it a region or a country) holds a comparative advantage when it is relatively more efficient at producing a good or service than other areas. The study therefore measures employment concentrations in order to give an understanding of underlying trends in comparative advantage.

If there are industries in which MCR is relatively specialised (in terms of employment concentration), we deduce that there must be a degree of comparative advantage held by MCR in those industries. A focus on a particular sector is a reasonable indicator of comparative advantage and may indicate greater potential for innovative practices due to

the geographic proximity of businesses. This is true even in declining sectors since comparative advantage is a relative concept, although innovation may be harder to get started.

The exact measure of employment concentration used in this analysis is a weighted 'distance' of employment proportions of districts in MCR from the national average in each sector. The resulting MCR employment concentration figure is a percentage that shows the amount by which employment in an industry in MCR differs from employment in that industry nationally.



The analysis of MCR's economy was split into 14 key sectors, based on the Office of National Statistics (ONS) four digit standard industrial codes, and which broadly align with definitions used in research commissioned previously by Manchester Enterprises (now the Commission for Economic Development, Employment and Skills), which wanted to continue using them. These groupings are summarised in Table 2.

Four were identified to be taken forward to the network modelling. In 2006, these key sectors accounted for 84 per cent of employment in Great Britain.

It should be noted at this early stage that the Life Sciences sector comprises both pharmaceutical companies and hospital/medicine/dental activities.

Analysis of ONS broad industrial groups in MCR showed that five saw their employment concentration fall or remain approximately constant, compared to the Great Britain average, from 1984 to 2006. Manufacturing and Public Administration, Education and Health saw the largest declines.

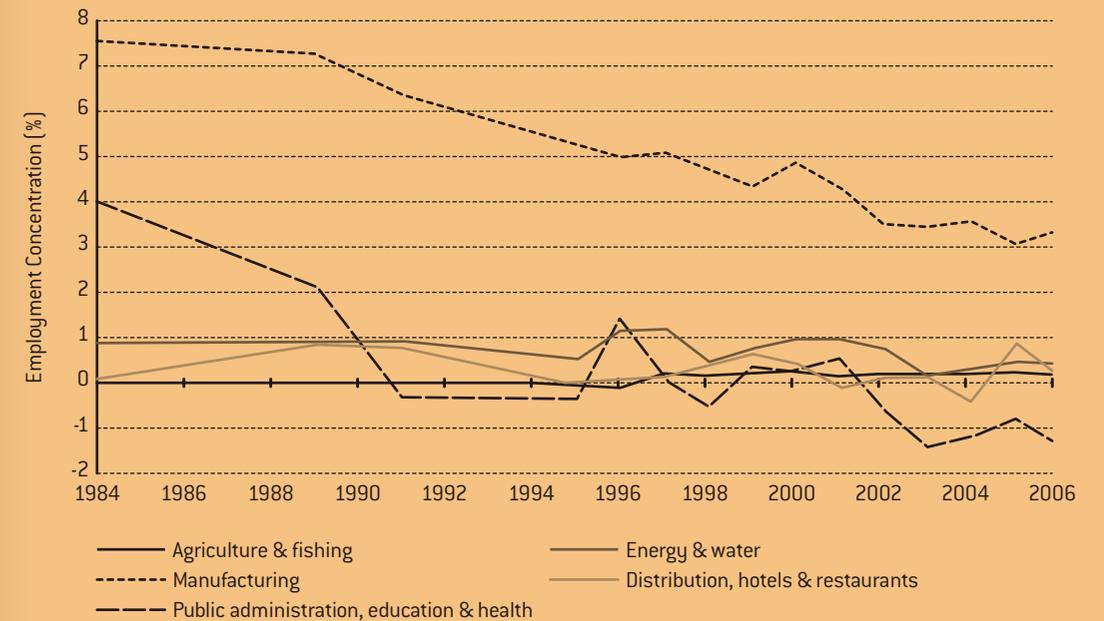
Although Manufacturing has seen a halving of its employment concentration it maintained a first place ranking throughout the period until 2006 when it was superseded by Financial and Professional Services. Manufacturing and Public Administration, Education and Health lost their employment concentration advantage as other industries emerged. These were a mix of service based industries such as Banking, Finance and Insurance as well as Transport and Communications and Construction. These trends are demonstrated in Figures 6 and 7.

Over the past 22 years, MCR's economic history is one of a decline in the breadth of its manufacturing, while retaining those production industries that were the strongest in its manufacturing base. The emerging industries created an overall more balanced mix of manufacturing and service sectors, taking advantage of Great Britain's growing competence in Professional Services.

Table 2: Key Sector definitions, those sectors marked with * are taken through to the network modelling phase.

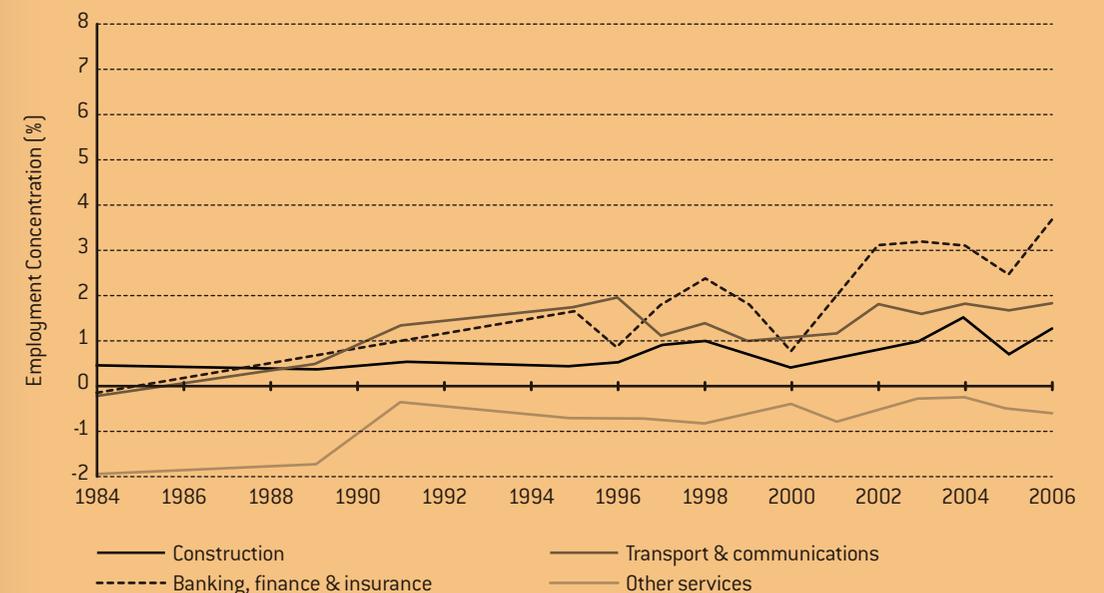
Key Sector
Aviation
Construction
Creative/Digital/New Media & ICT/Communications*
Education
Environmental Technology
Financial & Professional Services*
Hospitality and Tourism
Logistics
Life Sciences*
Other Manufacturing
Public Sector
Retail
Sport
Engineering & Textiles*

Figure 6: Broad industrial group employment concentration within MCR compared to Great Britain from 1984 to 2006 for those industries that saw a declining or stable employment concentration



Source: Annual Business Inquiry, ONS. © Crown Copyright

Figure 7: Broad industrial group employment concentration within MCR compared to Great Britain from 1984 to 2006 for those industries that saw an increase in employment concentration



Source: Annual Business Inquiry, ONS. © Crown Copyright

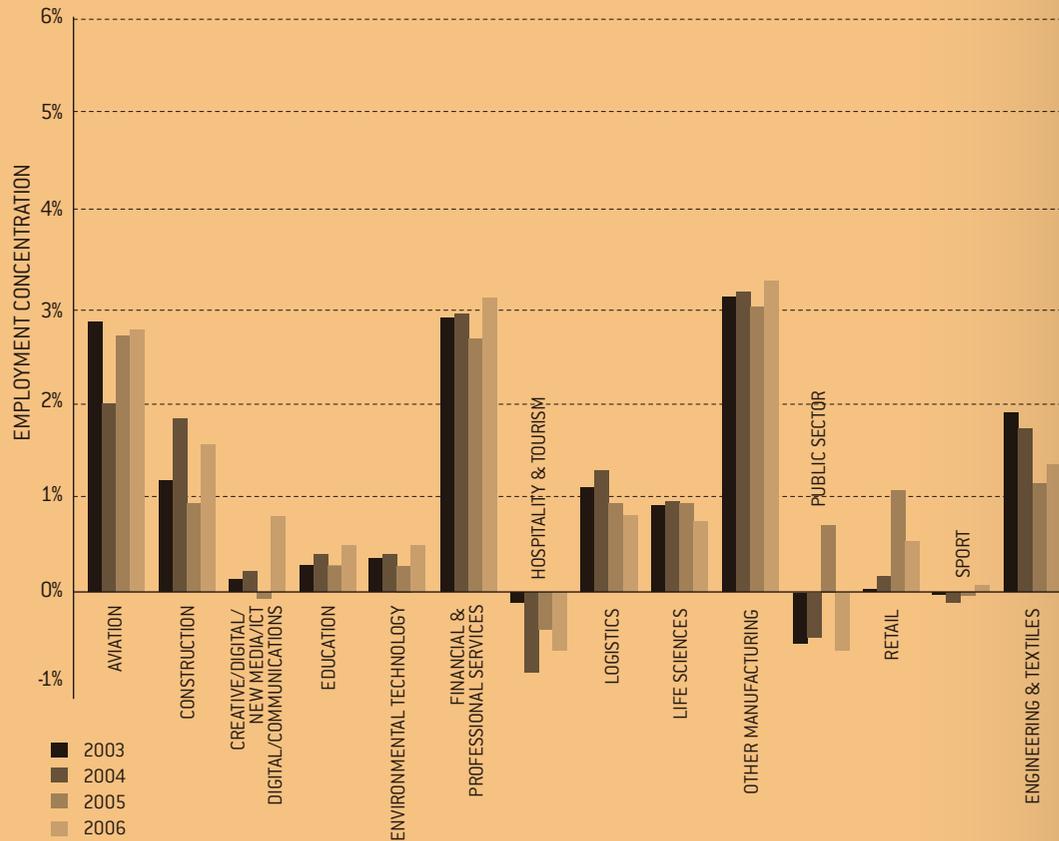
Analysis of the employment concentrations using the 14 key sectors defined in Table 1 was constrained to 2003 to 2006.

Further dis-aggregation to this level showed that, of the four industries studied in the network modelling, the Financial and Professional Services, and Creative/Digital/New Media and ICT/ Communications sectors had significant increases in employment concentrations over the period, while the Life Sciences and Engineering and Textiles industries had falling concentrations. This is shown in Figure 8. These are the industries identified to be taken forward to the modelling stage.

Financial and Professional Services is a large and strong industry sector in MCR, which is likely to provide continuing economic growth in the region. Creative/Digital/New Media and ICT/ Communications is a new and growing industry, with strength around the Oxford Road area, that is also likely to provide increasing economic opportunities.

Life Sciences are an important industry in MCR, with the presence of AstraZeneca, a large employer in Macclesfield. Engineering and Textiles are historically important industries in MCR, and although declining in recent years in its employment concentration, these have moved broadly towards a higher technology business model.

Figure 8: Employment concentration of all the industries in MCR compared to Great Britain between 2003 to 2006



The aim of the network study is to understand the drivers that enable the innovation of one firm to be taken up by other firms in the same industry, and in other industries, within MCR.

Furthermore, the study assesses whether differences in these drivers between the four industries of interest produces an industry with an inherently superior ability to disseminate innovation. This is an insight that allows for better policy direction.

Innovations must spread in order to effectively drive long run economic growth. Firms that are isolated and not able to share in the wider innovation network, cannot deliver sustainable economic growth to the regional economy. Therefore the ability of an economy to foster the spread and take up of innovations is vitally important.

