MANUFACTURING CHANGE: COMPETITIVENESS AND ADJUSTMENT THROUGH EVOLVING PRODUCTION RELATIONSHIPS

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ABSTRACT

Manufacturing is a vital and significant element of the British economy. The sector has made a transition towards the production of higher value-added products and services to remain competitive in increasingly international markets. A highly skilled and competitive supply base is central to the viability of the sector as tasks once undertaken by end-manufacturers are increasingly being absorbed into the portfolio of functions undertaken by the supplier. This thesis examines how one supply industry, intermediate metal processing (IMP), is adjusting to international competition in the context of increasingly complex dependencies in the supply chain.

An intensive study of IMP manufacturers in the West Midlands (UK) was undertaken through qualitative interviews and desk based research to understand the current challenges and opportunities the industry faced. The analysis is focused on the transition to higher value manufacturing and the complexity of buyer-supplier relationships. This is developed through a case study analysis of the industry's adjustment to rising industrial energy costs and a detailed examination of customer agreement structures in shaping transactional governance structures.

The research makes a contribution to current conceptions of the spatial organisation of production and the nature of production relationships. Mature industries, such as metal component manufacture, are successfully undertaking complex and varied forms of adaptation to remain competitive. Despite transitions to value-added products, costs continue to be an important element to both competitiveness and viability. Production relationships, and specifically the nature of the inter-firm agreement, are a significant aspect of adjustment and the capacity to capture value through governance mechanisms. Contracts are a relatively under represented factor of inter-firm relationships but are found to be central to the adaptability of firms, the attainment of value and stability of the business.

FOR MY PARENTS
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Contents

Table of Figures

Table of Tables

Table of Boxes

Glossary

Alloy – Mixture of two or more metal elements to generate specific properties.

Casting – The formation of metal shapes through the pouring of liquid metal. Production sites are termed ‘foundries’.

Component – A part of a larger product manufactured separately.

Contract manufacturer – A supplier firm that undertakes a specific set of related activities for its customer. Also termed first-tier supplier (automotive industry) and full package supplier (apparel industry).

End manufacturer – The final assembly manufacturer who sells direct to the end customer. OEMs are a common term to reflect end manufacturers in automotive, aerospace and power generation industries that purchase products sold under their brand name.

Ferrous metals – Iron based metals including steel (ferrous alloy).

Forging – The transformation of metal through applied pressure (‘metal bashing’).

Further manufacturer – An intermediate manufacturer who purchases from a manufacturer and sell to a manufacture.

Jobbing – A low volume (typically ‘one off’s’) manufacturer serving an extensive range of markets. Common in the casting industry.

Surcharge – A supplementary payment that reflects change in prices from a pre-agreed ‘base price’. Surcharges are commonly used between manufacturers in conjunction with commodity purchases, such as metal.

Tooling – Equipment used to manufacture components. Tooling is equipment adapted to specific products and commonly customised to each customer in the IMP industry.

Trade credit – A common credit system in the manufacturing system whereby products are exchanged between firms prior to payment ‘on credit’. Payment is usually made within 30-90 days of invoicing.

Abbreviations

CCL Climate Change Levy

CID Confidential Invoice Discounting

EII Energy Intensive Industry

GDP Gross Domestic Product

GVA Gross Value Added

IMP Intermediate Metal Processing

IPR Intellectual Property Rights

LTA Long Term Agreement

OEM Original Equipment Manufacturer

SIC Standard Industrial Classification

1 FORGES, FOUNDRIES AND CAPITALISM: ADAPTATION AND THE INTERMEDIATE METAL PROCESSING INDUSTRIES

> *As we pick our economy out of the ashes of the financial crisis, we need to ask ourselves: what do we want the new economy to look like? How can we make it better, greener, stronger? What are our true strengths? Manufacturing is absolutely central to the answer (Nick Clegg, Deputy Prime Minister cited in ESPRC, 2011).*