Our model studies the internal network structure of MCR. Firms in MCR who are not part of the internal MCR network may have important external linkages that foster innovation. However, to the extent that these innovations cannot spread to other firms in the City Region, the links are not of wider benefit to the economy of MCR.

A successful economy requires both internal and external links. External links allow for an infusion of new ideas, preventing technological lock-in. However it is internal links that allow for the full economic benefits of innovation to be realised in and across a regional economy.

5.1 The structure of industry networks in MCR

The survey data studied the trade links that existed entirely within MCR. That is, it asked firms based in MCR about the amount of trade they did, both upstream and downstream, with other MCR firms. Extensive literature suggests that trading links are one of the principle routes for the spread of innovation¹².

This study is an analysis of the innovation that occurs across a city regional network. As such, we study only trade links internal to MCR. This is not to suggest that external trade links are unimportant. On the contrary, a strong network that links MCR firms to national and international economies is likely to be beneficial to the levels of innovation in MCR. However the focus of this project was to understand the innovative capacity of the City Region's economy, not its full national or international context.

¹² Dyer, J. H. & Singh, H. (1998), The relational view: cooperative strategy and the sources of inter-organizational competitive advantage, Academy of Management Review.

It should further be noted that strong internal links may be beneficial for innovation, but detrimental in other economic senses. For example, firms that only do business with others in the region will not be exposed to the spur of competition and can become complacent. When circumstances change, they can be left behind. However, this study is solely an analysis of the implications for innovation of the structure of a city region's network.

Large numbers of firms in MCR identified themselves as having no trading links with other firms in the City Region, particularly in the Engineering and Textiles and the Creative/Digital/New Media and ICT/Communications industries. Generally these firms are well connected to firms outside MCR.

The lack of internal MCR links means that their role in the spread of innovation across the regional MCR network is limited. However, these firms may play an important role in the introduction of innovation into MCR from outside. The qualitative survey paints a picture in which textile firms interact strongly with their clients outside the region but have "little interest in networking and collaboration, particularly with their closest peers 'down the road'". In the creative sector some interviewees reported that they felt they were 'at the end of the food chain' with little control over the ideas that they had to work with.

Our analysis suggested that the characteristics of firms with and without internal MCR trade links were similar. They were both engaged in similar levels of innovative activity and had similar absorptive capacities. As such, firms without links inside MCR are not more or less innovative. However, their lack of internal MCR links weakens the density of MCR network and will hinder the penetration of an innovation across the regional network.

Table 3 provides the actual proportions alongside the results for the average percentage of trade that businesses in each industry performed within MCR. In the network model, information about the trade between businesses was used to inform the structure of each industry's network.

The analysis of the networks of each of the four industries provided additional insight into their internal structure and the prevalence of different roles. These roles have different impacts on how policy may be implemented successfully. Therefore one approach is not necessarily effective for multiple networks.

Table 3: Mean percentage of links within MCR for organisations within each industry (*Excluding those that do not have any MCR links)

Study industry group	Percentage of firms from survey that do not have trade links within MCR	Mean percentage of firms that have trade links within MCR*
Creative/Digital/ New Media and IT/Communications	34%	43%
Financial & Professional Services	28%	52%
Life Sciences	25%	70%
Engineering & Textiles	36%	34%

For example, from the distribution of links that firms had within MCR, we are able to identify the industries with the strongest 'hub' type structure. Hubs are firms who have a disproportionately large number of connections and are capable of a strong direct influence on how information flows across a network (their view can be spread to large numbers of firms directly).

A hub based industry is not about having a lot of firms with a lot of links; in this case well connected firms lose their near-uniqueness. Hub based networks have a few firms that have a lot of links. They are different to most firms and have more influence.

Under this definition Engineering and Textiles was the strongest hub type network and Life Sciences the weakest. This may seem unintuitive given that the region includes AstraZeneca, surely one of the largest hubs in the global Life Sciences industry. However, AstraZeneca does not perform a disproportionately large amount of their business within MCR and the measure used here, is based on proportions and not levels.

The network analysis also looked at the highest 'inbetweenness' of firms in each industry. A high inbetweenness indicates that a firm is acting as a bridge and is essential to allowing information to flow between disparate parts of a network. They therefore have an indirect influence on how information flows between firms (they can be seen as a bottleneck).

On this basis Engineering and Textiles had the network where the highest individual inbetweenness and with Life Sciences the lowest. This turns out to be the same ranking as the hub measure, and suggests that the various hubs are linked by bridges. However, there is no requirement that this be true and hubs could be isolated or linked in a variety of ways.

5.2

Secrecy and absorptive capacity

Trade linkages give one way of calibrating a network, but the willingness to use and form innovation networks, will also be governed by the ability to absorb innovation and the desire to keep it secret. The survey information was used to derive information on both of these. Questions on the activity of businesses in protecting their innovations were used to construct a secrecy index for each firm. From these answers we can build a picture of how active firms in an industry are in shielding their innovations, and thus part of the picture of how easy it is for innovations to spread.

The secrecy index is a figure between 0 and 1, which quantifies the extent to which an individual firm protects its innovations. If firms protect innovations, the ability of a network structure to spread innovation is reduced.

Absorptive capacity for innovation depends on a number of factors:

- the knowledge parity between the firm with and without the innovation (including its skill base, management and resources);
- the importance the firm without the innovation places on absorbing innovations; and
- the involvement of a firm in wider networks – knowledge transfer partnerships, business networks, links with higher education institutions, trade organisations, cluster organisations, and so on.

The survey asked firms about their involvement in the final factor (wider business networks), as this is the most relevant from a network perspective, and from this we are able to construct an absorptive index for each firm. The background literature also showed that the ability to absorb innovation was intimately tied to firms' involvement in the network of firms around them.

5.3

Constructing the model

The network model that has been built using this information consists of agents, which represent innovators within MCR, that are linked together. These links represent innovation relationships. In the model, agents have the ability to generate an innovation and, through the network of links and their behaviour, this innovation can spread to others.

For simplicity we refer to these agents as firms in most of the text below but they are actually any kind of organisation that is capable of implementing an innovation – a firm, or partnership, or not-for profit or publicly owned. The term 'firm' has been chosen to represent all these types. Innovation is the implementation of something new – however it is important to keep in mind that the idea itself, or the invention, can occur elsewhere.

Analysis of the model aims to discover insights into the most likely drivers of a widely spread innovation and to which characteristics of the model this is most sensitive. Of course any model is a simplification of reality in order to aid understanding. Here the study aims to capture the key elements in decision making which have been identified in the literature. However, this study does not aim to map the complete set of linkages in MCR. Not only would this be impossible, but since the network will be continually changing and developing, it would also be pointless.

5.4

The spread of innovation through mimicking

Copying others' innovations is widely held to be important, with take-up of new products accelerating as more have already taken it on board. However, the network model showed that the copying relationship is a surprisingly poor method for the spread of innovation.

Copying, or mimicking, occurs when a firm is convinced that this is a good idea. Some firms (like consumers) may pick up ideas early when there are only a few adopters. Most, however, have a threshold that sets the proportion of other firms which need to have adopted an innovation before they do.

In consumer markets this behaviour explains the well-known 'S' curve, where it takes some while before there are enough consumers to break through to the majority and accelerate the take-up. However, as a method for the spread of innovation, this turns out to be very weak. Typical penetrations of between 0.1 to 2.0 percent were seen in the model when firms were only allowed to use this method as a route to adopting innovation.

The mimicking mechanism is a poor method for the spread of innovation for two reasons. First, the mechanism works effectively only once a certain proportion of a firm's link-partners have already adopted the innovation. Therefore a large number of convergent conditions are required to be met before the innovation can spread. Second, innovation emerges from a limited number of firms, usually a single organisation or clique of collaborators.

Innovation will only be able to spread on this basis if it happens in firms which have both many links and whose links are to others with a high propensity to copy. It is not enough, for example, to have a hub (even if it is innovative) with lots of links. The firms on the end of the links must also have a high propensity to copy. This combination cannot be guaranteed, although the sector with the strongest hubs, Engineering and Textiles, does also exhibit the strongest tendency to innovate.

5.5 The spread of innovation through exchange

The exchange relationship is much more effective in spreading innovation across the network of firms. This is a more direct transmission of a new idea that depends on the willingness of one organisation to pass on an idea and the ability of another to absorb it. It does not therefore require the absorbing organisation to consider who else has already adopted the innovation.

Using only this method for the spread of innovation, cascades can reach up to 60 per cent of all firms in the model's network.

The exchange relationship is able to drive global cascades of innovation, whereas the mimicking behaviour alone is unable to. A global cascade is where an individual innovation spreads to its maximum extent. Not all innovations will do this, even where there appears to be an effective network. One agent's failure to 'use and pass on' as it were, can stop the process and there are many reasons why this could happen due to timing, pressures on relevant staff, financial constraints and so on.

The method is effective for the spread of innovation because it only requires one of a number of possible conditions to be met. Of all the other firms a firm is linked to, who have the innovation, only one relationship needs to be exploited for the innovation to spread.

The firm wanting to receive the innovation has a number of opportunities for this to occur – if one of its link-partners does not match this condition, it looks at the next, and so on. As such, cascades from only the exchange relationship more easily penetrate the network structure.



PASS



USE



&



ON

5.6 Cascades in different industries

The ranking of the performance of industries by their ability to spread innovation, remains constant across all the ranges of the variables in the model. This conclusion assumes that the maximum number of links a firm is capable of is the same in each industry. This result removes the constraint of having to consider the exact parameterisation that applies to the City Region’s economy.

The spread of innovation is dependent on the capacity of the network to facilitate a cascade across all agents, regardless of where an innovation starts. It is not the same as the ability to engage in innovation, which was shown in Table 1.

According to the quantitative survey, the Financial and Professional Services sector has the highest capacity to spread innovation and Life Sciences the least. The qualitative survey suggests that intense competition in services means that a new idea has a shelf life of only six months before it has been adopted by other providers, while those in the Life Sciences stress the constraints of regulation and the long development time requiring the formal protection of IP. Creative/Digital/New Media/IT/Communications industry and Engineering and Textiles are second and third respectively as shown in Table 4.

Some of the possible reasons for the relative slowness to spread innovation in the Life Sciences sector were set out by one interviewee – as shown below.

“Government regulation and the costs of clinical trials are the major external constraints reported by the companies in life sciences. The industry is heavily regulated in the UK, which brings a set of challenges – financial as well as social concerns about new ideas – which can make the sector very slow to adopt new ideas. As a result, some firms report that in some fields, there is a drift to undertaking bio-tech work in India and China where regulation is lighter.”

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More strongly linked industries generally allow for a greater degree of penetration of the innovation, i.e. more firms adopt it. The behaviour of firms in secrecy and absorption is as important as the network structure in driving global cascades of innovation.

Table 4: Ranking of industries by ability to spread innovation

Rank	Industry
1	Financial and Professional Services
2	Creative/Digital/New Media and IT/Communications
3	Engineering and Textiles
4	Life Sciences

5.7 Comparison of survey and model results

It is important to understand how the results of the survey relate to results of the network model. Table 5 presents a comparison where the four industries of interest are ranked in each case by:

- their ability to innovate;
- ability to absorb;
- secrecy index (with the lowest index first);
- the density of their network, and
- the model results for the spread of a single innovation and multiple innovations.

The model results then bring together the characteristics of the firms and organisations that have been studied and the importance of networks to these industries.

If we were to imagine a city regional economy without a network structure, it is clear that Life Sciences would be the least innovative under our analysis, indeed it had the lowest mean innovation index. The Engineering and Textiles industry would be the most innovative, but only just, since the mean innovation index of the top three industries varies by only 6% and the statistical Kolmogorov-Smirnov tests on these distributions showed them to be statistically similar. The detailed results are available in the associated papers.

The network model captures in broad terms this feature of the survey data – that industries with significantly lower innovation indices, such as Life Sciences, significantly underperform in their ability to spread innovation compared to the sectors with higher mean indices. Despite having a well-connected network and a low secrecy index, Life Sciences performs poorly. Its difficulty in absorbing innovation would appear to be the main culprit. This may be due to regulation,

whether in the pharmaceutical part of the sector or the broader medical delivery part of the sector.

The lack of hubs in this sector (and therefore the need for bridges) means that there are strong routes for the dissemination of available innovations, but clearly these are harder to take up. Ironically, the lack of a strong regional hub that can address some of the regulatory difficulties and produce a community of interest might be a possible barrier.

The existence of a global firm in MCR does not necessarily appear to be a particular benefit to the City Region’s (as distinct from the national) economy. It does not create a mechanism for the spread of innovation in MCR’s economy, even though it may play an innovative role itself.

What the model illuminates here is the differentiation that the role of network dynamics can introduce in industries. Once a city regional network structure is in place, we see that in the final evaluation of the model (when the propensity of firms to innovate is taken into account) the outcome is as much related to the diffusive and absorptive abilities of firms as their innovative abilities.

In the case of Engineering and Textiles there is a different dynamic. This sector has a high propensity to innovate, but its highly structured network makes this more a set of individual (rather than collaborative) actions. This sector has strong hubs and the most bridges (or bottlenecks) in its structure. This may be the result of the long history in this sector that has created a set of traditional relationships where the chance of a serendipitous move is relatively low. It is also the most secretive of the sectors and shows the weakest capacity to absorb ideas. In such a sector, an innovation could potentially have strong reach but only if it happens to start in the right place. However, most will peter out quickly.

The strong innovation performance thus operates on an individual basis and ideas will spread slowly if at all. Enabling a stronger spread of new ideas will require a different approach to that in the Life Sciences by fostering less traditional networks and possibly greater openness.

Financial and Professional Services exhibit a different pattern. Here, there is an effective and relatively unstructured network, like Life Sciences. However, unlike Life Sciences, there is strong capacity to absorb and little secrecy, which makes this network the most likely to generate a cascade, once an innovation exists.

Interviewees reported that ‘above all else, innovation is driven by the market’. Principally, this happens through interaction with clients, with ideas from client meetings being ‘fed up the pipe’. For larger companies ideas are developed as part of a specific project, so innovation

becomes an embedded process within contract work. This means that most employees and partners have to be alert to spotting new market opportunities’ and that ‘the adoption of innovation tends to happen quickly.’

The relatively low level of innovative activity might partly be the result – once there is something new it becomes business as usual rapidly, with consequent benefit to the customer, but costs to the innovators. If it is hard to hang on to the benefits this may deter the initial introduction of innovation. In this case, competition is probably the most likely spur to be new.

Creative and associated sectors sit in the middle of the results. Though the networks here are not the most dense and there is considerable secrecy, firms are nonetheless able to spread innovation quite effectively. The ability to absorb innovation may be key here and the sector lies second in the ability to innovate.

Table 5: Comparison of survey and model results on the drivers of the ‘innovation network’

Rank	SURVEY				NETWORK MODEL	
	Ability to innovate	Ability to absorb	Secrecy (least secret first)	Density of network	Single innovation	Multiple innovations
1	Engineering and Textiles	Financial and Professional Services	Life Sciences	Life Sciences	Financial and Professional Services	Financial and Professional Services
2	Creative/Digital/ New Media/IT/ Communications	Creative/Digital/ New Media/IT/ Communications	Financial and Professional Services	Financial and Professional Services	Creative/Digital/ New Media/IT/ Communications	Creative/Digital/ New Media/IT/ Communications
3	Financial and Professional Services	Engineering and Textiles	Creative/Digital/ New Media/IT/ Communications	Creative/Digital/ New Media/IT/ Communications	Engineering and Textiles	Engineering and Textiles
4	Life Sciences	Life Sciences	Engineering and Textiles	Engineering and Textiles	Life Sciences	Life Sciences

6.0 POLICY IMPLICATIONS

The previous section has discussed the results for the individual sectors on which the study team concentrated.

It shows how the capacity of firms and the networks in which they operate can produce a range of potential outcomes. This need for innovation support, which is targeted to specific needs, is in line with the experience at, for example, Manchester Science Park. Here it is understood that making connections is a very focussed activity that requires careful management.

Some suggestions for potential ways to engage in particular mixes of firm and network characteristics have been suggested in Section 6. Here we present some more general conclusions.

6.1 Just one link

The survey identified a large number of firms in MCR that had no trading links with other firms in the region, particularly in the Engineering & Textiles and the Creative/Digital/New Media and IT/Communications industries. It is important to understand the innovative abilities of these firms.

Analysis of these responses to the survey did not identify any particular characteristics that differentiated them from the overall sample. They appear to be engaged in a similar distribution of activities to generate internal innovation as firms that held business links within MCR.

This study did not set out to address why they are not engaged with the wider MCR network and further research would be beneficial. However, the results of the network model demonstrate that increasing connections improve the chances of generating cascades of innovation, whatever the characteristics of the firms or other organisations.

This study demonstrated that increased connectivity in a proximal network improved the capacity of that network to spread the innovation of one firm to others, but only when these relationships were collaborative and direct. If additional links are solely used to observe and mimic the innovations of others, then these additional links have very little impact and in some cases are detrimental.

The addition of just one link between each isolated firm and the wider City Regional system will increase the capacity of MCR's economy to benefit from innovation. As it stands these firms may innovate, either through their own internal processes or by engaging with firms outside MCR, but this will be contained – the innovation cannot spread beyond the boundaries of these isolated firms to the rest of MCR. The development of relationships with other MCR businesses will allow this innovation to be adopted by a wider audience. This will be particularly important in facilitating links across sectors and through the supply chains.

Once these firms are included into the City Regional network additional links will continue to be beneficial, as new routes will be created for innovation to spread through and these may circumnavigate firms that otherwise prevent an innovation reaching its full potential.

However, policy maker control over innovation networks is necessarily limited. Ahrweiler, de Jong and Windrum note that “processes in networks are non-linear and self-organising” and that innovation networks are “evolutionary transitions leading to self-organising interaction patterns”¹³. Yet, although control is certainly impossible, influence is not.

The creation of ‘just one link’ between previously internally isolated firms and MCR's network is possible through the introduction and promotion of business networks and the like, that specifically target previously internally isolated firms. These firms may be large multinationals with diverse international links who are located in MCR, but do not necessarily interact with other firms in the region, or may be small firms with few or no regional or wider links. Encouraging previously isolated firms to enter the network is crucial.

The literature review and the modelling have shown that innovation is largely collaborative and cumulative. If firms in a regional economy are not collaborating, the innovative ability of the City Region is limited. This is not to ignore the potential for innovative firms that are connected to networks outside the region. However such firms are then essentially not part of the City Regional economy and are moreover likely to be footloose since they will not be locally embedded.

The potential for an Innovation Hub would clearly help improve the linkages between existing knowledge communities and by doing so may well add the small number of linkages that are necessary to create an effective innovation network in MCR.

It should be noted that not all linkages will result in innovation. Effective linkages will need purposive communication of the kind that the Science Park tries to provide for its occupants.

¹³ Ahrweiler, P., de Jong, S., and Windrum, P. (2002) Evaluating Innovation Networks, in: Pyka, A., and Küppers, G. Innovation Networks: Theory and Practice, Edward Elgar Publishing.

6.2 Beyond sectors – exchange not copy

The network model highlighted the effectiveness of direct collaborative business relationships, over group competitive pressures, as a means to both spreading innovation to a wider audience and causing this to occur more frequently. Furthermore, the study demonstrated that only a relatively small increase in the degree to which inter-organisational links were used for such a purpose, dramatically increased the number of businesses that could benefit from an innovation.

The Manchester Science Park has established that refining the messages for their clients and occupiers is an essential element in creating meaningful linkages and relationships. Indeed, too much communication can be unhelpful.

“In beginning the task of moving Libra’s content creation skills into a more digital environment, they participated in a residential workshop run by the Regional Screen Agency Northwest, Northwest Vision and Media in Autumn 2007... they have met and subsequently partnered with a social networking/online community building specialist company called Ymogen, based in London. In particular, they have developed an educational online social networking site for young people, ‘The Big Shakespeare Mash-Up’, which is an application of Ymogen’s proprietary technology that supports young people to film their own scenes from Shakespeare plays and then upload, share, combine and comment on these online.”

BOP Consulting

A focus on business development through classic sectoral based policies, such as industry commerce events, can at best inhibit, and at worst prohibit, the spread of innovation. Both the qualitative work and rigorous modelling in this study has shown that direct collaborative business relationships are significantly more effective than group competitive pressures. These relationships are much more likely to be established cross-sectorally. The classic approach of business industry network groups as a model for spreading innovation is in fact extremely inefficient.

There are a number of reasons for this. Within industry specific networking groups, competitive pressure and the need to gain and sustain a competitive advantage over rivals can inhibit the flows of information between firms. Within the vernacular of the model this is analogous to bringing together groups of firms who desire to keep their innovation secret. Cross-sectoral connections are more likely to mean secrecy barriers are lowered, and the vital condition in the network model of having a secrecy index low enough for innovation to spread, is more likely to be met.

In the network model, the spread of innovation can occur using one of two mechanisms – the copying mechanism and the exchange mechanism. Industry specific networks are more likely to make use of the mimicking behaviour, where mimetic pressure means firms adopt innovations simply because they see a critical amount of their competitors doing the same thing. This mechanism for the spread of innovation is very poor. Mimetic behaviour alone results in a very low penetration of an innovation across a network structure.

14 White, D., Sectoral Innovation – Initiative beyond clusters, Keynote speech of the 10th IRC Network Annual Meeting, 27th-29th September 2006.

Cross-industry organisation connection is better characterised by the exchange relationship rather than mimicking behaviour. Firms from different industries are unlikely to be able to, or indeed want to, mimic the behaviour of other firms. However, the ability to exchange innovation does exist, and the barriers to such an exchange will be much lower than with intra-industry links. Competitive pressures will be absent and the flow of innovation is actually much more likely.

Innovation is not driven by the average behaviour. It is driven by that single spark of a new idea – the defeat of habit by originality. Industry specific business networks can cement habit and the average behaviour. Although such business networks can be and are very useful for more mainstream business development, innovation is very different. The qualitative survey shows how many respondents stressed the role of clients in generating ideas and innovations, whether in new textiles, a management consultancy idea, a medical service or a film.

Although the creation of business networks that are tailored to specific industries has become the policy orthodoxy, our research suggests that when the aim is to foster and spread innovation, such business networks can be far less effective than cross-sector business networks. A key policy result of the network study is to encourage those links that are best able to aid the spread of innovation. Cross-industry links are just such.

There is agreement with this point in the literature. For example White notes that “contacts between sectors are important because they bring new ideas and provide access to new markets, based on the knowledge from other sectors”¹⁴.

The study therefore recommends the creation of networking groups and initiatives that encourage cross-sectoral networking which has the capacity to develop exchange relationships.

Creating such potential will have to be done in a focused way to take account of the differing characteristics of firms and organisations with respect to secrecy and absorption.

6.3 A new (old) role for universities

MCR has a significant cluster of university activity. The study has indicated that there is scope for these universities to play a central part in the innovation network, albeit a very different role from that which has been most recently put forward.

The model of university engagement, which has been supported by policy in recent years, has been through the patenting of inventions and the spinning-off of new ideas into start-up companies. The commercialisation of inventions, and hoped-for profits from this, has driven much of university economic activity. Universities are set up to undertake invention, and the route to innovation from this is via spin-offs. However the spin-off often wraps itself in layers of secrecy that will limit the potential for influencing others and extending the innovation.

Emerging research is encouraging a return to the role of universities as facilitators of wider economic linkages¹⁵, an argument that this study supports. Universities should be enabled and encouraged to play a role as social spaces where links between other economic actors are brought together. As social spaces that bring together firms and other important parts of the innovation process universities can function as important bridges in the network structure, creating the vital links between firms in the region that facilitate the spread of innovation.

This role means universities become important in creating low barrier routes in the City Region's network that can be used for the spread of innovation, breaking down the secrecy barriers in the network structure and enabling the important exchange relationship to function. This model moves away from the focus on commercialisation in universities as a source of innovation, and back to an older model of universities as facilitators of inter-organisational relationships. Universities become important hubs in the wider network structure. Historically, the Manchester Joint Research Council fulfilled such a role.

“Several of the Financial & Professional Services companies interviewed are involved in specific research collaborations and more general relationships with HEIs. Two companies are involved in research with Lancaster University Business School, one in relationship to leadership (CFS), and another sponsors a degree as a useful way to access new talent. Relationships were also cited with York University (E&Y). However, a number of interviewees felt that academic research collaborations in this area need to be managed carefully, because of different working practices and expectations.

In Life Sciences, the ideas are sourced externally from a network of academics and researchers, and companies concentrate on bringing them to market. Even for AstraZeneca, close links with universities, as well as small research companies, are crucial to their innovation process.”

BOP Consulting

¹⁵ For example: Lester, R., Universities, Innovation, and the Competitiveness of Local Economies, IPC Working Paper, MIT.

The network model showed exchange behaviour to be the important mechanism by which innovation can spread. Universities can be key enablers of this exchange mechanism by bringing together firms from a range of industries into an open and collaborative setting where knowledge exchange is enabled and encouraged.

6.4 Key performance indicators

The key metrics that policy makers need to monitor in the future economic development of MCR are those used to feed into the network model developed in these reports.

The model used the following innovation indices to model the innovative performance of MCR:

- innovation index;
- ratio of absorptive index to secrecy index; and
- network density.

The report details how these indices are constructed. In order to measure these indices in the future, primary research using questions modelled on the Experian questionnaire would need to be repeated.

An increase in network density, a rise in the innovation index and an increase in the ratio of the absorptive index – to – secrecy index are all indicators of an improvement in the capacity of the network to spread innovation.

The most influential of these KPIs is the absorptive index to secrecy index ratio. This is a measure of the extent to which organisations are open to the outside world in relation to their focus on protecting their innovations. In this study openness was measured in relation to engagement with third parties, universities and so on, while secrecy was measured in relation to the use of copyrights and so on.

The network model has suggested that the exchange relationship is the most important mechanism by which innovation can spread. Affecting this indicator requires encouraging firms to engage in the wider networks by which innovations spread – knowledge transfer partnerships, business networks, links with higher education institutions, trade organisations, and so on.

Given what we have said above about the importance of cross-sectoral links, we suggest that a further KPI is the number of cross-sectoral networking events being run per year.

The fact that the industries, with both the most and least bridges and hubs, are the least able to spread innovation indicates that these characteristics play only a minor role in influencing the dynamics of innovation¹⁶.

Firm behaviour and the overall level of connectivity are more important. The reasons for this are complex but essentially because the networks are clustered there are multiple unique paths between firms. These paths act to diminish the relevance of structure and places a greater importance on what firms and organisations actually do.

Successful innovation reaches across a network. Its ability to do so rests as much on the ability to absorb the innovation and willingness to pass it on as the number of connections. Absorptive capacity is measured by the ways that organisations engage with the world beyond them; such engagement is most simply measured by firm level data lists.

Of course, innovation will spread in more hidden ways and not every connection or every link is active and effective. However, the bigger the lists the more likely it is that there are effective links.

It is important that policy does not bombard the lists with too much material or too many initiatives. Too much connection can create noise in the message. But the potential can be measured by the ability to create the lists. It is the quality and not the quantity of actual engagement that will make a difference.

¹⁶ The statement only applies to the average behaviour of the network and not to the range of possible outcomes. The presence of hubs and bridges certainly has an impact on the range of possible outcomes.

ANNEX: SUMMARY OF QUALITATIVE RESEARCH AND ONLINE PANEL SURVEY

This annex contains a summary of the qualitative work and the online panel survey conducted for the Innovation Systems project.

Introduction

These elements of the research follow the rest of the project in focusing on four specific sectors: Creative/Digital/New Media and ICT; Life Sciences, Engineering and Textiles; Financial and Professional Services.

The qualitative research involved interviews with businesses, trade bodies and support agencies in each sector. This element of the research was designed to provide the study with real-world experience of innovation practices. The findings have been used to:

- develop the telephone survey questionnaire designed to provide quantitative results;
- test against the network modelling process and the literature review; and
- provide case studies and illustrations that shed further light on how the innovation system in Manchester City Region functions.

It should be noted that, to avoid duplication of survey calls and to increase cost effectiveness, the quantitative telephone research for this project was carried out by Experian. These results are reported elsewhere. The qualitative work reported here is designed to add flavour and colour to the telephone survey and to build on it.

In timing terms, an initial set of interviews to help frame the questionnaire were held in March and April. Further qualitative interviews followed in the summer and autumn once the quantitative survey had been carried out. The agreed range and number of interviews were undertaken though some industries proved harder than others to find willing respondents. The Life Sciences sector was also the subject of consultation in this period by Manchester: Knowledge Capital and effort was made to avoid concurrent and duplicating interviews.

Qualitative research

The following sections summarise the findings from the firm interviews, consultation with sector and innovation support bodies, and the focus group. It should be stressed that the sector summaries are not intended to be authoritative and detailed overviews of each sector in the Manchester City Region. Rather, they pull together relevant observations from the qualitative work that informs and supports the overall themes of the current research.

The focus of this research has been to establish the nature of the innovation process in the sectors that were identified as of particular interest.

17 Innovation Networks Study for Manchester City South Partnership, November 2008

It has been informed by additional discussions and interviews with those engaged across Manchester as a whole. In particular, Manchester: Knowledge Capital provided an overview of their activities and impact, and the report by Zernike¹⁷ for the Manchester City South Partnership also provided important background. This report concluded that an Innovation Hub would provide the opportunity to increase linkages across a variety of networks and thus improve innovation.

Each sector summary has two elements: a general overview and one individual case study. It should be noted that, due to the relatively small numbers of interviews that were possible within the time and resources of the project budget, some priorities had to be established within each of the four sectors in order to give the qualitative research more coherence. So, the focus of the qualitative research was as follows:

- **Engineering and Textiles: focus on Textiles;**
- **Life Sciences: Bio-tech. and Pharmaceuticals;**
- **Creative/Digital/New Media and ICT: software, new media and TV; and**
- **Financial and Professional Services: professional service firms, banking.**

Textiles

Manchester's history and development is inextricably connected to the growth of the City's textile industry throughout the nineteenth century. Famously known as 'Cottonopolis', Manchester's population boomed during the early part of the 19th century as mills were erected. Technological innovation was at the heart of this growth and urban development: Manchester became a major centre for manufacturing innovation, linked to the textile industry, as technological change facilitated the shift from hand-spinning and handlooms to the steam powered mills of the late 18th century, to the power looms of the 19th century. During the 20th century,

Manchester's textile industry suffered a steady decline. The First World War stopped access to the export markets; meanwhile cotton processing in other parts of the world increased. Underlying structural changes began to supplant the old industries, including textile manufacture. In the 1970s the northwest went through a massive rationalisation in the textile industry. The companies that survived were those able to diversify, into areas such as technical textiles (an umbrella term that encompasses a wide range of uses for textiles in areas such as aerospace, defence and health).

Today the City's textile industry is diverse. Some elements of the 'rag trade' still exist in the City Region, but these are relatively autonomous and are not engaged with the research base, either commercially or through links to higher education research. The manufacture of technical textiles sector in the region is relatively successful. However, many of the key companies in this Northwest 'cluster' are actually based outside of the Manchester City Region (MCR). But within MCR, there remain a range of interesting companies operating within the textiles value chain but who are not themselves engaged in manufacturing.

Where do ideas come from?

The case studies suggest that the textile sector in MCR is highly receptive to new ideas, if they can be easily marketised. For Character World, who acquire licences from media firms such as Lucas Entertainment to design, manufacture and sell official Star Wars bedding and other textile goods, 'ideas come from everywhere', they have 20 employees in areas of design and product development, and clients approach them externally with ideas for new products. Other companies consulted with generated ideas largely from external sources, such as interaction with the trade, meeting and talking to suppliers and visiting key conferences. Dedicated processes for receiving feedback from consumers were also used to feed into product development. Within the smaller companies, ideas generation was less formalised, and largely occurred in response to customer needs.

Capturing ideas

Processes for capturing ideas were largely unstructured in the small businesses interviewed for the study, though as noted above, firms are aware of the importance of harnessing information and feedback from customers and suppliers in particular, and some also report the importance of regular reading of trade publications to maintain awareness of peers and relevant technological developments.

Uptake of ideas

The majority the companies consulted felt that they were very open to new ideas, and that it was easy for a new idea to get taken up within the company. However, it should be noted that the consultees are not very representative of the sector as a whole. Gaining access to interviewees in this sector was more difficult than in any of the other three sectors, with many responding badly to the idea of talking about innovation: 'we don't do that' being a characteristic response. Consultation with TexNet¹⁸ confirmed this observation. Those companies that did participate in the research tend to be relatively more advanced in their innovation processes than the sector as a whole.

External constraints

In the textile industry, there are certain ISO regulatory constraints on innovation¹⁹. This means that products and processes used have to pass all the relevant tests, with outsourced providers needing to be audited, and yarns tested for safety. Furthermore, there is a set of market based constraints. Some companies sell direct to trade, and not to the end consumer, therefore any new products have to be acceptable to the retailers, who can be quite conservative. Others are dealing with global companies. For example, Sage Zander, who deal in fibre carbon, explained that there are a handful of established international competitors that act as de facto gatekeepers to the market, and this has made market-entry difficult.

Partnering for innovation

There was no evidence of partnership working with other companies in our research. This was backed up by consultation with TexNet who explained that many of the textile companies in MCR, including those in technical textiles, are family run businesses with little interest in networking and collaboration, particularly with their closest peers 'down the road'.

Knowledge of competitors

All companies consulted knew who their strongest competitors were. They varied from regional, national to international competition, depending on the nature of the sector. They 'run into' each other from time to time, but there is no formal interaction.

Membership of business-specific networks, associations and forums

Most of the companies consulted with belonged to/use some form of business network, ranging from generic ones such as Business Link and Chambers of Commerce, to a national membership organisation for Chief Executives. The smallest company did not belong to any formal group or networking organisation; which was symptomatic of the small, relatively restricted nature of the network in which the firm was embedded.

HE research collaborations

The majority of companies consulted were actively involved in research collaborations with universities. This is not typical of the wider sector. Two had a regular work placement scheme with two different HEIs. Character World are involved in a research project developing the art of bedding with the University of Manchester (previously UMIST), with a product developed from that relationship now just reaching the market in Argos.

¹⁸ TexNet is the cluster support agency for the technical textiles sector in the Northwest.

¹⁹ The International Organisation for Standardisation (ISO) set standards across a range of sectors that often become law, either through treaties or national standards.

Awareness of government schemes to support innovation

In terms of awareness and involvement in government schemes to support innovation the picture was varied. While there was a general awareness of schemes, the majority did not get involved with them. Only one company was actively involved in a programme – Knowledge 2 Innovate (HC).

Protecting innovation

The protection of innovation was a mixture of formal and informal processes. Companies do use patent, copyright and trademark protection. But getting a product to market first and establishing brand recognition was also seen as key to protecting innovations. Other informal means, such as the complexity of the design and manufacture process (e.g. 'we try make to make it as complicated as possible'), were also used to try and prevent mimicking.

Hilly Clothing

Hilly Clothing was formed in 1992 by Dr. Ron Hill, MBE, the former European and Commonwealth marathon champion. Based in Hyde, the company is now one of the UK's leading brands of technical running socks and accessories. Dr Hill exploited a gap in the market to develop a range of technical performance running socks, which allowed him to combine his background in textile chemistry (he had a PhD in this area) with his running expertise. The company specialises in developing and selling technical athletic running socks and other accessories used by runners. Hilly has been consciously grown as a small-scale family business, and the range of products are sold to specialist running stores by external sales agents.

The range was initially split into two categories: Mono Skin and Twin Skin. All four socks have been improved over recent years. Major recent innovative developments include new technical socks, as well as a comprehensive range of accessories, including reflectives, hats, gloves, water carries, and neoprene products.

Hilly do not manufacture directly. They source yarns and technologies internationally as well as contracting out the manufacture. The heart of the business is therefore product development, branding and sales, which accounts for the bulk of Hilly's current staff.

The role of innovation within firm competitiveness

Innovation is crucial to Hilly's competitiveness. They develop specialist products that command a premium price at retail, rather than selling large volumes at low margins. Staying ahead of strong international competition means that fast adoption of new technology is vital. Technically, their innovation process centres on spotting trends in technology, marketing them effectively, and being the first to market. For example, their new product 'Twin Skin Anklelet' sock has been very successful, and it means that Hilly has now captured brand recognition for a specific technology.

Protecting innovation

The formal 'protection' used by Hilly for their products is trademarks rather than patents. But more informal means of protection are also crucial to Hilly: in particular branding and speed to market.

Sourcing innovation

Hilly source ideas for innovations from a variety of means, though many of these flow through the external links of the company's network:

- their suppliers show them new developments and new innovations within the marketplace;
- they attend the major sports products exhibition conference in Munich (ISPO); and
- they talk to end users – for example, every year Hilly go to the London Marathon to see what the runners are doing, and to find out what they might want.

In addition to these upstream and downstream linkages within the supply chain, Hilly has also extended their firm network and the routes by which they source innovation by developing links with the Higher Education sector and support agencies in the Northwest (e.g. TexNet). Their work with HE gives them access to new research, and additional resources. Moreover, they have undertaken a number of projects with students in which students, for instance, complete a design project of specific relevance to a Hilly product category.

They are also aware of government schemes in their sector to support innovation, and are currently involved with K2I, which offers one-to-one business support around innovation²⁰. However, sometimes they find it unclear what they are going to get from such involvements, with the time input required to participate in such schemes being a very limited resource.

Finally, more codified knowledge is also important to Hilly's innovation processes and their product development team are always reading specialist publications, such as World Sport Active Wear, for articles on innovations and trends.

Exploiting innovation

Hilly's attitude towards the uptake of new ideas within the company is varied. They are very open to new developments within their field but they have to ensure that they only spend time developing new ideas that fit very specifically within their niche area in the market. That is, Hilly are very conscious of the degree of 'brand stretch' that the consumers will accept and need to make sure that any new product lines do not dilute the overall brand that they have built up.

Constraints on innovation

Hilly also face market pressures against innovation, and these pressures arise from the fact that, at present, Hilly do not sell directly to end consumers (not even from their website). Thus Hilly's current customers – the retailers – decide what product they want to have in the store, and can be quite conservative. Many of Hilly's stockists are fairly small and with limited space. They are increasingly looking to rationalise ranges and not take on additional stock. This means that Hilly has decided to focus on a core offer and develop distinction within their specialist range.

²⁰ The Knowledge to Innovate programme is funded by the Northwest Regional Development Agency to work with small and medium sized companies based in the Northwest who recognise the importance of innovation but who require practical assistance to successfully take their knowledge and experience to the next level.

Financial and Professional Services

Over the last decade, the Manchester City Region's economic growth has been driven in large part by the rapid expansion of the Financial and Professional services sector. It is recognised as the leading centre in the UK for Financial and Professional Services outside London²¹. National and regional strategies have prioritised the sector as a key growth opportunity for the Northwest and policymakers are undertaking work to explore and exploit opportunities for the sector including: promoting MCR as a key location for Financial and Professional services internationally; identifying areas for greater collaboration; developing skills; and prioritising the development of transport, digital and physical infrastructure to build long term capacity for the sector.

Innovation has been key to the recent rapid growth of the sector nationally and regionally, much of it facilitated by the adoption of new information and communication technologies (ICTs). Within the Financial and Professional services sector in MCR, there is a polarity between a number of very large global companies and independent SMEs, with actually very few 'medium'-sized companies in between. As the interviewees for the project straddled this divide, a range of differing attitudes, cultures and processes around generating, capturing and exploiting innovation were expressed.

Where do ideas come from?

Ideas-generation varies significantly between companies. However, certain patterns emerged. Above all else, innovation is driven by the market. Principally, this happens through interaction with clients, with ideas from client meetings being 'fed up the pipe'. For larger companies ideas are developed as part of a specific project, so innovation becomes an embedded process within contract work. This means that most employees and partners have to be alert to spotting new market opportunities.

²¹ See Manchester Enterprises (2006) The Manchester City Region Development Programme 2006: Accelerating the Economic Growth of the North, p.21.

Capturing ideas

In terms of capturing ideas for innovation, the companies consulted used a mixture of formal and informal processes. For the smaller companies consulted, much of the ideas generation was captured through informal processes – by recruiting people who are keen, confident and ambitious – 'with a wet nose' as one interviewee described. The larger companies have more structured mechanisms, such as business innovation meetings, where teams working in certain areas will get together and brainstorm. Partnership working for generating and capturing ideas was also seen as key to the large professional services/management consultancies interviewed. This takes the form of both academic partnerships and other commercial companies.

Uptake of ideas

In terms of the ease of uptake of new ideas, the findings here were ambiguous. The large professional services companies report that new ideas were encouraged, across all levels of the organisation. But several interviewees also stress the importance of balancing new ideas with the need to focus on existing priorities and change programmes. For instance, the long term investment cycles in IT systems can potentially 'crowd out' other innovations within retail banking, due simply to the time and resource that they take to implement.

External constraints

Regulation is a key factor that impacts on innovation within the Financial and Professional services sector. In the financial services industry, tight regulation can impede or facilitate certain forms of innovation. Moreover, market conventions/perceptions can be key informal modes of constraint. For example, as one consultee told us, if a number of actors in the market offer free banking – in order to make money from customers' overdraft facilities – it becomes very hard for other actors to introduce an annual charge for a banking service (even if the overall cost to the consumer would be lower on average).

For other companies, clients have a strong bearing in determining the degree of ‘innovation’ that is allowed into the market. This applies particularly in the public sector. Public sector agencies are not generally very adaptable, receptive customers in terms of innovation. Contracting is instead undertaken through often tightly prescribed tendering processes that can leave little room for innovative or creative solutions. Another example where the actions of customers limits the degree to which innovations can be adopted is in many areas of accountancy. In the wake of high profile scandals such as Enron, creative innovation is actively avoided in areas such as auditing, in favour of repetition and traditional methods.

Partnering for innovation

Partnership with other businesses is a key factor for the companies in the financial professional services sector interviewed for this research. For The Co-operative, this occurs in the form of brand development, distribution and technology development. Partners are regional, national and international. Other instances highlight the use of outsource providers, although interviewees express the importance of matching the ethics and quality standards of outsource providers with those of your own company if the relationship is to work.

Knowledge of competitors

All companies consulted had a sense of who their strongest competitors were. They varied from local, regional and national to international – with these levels of competition roughly correlated positively to the size of the businesses interviewed. In certain areas, competition rules mean that, at a formal level, businesses said that they are constrained from talking to each other. However, informally, there is a lot of staff movement between companies in specific sub-sectors (e.g. management consultancies), leading to a more informal set of knowledge sharing and interactions between competitors.

Membership of business-specific networks, associations and forums

Nearly all of the companies consulted were members of a variety of formal business networks, associations and forums. However, the more niche the company, the less this appeared to be a relevant driver.

HE research collaborations

Several of the companies interviewed are involved in specific research collaborations and more general relationships with HEIs. Two companies are involved in research with Lancaster University Business School, one in relationship to leadership (CFS), and another sponsors a degree as a useful way to access new talent. Relationships were also cited with York University (E&Y). However, a number of interviewees felt that academic research collaborations in this area need to be managed carefully, because of different working practices and expectations.

Protecting innovation

In financial and professional services it is relatively easy and common for competitors to mimic and copy products and services. The adoption of innovation therefore tends to happen quickly – one professional services interviewee stating a window of six months as being common – with any related market advantage being spent after this time frame. Mimicking comes from peer knowledge on both the supply and demand-side and is possible because the ‘secrecy’ applied to innovations in the sector is often relatively light. Protection, where it exists, largely resides in organisational routines and processes, for instance, implementing systems that handle complex organisational processes such as customer management. These systems provide market advantage, and take time and money to establish. There are, of course, exceptions to this and particularly within management consulting, interviewees reported the use of formal measures to protect IP such as copyright and trademarks. However, while the smaller consulting companies in the research sought to gain recognition for their ideas, they did not seek to protect this formally using intellectual property law.

Innovation as a key determinant of success

Innovation was felt to be important but this varied across the different sub-sectors. For the management consultancy companies and divisions interviewed in the research, it was identified as essential to growth as the market is in constant churn with finite work available. These companies therefore feel that it is essential to innovate in order to grow and keep market share. In the financial – as opposed to business services sector – it was felt to be more difficult to measure in its scale of importance. On the one hand it was seen to be important but it was also felt to be a disruptive factor, which needed to be managed closely, as ‘innovation can bring unexpected problems’ as one interviewee put it. Further, in some areas, innovation was almost deliberately avoided, as in auditing. In terms of financial advisors, technological innovation was seen as vital, though this principally referred to the adoption of generic innovations (principally in IT), rather than through the endogenous generation and exploitation of new ideas.

Spin-offs and mergers

Spin-off activity was apparent with the larger firms in the study. Staff from Ernst & Young based in Manchester and Leeds, for instance, had relatively recently left the company in order to set up a private equity house, and have since worked extensively with Ernst & Young in their new specialism. Acquisitions are an important way of accessing external innovations for PWC, and they regularly scan niche competitors for potential acquisitions, though this was less important for Ernst & Young.

Case Study: PWC

PWC is a global professional services company with more than 16,000 partners and staff in the UK alone. Nationally, the company works across a diverse range of sectors, including government and the public sector, financial services, retail and consumer goods, telecoms and manufacturing. The work that they do includes auditing, financial services, process improvement consultancy, taxation and HR consulting. In Manchester, PWC has two offices, and specialises in work in the public sector.

The role of innovation within firm competitiveness

Innovation is deemed as essential to PWC’s growth. The consultancy market is highly dynamic and in constant churn, with intense competition for contracts. This competition drives innovation, because the work is finite, so firms are competing for a limited pool of work. In this highly competitive context, innovation is vital to market distinction and differentiation.

Protecting innovation

PWC is very proactive about protecting their innovation. They always attempt to get formal IP protection for their products and services where possible as the firm actively seeks to commoditise learning and innovation developed through bespoke service contracts. Due to their size and reputation, they have more control over this area of the market than many other smaller professional services companies and they exercise this through strict business terms that allow them to retain any IP developed through a bespoke contract.

Sourcing innovation

Within PWC innovative new ideas come from structured brainstorming sessions, on-the-job innovation (the lion's share), and through partnership working. Internally, there is a clear, dedicated structure for capturing new ideas. PWC is split into a number of divisions, each with industry specialists with responsibility for product development. New ideas are generated by these individuals, who look at ongoing industry issues and work out ways to address them. For example, currently there are a number of 'live' issues related to capital liquidity – so PWC have business recovery services within the company that are currently developing new services for clients in this area. Regional team brainstorming is part of this process, through 'business innovation' meetings.

PWC also undertake 'thought leadership' exercises, which they see as very important for idea generation. This work is often done in partnership with other organisations. For example, they regularly work with The Centre for Financial Services Innovation, undertaking global surveys of Chief Executives. The research briefings that emerged from this work have allowed them to stay in touch with new developments in their sectors and develop new products and services in response to client needs. Indeed, partnership working is a key aspect of their business model, regionally and internationally – including the use of a range of outsource providers.

Exploiting innovation

It is relatively easy for new ideas to get taken forward within PWC. Employees and partners are encouraged to have development objectives. At a junior level, this could be as simple as an idea for a client. At a more senior level, it is about developing income-generating ideas.

PWC is also involved in a number of networks and associations that allow them to share ideas. This ranges from membership of the CBI to a number of other major trade organisations; 'too many to mention'. They are also involved in a number of research collaborations regionally, nationally and internationally with universities. For example, PWC in the US has recently been undertaking research with Duke University into leading practices in offshoring/outsourcing²². Closer to home, Newcastle University currently offers a business degree called 'Flying Start' in collaboration with PWC and the Institute of Chartered Accountants in England and Wales (ICAEW). It is designed to equip students with a range of business skills that will help them develop their future career²³.

Constraints on innovation

Regulation plays a role in constraining certain forms of collaborative working that could lead to innovation. Compliance and competition rules mean that they are sometimes unable to develop ideas jointly with clients, or run joint seminars, and undertake joint ventures. This is because of the need to maintain absolute independence from their clients. However, apart from these instances, the company feels that they are 'relatively unconstrained' in terms of what kinds of innovation are allowed into the marketplace.

²² <http://www.globenewswire.com/newsroom/news.html?id=147086>

²³ <http://www.ncl.ac.uk/nubs/undergrad/flyingstart/>

Life Sciences

Life Sciences is a significant sector nationally, representing 12.5% of total employment in Great Britain. Within MCR, it is also critical, accounting for the third largest contribution to City Region GVA output in 2003. The sector is highly networked, both to the region's centres for medical research (particularly the hospitals – for example the Manchester teaching hospitals), but also with biotechnology industries due to the presence of large private sector companies and university research specialism. There is a dynamic structure for facilitating spin-out and incubation activity, largely based on initiatives undertaken between the University of Manchester and the NWDA. Therefore the success of the sector is based on close network interaction and public-private sector support structures.

Life Sciences as defined above is, however, very widely drawn. It includes the extended healthcare sector – hospitals, GPs, dentists, vets, and care homes – as well as pharmaceuticals and bio-tech. The qualitative research in this study has focused mainly on bio-tech and pharmaceuticals, as well as organisations that work on innovation within the NHS (as this is so important to the market within the UK).

Where do ideas come from?

The qualitative research demonstrates that new ideas emerge from a variety of sources, as would be expected. For healthcare research companies (and within the NHS), ideas were largely generated internally, although there is evidence that partnership activity for the development of new products is also actively pursued (by Gentronix in particular). One company interviewed for the research, Epistem, is a product development company. The ideas (or 'inventions') are sourced externally from a network of academics and researchers, Epistem concentrate on bringing them to market. Even for AstraZeneca, close links with universities, as well as small research companies, are crucial to

their innovation process. The explosion in research – estimated at 200 new academic papers per day globally – means that even the global 'Big Pharma' companies such as AstraZeneca cannot hope to compete with/keep informed about this knowledge base through their own internal efforts. This increase in knowledge and research has therefore shifted the information agenda – ideas generation for AstraZeneca is now seen as a much more open process of sharing, rather than 'keeping it in house'. This more distributed model of innovation is being promoted and supported by web-based technologies and applications.

Capturing ideas

In contrast to other sectors investigated for this study, the Life Sciences sector has far more formalised processes in place for capturing ideas. However, much informal activity takes place as well. The NHS has established an IT hub for capturing good ideas from clinicians to develop for market, called Trustech. There is also a Knowledge Transfer Network for healthcare devices that is specifically focused on innovation. Access to academic journals and e-zines is seen as crucial, as well as close interaction with the research community. Regular attendance at international conferences was also cited as important, to keep abreast of new ideas and developments in the field.

For AstraZeneca, a specific organisational structure had been created within the organisation in order to foster a culture of innovation, and to insulate their scientific innovators from the 'corporate machine'. In practice, their scientific innovators have often been acquired by buying innovative, small companies. The acquired companies are usually left as smaller units, rather than being absorbed into the parent company in order to preserve their character and innovative potential. For most of the smaller companies interviewed, there was evidence of less structured processes for capturing innovation, with more of a reliance on internal reporting within a much smaller corporate structure.

Uptake of ideas

Uptake of ideas within Life Sciences is clearly dictated by the market, and by the cost of product development. The research phase for many drugs and assays can be around eight years, which clearly constrains decisions about what kinds of ideas get taken forward. However, despite this, the research shows that a culture exists where internal take-up of ideas is relatively easy and encouraged. It is the market uptake of new ideas, particularly for smaller companies, that is far more challenging.

External constraints

Government regulation and the costs of clinical trials are the major external constraints reported by the companies in the study. Life Sciences is heavily regulated in the UK, which brings a set of challenges – financial as well as social concerns about new ideas – which can make the sector very slow to adopt new ideas. As a result, some firms report that in some fields, there is a drift to undertaking bio-tech work in India and China where regulation is lighter.

Regulation can also be a barrier in an entirely different way for healthcare devices, where there is less regulation. As one interviewee explained, when you bring a drug through the regulatory process it can take 5-8 years. This means that when it does finally get to market, it is backed up by a substantial body of research evidence. For healthcare devices, regulation does not currently demand the same level of evidence. So barriers to entry are lower, and much of the evidence of efficacy is generated in the market through usage. However, this can mean paradoxically that the relative lack of evidence stymies adoption as NICE may feel much less comfortable about the introduction of a new medical device – on which there is relatively little research evidence – than it would a heavily tested drug.

Additional market barriers to innovation, both public and private, were also reported by companies. Investors often want quick returns, and the research phase for drug development, for example, is often considered too long. Secondly, the NHS supply chain can be a major barrier to innovation. NHS contracts are frequently established for three years, which effectively seals the NHS market and drives down the demand for new innovations. In the commercial sector, the pharmaceutical market is dominated by ten global companies. This oligopolistic structure brings both rewards and barriers. If a firm manages to sell a product to one of the top companies, then everyone else follows and copies – making it easier to ramp up the sales. The downside is, of course, the difficulty of making the first initial sale to these ‘gatekeepers’, and this can seal the success or failure of a product.

Partnering for innovation

The interviews provide evidence of partnership activity. One company, Gentronix, was developing a contract research relationship with a company in the US, and was in the process of developing other relationships in the UK and Europe. Less formal network partnerships were important as well, involving clinicians, researchers and scientists within the Higher Education environment.

Knowledge of competitors

In terms of their knowledge of their competitors, two of the companies interviewed felt that they did not have specific competitors because of the niche nature of what they do. For these companies, competition operates primarily in terms of competition for inputs (research funding principally, but also skills) rather than product markets. More generally, competition is always reported as national and international in nature.

Membership of business-specific networks, associations and forums

This is a highly networked sector, with all companies interviewed belonging to business and academic networks and associations. This ranged from national trade associations, such as the Bioindustry Association, regional cluster organisations (Bionow), to international research networks. However, it was felt by a number of interviewees that there was not sufficient critical mass in biotech to warrant a local biotech network/cluster organisation.

HE research collaborations

As would be expected in such a knowledge intensive sector, close links with the HE research community are critical. Indeed, most of the interviewees in the research had worked in companies which had been directly spun-out from universities. Several companies interviewed are based within laboratory business incubation centres next to Manchester University. Academic research is critical. However, the regional cluster organisation (BioNow) felt that many of the biotech businesses maintain a residue of academic culture – in particular, that they are highly protective of their ideas, and that this can be a hindrance to the realisation of innovation. There appeared to be more collaboration generally within the smaller companies, but as you move up the size and value chain, this reduces drastically.

Awareness of government schemes to support innovation

While there was general awareness of government schemes to support innovation within this sector, generally there were mixed views as to their efficacy. Within the public and private sector environment, it was felt that grants from funding bodies were critical, by giving you the money to focus on pure research. However, the view was expressed that government-led initiatives to support innovation, such as the KTN, had little impact in terms of decision

making processes and new ideas. On the other hand, one company that we spoke to reported that access to subsidised laboratory space and, particularly, to flexible payment terms, has been critical to their survival on a number of occasions.

Protecting innovation

Attitudes towards the protection of innovation were varied. The organisation that works at the interface between the NHS and the market advises innovative clinicians working in healthcare devices to not talk about their discovery if they have any ambitions towards commercialisation. However, this can be difficult as there is a pressure within academic research to publish papers and to publicise individual research (through the Research Assessment Exercise, for example).

Patents are still the main formal way of protecting innovation in life sciences. However, there are problems with the model, mainly due to the time and expense that the process takes. It was reported that by foregoing the patent route, a company could often gain three years advantage on rival firms in terms of time to market, meaning that companies are starting to use lighter (and quicker) forms of formal IP protection, such as Trademarks.

Informal methods of protecting innovation are also used. For example, one company described how they put chemical gateways into their products explicitly to stop rivals from copying them.

Innovation as a key determinant of success

All companies interviewed said that innovation was absolutely critical to their success. The cost of research was an issue, in an R&D led market, but this was seen as the same for all companies in the marketplace. As an indication of resource commitments, one company cited external research contract expenditure alone to equate to 5% of income.

Spin offs and mergers

Many of the companies consulted were relatively young and small, and therefore not at the stage where they had experience of mergers and acquisitions activity. However, there was clearly a desire from some interviewees to expand into this area. One company described that they were looking at merger opportunities to broaden the technology base of the company. As noted previously, AstraZeneca regularly acquire small companies as part of their innovation market strategy.

Case study: Myconistica

Myconistica Ltd are a spin out from the University of Manchester and Wythenshawe hospital, and a Partner Company of Amphion Innovations plc²⁴. The founder, David Denning, is a Professor of Immunology at the University, and retains a part-time post there. The company was founded in 2006 and moved to its current site in Cheshire in 2007. They have 24 staff in the Cheshire office, with six new recruits waiting to start.

They develop and supply molecular diagnostic products to aid rapid and accurate diagnosis of life-threatening invasive fungal infections, which they supply to hospitals and hospital laboratories. The products are used by hospital laboratories for patients who are severely immuno-compromised, i.e. after transplants and while in intensive care. In biotech terms, they make the diagnostic product (the 'razor blade'), not the platform on which it operates (the 'razor'). The Cheshire based office is the only one in the UK – and it contains the laboratory as well as the office staff. They are just about to open a sales and distribution office in Charleston, South Carolina.

The role of innovation within firm competitiveness

Innovation is the life-blood of their business but they are still in the early stages (products about to be launched). It is an R&D-led market, but cost is an issue. The same is true for all companies in this market – they are not selling widgets, but the market is still price-sensitive.

Protecting innovation

Ideas come from outside the company – Myconistica is a product development company. This means that they produce a diagnostic product, rather than undertaking the R&D for the chemicals in the products. They protect their products through trademark, rather than patent.

Sourcing innovation

Ideas largely come from outside the company – Myconistica is a product development company. They are linked into a network of academics and researchers, and ideas come through highly-trained staff that go to conferences, read journals, and keep up with academic research in the area.

24 Amphion, AIM: AMP, develops and operates companies in the life sciences and technology sectors.

There are no specific formal processes for capturing ideas – other than internal reporting – and, given the company's small size, there is no real problem getting ideas taken forward within the business.

Partnership and networking for innovation

They have to work with other companies, as they just supply part of the product. There are fewer of the 'platform' companies and these act effectively as gatekeepers to the development of Myconistica's diagnostic product. This 'makes life interesting', but it is vital to work effectively with them, as a small firm like them could not afford, for example, to get FDA approval (the US Food and Drug Administration) on their own.

Myconistica are globally networked within the biotech sector, as well as regionally, such as through the NWDA networks. The regional networks have been useful in terms of accessing DTI Passport for Industry funding (now defunct) but they are limited in their impact by the size of the local cluster. Myconistica feel that the Northwest does not yet have the critical mass of companies and researchers that exist in the Oxford /Cambridge/London triangle in the UK, or in other competitor locations internationally, such as Toronto.

Constraints on innovation

Myconistica's customers are hospital laboratories. The company feel that the current practices of the NHS – as the monopsony buyer for the laboratories – act as a brake to innovation. They contrast the NHS' cautious attitude, tight regulations and long term contracting decisions unfavourably with the practices of other national healthcare systems internationally. For this reason, the US represents their biggest market, with Germany, France and Spain on course to become a bigger market than the UK in Europe.

Otherwise, Myconistica see constraints on innovation related to a range of locational disadvantages:

- skills – Myconistica report that there are not enough staff locally with the right skills and it is hard to persuade skilled staff from outside the region to move to the Northwest. They believe that, at present, people working in bio-tech in the UK generally prefer to be based in the Southeast, as the larger number (and diversity) of companies enhances career progression;
- lack of suitable lab space – they found it difficult to obtain the right space when they moved away from the University; and
- lack of incentives to locate in the Northwest – this was contrasted with Ontario (where the interviewee used to work) which offers a 'one stop' shop for bio-tech companies, offering help with access to lawyers, architects, financiers. They have also been offered more help in South Carolina, where they are in the process of setting up an office. Myconistica believe that the Northwest needs a more integrated approach in terms of support packages for the sector.

Creative/Digital/New Media and ICT

For the purposes of the current research, two of Manchester Enterprises priority sectors were taken together: Creative and Digital Industries (CDI) and ICT. In reality, there is a strong overlap between the ICT sector and the 'Digital Industries' element of the CDI sector, but it does mean that the sector encompasses a potentially vast range of activities. For this reason, the main focus of the qualitative research was the activities that are at the centre of these two sector classifications – software development and internet services – as well as the more traditional TV sector.

The rationale for choosing TV is that it is currently facing significant technological and business innovation challenges. The industry in Manchester is also set to undergo a step change in terms of its size and scope with the re-location to Salford Quays of five BBC departments, beginning from 2009. The BBC move is just one element within the much larger MediaCityUK complex, that is intended to establish the City Region as a national and international centre of excellence for media and new media production. MediaCityUK should provide major new innovation assets to the MCR economy. A Media Enterprise Centre, a Northern Centre of Excellence in Media Enterprise and Skills, and a Media Research Institute are planned, and the development is hoped to eventually generate 15,500 job opportunities.

Of course, Manchester also has a long and distinguished history of innovation in electronics and electrical engineering, and computing in particular. The University of Manchester built one of the earliest computers, and developed this further through a partnership with the Manchester base of Ferranti. The ICT and communications sector remains vital to MCR, both as a generator of jobs and economic activity in its own right, and also as a key driver of productivity and competitiveness gains for all industry within the region. The sector is now the most dynamic sector within the City Region, as measured by recent GVA growth (1998 and 2003)²⁵.

Innovation as a key determinant of success

Innovation is key to the Creative/Digital/New Media and ICT sector. Much of the sector – software, IT hardware, internet applications and services, for example – is explicitly concerned with developing and bringing to market technological innovations that are taken up by the rest of the economy. In the areas of the sector where the content is more cultural and creative, rather than technology-based, producers and companies have to be highly creative in what are very saturated and highly risky markets. It is often noted that producers effectively develop a succession of 'prototypes' that never lead to a production run – i.e. each new novel or film is different from the last. Of course, this is not strictly true. The development of 'franchises' in games and films or 'formats' for TV, illustrate that some of the high development costs for new products can be amortised over more than one product and more importantly, that achieving strong sales for the first Harry Potter, Wife Swap or Lego Star Wars reduces the uncertainty of whether the next iteration will be successful.

It is also possible for cultural/creative producers to be highly creative without necessarily being highly innovative, whether this relates to the cultural form itself (genre, format, style), how this is produced (the production process), or how it is sold and distributed to the market. Often, simply the demands of being able to create and develop the next project (e.g. a TV show, a computer game) are such that the generally small companies involved in content development lack the internal resources to fully exploit their innovative potential. This is despite the knowledge that many major creative and cultural innovations tend also to be bound-up with innovations in production processes (e.g. 'talkies', 3-D computer games, rock 'n' roll) or distribution means (e.g. online games and social media sites).

Lastly, there is also a big difference within the sector between service-based companies and product-based companies, and this carries through into their attitudes and practices regarding innovation. With no intellectual property with which to capitalise the business, creative service companies have to be very focused on continual revenue generation and, as with content development companies, this can often leave few internal resources available for more structured innovation activity.

Where do ideas come from?

Ideas generation varies significantly between companies and the range of sub-sectors. Even the two software companies were very different. Transitive are a classic – but actually very rare – example of a successful university spin-out company based entirely on core technology developed within the University of Manchester's Computer Science department in the mid-1990s. Generis, a software development company that operates exclusively within the energy utilities market, has developed their products by commoditising bespoke IT service work. With creative service companies, where what is being sold is often relatively 'intangible' (e.g. design quality), the ideas tend to come from clients and internally from staff, in responding creatively to client briefs. Independent TV production is similar in that ideas are generated internally and shaped in negotiation with broadcast commissioners, though they have a less direct and hands-on input than in the development of corporate websites and other computer services.

Capturing ideas

For TV production companies, including the interviewee in the study, capturing ideas is rarely a problem. As their businesses rely, to a large extent in idea generation, a lot of resource is dedicated to this process. The difficulty for TV production companies is making a commercial return on the ideas as, historically, the independent production business model has been advanced against royalties (i.e. producers relinquish their IP in order to draw down funding from commissioners to make the programmes).

Related challenges face service companies in digital media or IT. Essentially this centres upon how to commoditise knowledge and expertise developed through bespoke contract work into some more replicable form (e.g. a software application, a new internal system). As noted above, the pressure to make many repeated sales, coupled often with a desire to not impose too much structure in order to allow employees creative freedom, can make this process very challenging for creative service companies. However, one company interviewed (Generis) had made a total transition from an IT services business to a software development company selling their own licensed products. But this step change was only triggered by the introduction of a key staff member who had developed knowledge of selling packaged software by working in the US. It also required Generis to buy back the IP that they had initially developed for a client (British Gas) through a large service contract.

Uptake of ideas

Getting software products adopted can be difficult, particularly if the company is a start-up based around new to the market technology. For Transitive, this was a major problem. The biggest single factor in overcoming it has been the networks that their investors (a collection of major US and international technology-specialist venture capital companies) – who sit on Transitive's board – bring. This has given them access to the major US technology companies that have become their core clients (e.g. IBM, Apple, Silicon Graphics, HP). To further aid this process, Transitive's investors also pushed for the company to move its head office and sales team to Silicon Valley, in order to be geographically closer to this collection of vital global 'hub' firms.

²⁵ Manchester Enterprises (2006) The Manchester City Region Developments Programme 2006, p.25.

For Generis, the uptake of their products has been aided by regulatory reform in the energy sector in the UK. Not only did Ofgem's Review of Gas Meter Arrangements create, in effect, a market for Generis – standardised meter software that can be used by a variety of competing energy suppliers – but the new companies that the regulatory liberalisation ushered into the market were more prepared to work with small, innovative companies (such as Generis) than the incumbent.

The role of the client (aka broadcasters commissioners) as a stimulator or barrier to innovation is also very relevant to the TV industry. Channel 4, for instance, was explicitly set-up with a new commissioning model in order to drive innovation in programme making. The TV production company in the research reported the continued importance of the handful of TV commissioners as 'gatekeepers' to the market. Maintaining very strong relationships with commissioners is key to success and based largely on in-person contact. This makes it that much more difficult in Manchester given that the commissioners are all based in London.

Lastly, the uptake of ideas is partly a factor of the position in the supply chain. For instance, the motion graphics and post production interviewee noted that, as their clients are usually advertising agencies or TV production companies – that are themselves working for a corporate or commissioner – it often 'feels like you're at the end of the food chain', with little control over the market.

Protecting innovation

There is a general split within the sector between product-based companies and service businesses. The software companies in the research use formal IP protection whereas service businesses use informal methods. Key to the informal methods for the digital media agency in the research is building-up reputation and branding effects. As people are so important to service businesses, ensuring that the 'key talent' in the business are happy and stay with the company is also an aspect of protecting innovation, and one that applies equally in TV production.

External constraints

The experience of any possible external constraints to innovation is very varied across the interviewees. As noted previously, government regulation pertaining to utilities and the energy market is a key enabler/constrainer for Generis. The regulatory environment in TV is also very important. For instance, while the 2003 Communications Act sought to make it easier for independent producers to keep hold of their IP by introducing new Terms of Trade with broadcasters, the Act only relates to terrestrial broadcasters and therefore any independent who's main clients are satellite and cable broadcasters remain disadvantaged with regard to rights holding.

Beyond these specific instances however, the interviewees did not report specific external constraints beyond the commercial difficulties of getting innovations take up across the market by customers (see above).

Partnering for innovation

Across the interviewees, there were a number of examples of partnering, though not all were driven by the need to search for/acquire innovations. In particular, within the creative services companies interviewed, partnering was viewed as primarily a means of business development – to win larger contracts and/or offer a greater service/product mix. Partnerships driven by innovation were, however, reported by Libra TV, who are partnering with a digital media company to develop new social networking media products, and by Generis, who negotiated with a client to become a partner in the development (and the revenue return) on software developed specifically for them but then sold onto other companies.

Knowledge of competitors

All the companies interviewed report having a very strong understanding of their competitors, though not all have undertaken formal competitor mapping. There is, however, a big difference in terms of (i) where competitors are based and (ii) the degree of interaction that companies have with their competitors. For the software companies in the research there are not many direct competitors globally as they are both selling particular solutions that, in Generis' case, is still too niche to interest potentially very large competitors into their market (e.g. SAP). For the creative service companies, competitors are more numerous and local, though London firms are often cited as the major competitors.

Membership of business-specific networks, associations and forums

This varies across the interviewees. The creative service companies are very well networked within Manchester, but this is more likely to take place through socialising with peers and clients. Transitive encourages their staff to join professional associations and societies (e.g. British Computer Society, Institute of Engineering and Technology) in order to support their continuing development as software engineers.

Awareness of government innovation schemes

Again, this varies across the companies within the research. In TV, a lot of public support is available though much of it not with the primary purpose of supporting innovation. However, Libra has participated in a scheme run by Northwest Vision and Media, that was designed to support innovation and found it very helpful (see case study below). Creative service companies tend to 'stay as far away as possible from government schemes or universities', as one interviewee put it, as the time and resource taken-up by interacting with the public sector is seen as not worth the potential rewards²⁶. One of the software companies had pursued an R&D development grant, but had to relinquish their interest in it as they were acquired by a large company during the process which meant that they no longer met the SME requirement criteria.

HE research collaborations

The basic split across the interviewees is that both software companies had some experience of collaboration with HE but no one else had any research links. Transitive remain in close contact with the University of Manchester's Computer Science department, after their spin-out. The Managing Director notes that the Commercialisation Department of the University did play a crucial role in the eventual success of the company by linking him with the venture capital firm Pond Ventures. Transitive have also observed the spin-out process to be improving due to less of an emphasis within the University on revenue generation for this kind of activity. Generis has had more limited interaction with the HE base, but did engage Manchester Business School to undertake some consultancy work on smart metering.

Spin-outs and acquisitions

The interviews contained one spin-out company that has subsequently been acquired by IBM (Transitive), while Generis had also recently been acquired by a division of Macquarrie. The motion graphics/post production company was newly constituted as an independent company following an MBO in 2003. None of the companies had themselves made acquisitions.

²⁶ The important exception to this is working more closely with universities to improve the skills of relevant graduates, though this does not happen through formal government schemes.

Case study: Libra TV

Libra TV was formed in April 2000 in Manchester by Maddy Wiltshire and Louise Lynch, two TV producers who worked together at a former independent TV production company in the area, Mentorn North. The company are specialists in children's and education programming and currently have seven staff including the two Directors.

As with many independents, they have built-up their business through having strong, long term client relationships with a small number of commissioners. Their current main client is the satellite and broadband channel Teacher's TV, where the main commissioners Libra work with came from Channel 4 Learning, with whom Libra also worked. Until the recent closure of the channel, Discovery Kids was also a key client and the commissioner that Libra worked with was an ex-boss of the two Directors from Mentorn.

The role of innovation within firm competitiveness

As noted previously, new television programmes depend on new ideas, even if these can to some extent be 'formularised' through the development of series and formats. Therefore, ideas generation is a key part of an independent's operations.

However, there is currently increasing market pressure to make more fundamental innovations in television production. These pressures are driven by changes in audience behaviour and the emergence of more existing TV channels and rival media platforms such as the internet. As audiences are split across more TV channels, and are watching increasingly less TV overall – as digital media consumption grows (web, social networking, gaming,

etc.) – commissioning budgets have fallen with some types of content particularly hard hit (e.g. domestic children's programmes), while TV commissioners are also increasingly seeking to commission 'wrap around' digital media products and services (e.g. websites, special online only mini episodes, etc.) alongside the broadcast TV product.

As children and young people are migrating to new digital media platforms faster than other audience demographics, the need for TV commissioners to undertake '360' commissioning (i.e. across all platforms) as well as online only commissioning, is hitting hardest in this market. Therefore, Libra need to ensure that they can grow from their broadcast base into this more complex 'pervasive media' environment.

Protecting innovation

Television production is protected by intellectual property legislation but, as noted above, the difficulty for independent producers has always been hanging onto these rights as they have traditionally traded them to the broadcasters in return for upfront, guaranteed development funds to make the programmes. As Libra's main clients are satellite/digital channels (e.g. Teacher's TV, Discovery Kids), they have not benefited from the 2003 Communications Act, which has made it easier to retain rights when dealing with terrestrial broadcasters. Although protection may become increasingly important in a potentially more online future for Libra, at present it is not seen as a major problem.

Sourcing innovation

Ideas generation and treatment generation – the first stage of turning ideas into products to be pitched to commissioners – is a constant process. Libra estimate that just one

in 20 ideas actually makes it into a commission. This high redundancy rate places a significant burden on the company and around 10% of annual turnover is spent on this development process.

The ideas are by no means all internally generated. Libra has strong relationships with a network of writers across the country who approach them with ideas, as well as good relationships with schools, and teachers are sometimes paid to help develop ideas.

Partnership and networking for innovation

As professionals involved in most areas of TV production (i.e. camera, sound, editing, etc.) are predominantly freelance, Libra, as with all independent production companies, has relationships with a wide range of individuals and partners. However, these are predominantly production networks not innovation networks.

In beginning the task of moving Libra's content creation skills into a more digital environment, they participated in a residential workshop run by the Regional Screen Agency, Northwest Vision and Media, in Autumn 2007. The workshop, 'Alchemy', placed eight independent TV production companies from the region together with eight digital media companies to workshop the development of new products and services.

Through the Alchemy process, they have met and subsequently partnered with a social networking/online community building specialist company called Ymogen, based in London. In particular, they have developed an educational online social networking site for young people, 'The Big Shakespeare Mash-Up', which is an application

of Ymogen's proprietary technology that supports young people to film their own scenes from Shakespeare plays and then upload, share, combine and comment on these online. Libra and Ymogen have already attracted some development funds and projects, and are currently looking for more.

For Libra it represents a big step as, not only does this move into online mean new content creation and production skills, but also potential new clients and new business models (they are currently investigating site sponsorship and advertising opportunities, for example). Libra describe the process as challenging but important, even if the Shakespeare Mash-up project ultimately does not become commercially viable.

Exploiting innovation

As noted, in Libra's existing TV business, fully exploiting their innovations is difficult due to asymmetrical market relationships with broadcasters that make it difficult to hold onto the rights. On the contrary, the potential for exploiting innovations related to their emerging digital media offer is arguably greater albeit riskier, as they have will have to more pro-actively find development funds to build the applications and sites. In order to help them navigate their way through the potential commercial pitfalls, they have employed a specialist business consultant to advise them on exploitation. Libra now have in place a Memorandum of Understanding and revenue share deal with Ymogen regarding the Shakespeare project.

Constraints on innovation

Internal resources constraints are the main factor, as with many independent TV production companies.

Online panel survey

As the literature review (see the online Appendices: www.manchester-review.org.uk) demonstrates, network relationships are important for innovation. Other elements of the current research, in particular the telephone survey, have concentrated on understanding the transactional, market-based links and relationships that firms have with each other and with other actors in the innovation eco system (e.g. universities). But there is a further dimension to consider: the social networks of a firm, as constituted through the links and relationships of individual employees and owner/managers.

Again, the literature review points to the importance of social distance in the exchange of knowledge that supports innovation. Social networks are particularly important in the diffusion of tacit knowledge, while individuals' attendance at 'temporary clusters' (e.g. trade fairs, conferences, events) can offset the need for geographical proximity and agglomeration at the firm level.

The qualitative research examined some issues of how social networks interact with market networks. But to help calibrate the network modelling process, a quantitative survey of social networking behaviour across the four sectors was also undertaken. This took the form of an online panel survey that was run three times over a period of ten weeks.

Respondents were asked about two main forms of social networks:

- longer lasting and/or 'structural' links – what groups/networks do people belong to for business purposes? Do individuals have mentors? Are there strong labour market effects linking people across companies due to previous histories of co-working?
- short-term links – what is the regularity with which people attend formal networking/ 'temporary cluster' events? How regularly do people socialise with other people in a work context?

For each of these types of question, respondents are asked about whether the interactions occur within

- the same sector/industry or cross sectorally; and
- in the same or different geographical areas.

The full survey questionnaires are included as Appendix 2.

The survey took the form of a panel survey – i.e. the same set of individuals asked questions (many the same) over successive rounds – in order to ensure that respondents had adequate recall of what events and socialising they had participated in. That is, it was felt that if respondents were asked to assess, for instance, how many times had they socialised with other people in a work context over the last three months, responses would be less accurate than asking them the same question for the last month or fortnight.

Finally, in attempting to get a snapshot of the network connections of individuals, respondents were also asked to refer people that they were linked with (in some work capacity) to also complete the survey.

Recruiting panel respondents

The initial target for the online panel was 50 individuals from firms across the four sectors in MCR. In order to 'seed' the panel, respondents to the telephone survey were asked if they would like the chance to participate in the later online panel.

While recruiting panel members from the telephone survey did work, the wider dissemination of the survey failed to recruit any new participants. This means that the response rate was unfortunately low, and this was compounded in rounds two and three by drop-outs from the first survey that was not sufficiently offset by new respondents that were referred to the survey by people they were linked with. Given the tight timescale for completion of the project, it was not possible to delay the surveys to try and work with MIER to improve the response rate.

After cleaning the survey data and discarding spoiled and/or very incomplete entries, 37 discrete individuals gave usable responses in one or more rounds of the survey. Eight people answered questions in all three rounds; nine did so in two of the three; and 20 did so in just one of the rounds, giving a total of 62 responses overall.

The majority of questions were the same in each round, so the results for those have been combined in the analysis below. There were, however, two questions that were asked only in rounds two and three, and a handful of questions that were unique to each of rounds two and three. The responses to these are discussed separately.

Main findings

The overall sample size is small. As a result, one cannot draw robust conclusions from this data, and it does not allow for any analysis of the responses according to the individual sectors. However, with this caution in mind the main findings are suggestive and are as follows:

- majority are members of business/professional specific groups and networks. 60% of the respondents belonged to a professional association/network or special interest group of some kind as part of their working life;
- benefits of membership/participation lie in broadening information flows and meeting people from outside the locality, although much of this activity takes place online;
- less use and benefits to generic social networking sites. A third of respondents used social networking sites as part of their working life, but the business benefits they gained from this were rated as being more limited than those related to membership of more specific groups and networks;
- majority had not attended any physical knowledge sharing opportunities. Just over a third of respondents had attended a business briefing, conference or seminar in the last month;
- physical knowledge sharing opportunities are closely bounded. Participation in knowledge sharing events is overwhelmingly related to activities that are directly related to an individual's business. Only a handful of respondents seek knowledge that is further afield (i.e. 'indirectly' or 'loosely connected' to their business);
- socialising in a work context is widespread, regular and more cross sectoral. 84% had socialised with people from their industry in the last month. 62% had mixed with people from other industries. In both cases such meetings were most likely to take place once a month; and
- knowledge exchange up and down the supply chain is also very widespread and regular. Most of the respondents also physically met current or potential clients, suppliers and partners at least once a month.

Contact	Job Title	Organisation name	Sector	Type
Dave Burgess	Business Development Manager	Generis Technology	CDICT	Company
Alasdair Rawsthorne	MD	Transitive	CDICT	Company
Tony Foggett	MD	CodeComputerlove	CDICT	Company
Martin Dixon	MD	422	CDICT	Company
Louise Lynch	MD	Libra TV	CDICT	Company
Shaun Fensome	Chair	Manchester Digital	CDICT	Trade Association
Lynn Barbour	Director	CIDS	CDICT	Support Agency
Iain Bennett	Sector Lead, Creative & Digital	NWDA	CDICT	Support Agency
Maddy Wiltshire	MD	Libra TV	CDICT	Company
Chris Sheffield	CEO	Milion-2-1	CDICT	Company
Michael Gill	Director	Medilink	Life Sci	Support Agency
Clare O'Neil	Deputy Chief Exec	Manchester: Knowledge Capital	Cross sect	Support Agency
Geoff Davison	Sector Lead Life Sciences	NWDA/BioNow	Life Sci	Support Agency
John Nicholson	Chairman	Gentronix	Life Sci	Company
Margaret Parton	CEO	NHS Technology	Life Sci	Technology hub
John Stageman	VP	AstraZeneca	Life Sci	Company
John Rylands	Finance Director	Epistem	Life Sci	Company
John Thornback	Chief Operating Officer	Myconistica	Life Sci	Company
David A Roper	Partner	PWC	Fin Pro	Company
Simon Oldfield	Partner	Ernst and Young	Fin Pro	Company
Daniel Mouawad	CEO	Pro Manchester	FinPro	Trade Association
David Parish	Partner	St James Place	FinPro	Company
Simon Hooton	Director	Regeneris	FinPro	Company
David Anderson	CEO	Co-op Financial Services	FinPro	Company
Adam Buckley	Head of Education & Training	Manufacturing Institute	Textiles	Support Agency
Dr Eddie Kirby	Operations Support Manager	Manufacturing Institute	Textiles	Support Agency
Bill Mills	Director	TexNet	Textiles	Support Agency
Danny Schweiger	Managing Director	Character World	Textiles	Company
Graham Richards	Managing Director	Hilly Clothing	Textiles	Company
Peter Cockitt	Managing Director	Sage Zander	Textiles	Company
Jackie Potter	CEO	City South Partnership		
Jane Davies	CEO	Manchester Science Park		

Bridget Rosewell

Bridget Rosewell is one of the founding directors and Chairman of Volterra Consulting, established in 1998 to apply leading-edge mathematical and statistical techniques to solve economic and business problems. Bridget has just completed six years as consultant Chief Economist for the Greater London Authority. She was a member of the 'Seven Wise Men' which advised Ken Clarke and also advises the Treasury Select Committee on monetary policy.

Greg Wiltshire (Volterra): Consultant

Greg is a Senior Consultant at Volterra having joined in Summer 2006. Greg has recently worked on building the economic models to calculate the increase in tax receipts as a result of London's Crossrail development under a range of scenarios, as well as the development of forecasting models of the London economy for GLA.

Paul Owens (BOP): Primary Research Director

Paul is a founder of BOP and leads the companies work in economic development and creative industries, with particular knowledge of skills and training, entrepreneurship, cluster development and economic impact analysis. In the past two years he has led a wide range of high-profile research and strategy projects for clients including the DCMS, NESTA, the British Council, the Mayor of London, Skillset, Unesco and a number of English Regional Development Agencies.

Richard Naylor (BOP): Primary Research Manager

Richard's expertise lies in the fields of urban and regional development, media and creative industries. He has over ten years of contract research experience, working for a range of clients including the DCMS, European Commission, the DTI, the Economic and Social Research Council, and the London Development Agency.

Professor Stan Metcalfe (through Volterra): Academic Adviser

He is Emeritus Professor of Political Economy at the University of Manchester, a visiting Professor at the University of Queensland and a Senior Research Associate at the Centre for Business Research at the University of Cambridge. He has been actively involved in the development of science and technology policy in the UK, being a member first of ACARD and subsequently ACOST. His research interests are currently focused upon evolutionary economics and the modelling of evolutionary processes in relation to innovation, competition and economic growth.