Over the past few decades British manufacturing has been considered a ‘thing of the past’, a previous success story that has little significance for a country with a post-industrial economy. Manufacturing employment declined by just under four million between 1978 to 2008 (PWC, 2009) and its contribution to gross domestic product (GDP) fell to 11% by 2009 (BIS, 2010a). This has been a relative rather than absolute decline, reflecting the changing composition of the sector, its position in the increasingly internationalised economy and the nature of its business rather than reduced significance. In 2009 the sector employed 8% of the United Kingdom’s (UK) workforce (BIS, 2010b), contributed £140billion in gross value added (GVA) (BIS, 2010a) and 50% of total exports (Benedettini *et al.*, 2010). Most interestingly, the sector is the largest exporter of high-technology products (BERR and IUS, 2008), contributes the largest proportion of investment in innovation and research and development (R&D) (75%) (BIS, 2009a) and since 1980 the overall value of its products have risen by a third in real terms (BIS, 2010a). Manufacturing is undergoing a transition but it remains a critical component of the UK economy.

The growth of the manufacturing sector is a current strategic focus of government policy which emphasises the re-balancing of the service dominated British economy following the economic crash of 2008 (HMT and BIS, 2011). In an endeavour to ‘make things again’, the strategy focuses on developing existing competitive strengths and industries where the UK has a global comparative advantage, as well as developing future markets, and specifically low-carbon technologies. The focus is on advanced manufacturing where *value*[1] can be attained through product and business model innovations (GHK *et al.*, 2009). Fundamental to this strategy is the growth of UK exports (HMT and BIS, 2011). Export levels have reduced significantly over the past decade, particularly in finished manufactured goods where foreign investment in assembly plants in the UK has reduced export activity and influenced the level of imports in the supply chain (ERA, 2011). The UK ‘strategy for growth’ aims to rebalance this deficit and encourage export-led recovery. Both these objectives, high value and export growth, are underpinned by the stability and growth of the manufacturing sector and particularly the supply industries in the UK.

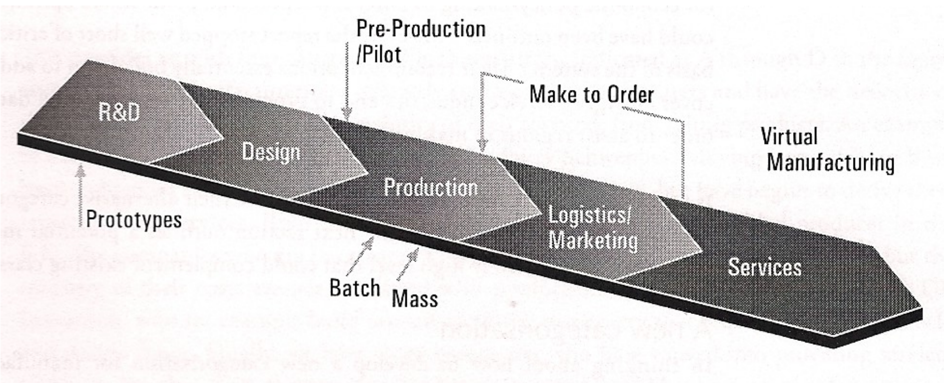
1.1 Manufacture and Production

Manufacturing involves several related activities that together produce a product. The common misrepresentation of manufacturing as purely a production process ignores the multitude of associated activities required to procure inputs, produce a product and then sell completed products. Within the production process there are several

[1] Value is defined here as the estimated monetary worth of a product or service. The term ‘value added’ is often used in conceptions of production systems and refers to the increased worth of the product for sale as a result of an activity, such as further processing. These definitions of value do not reflect the costs of performing these functions.

stages, each requiring a distinct process and capacity. Livesey (2006) identifies these stages and activities and develops a value chain definition of modern manufacturing, illustrated in Figure 1.1. Production, defined as processes that involve physical alterations to raw materials, only constitute one of the five essential activities in the manufacturing process. Production takes several forms: prototype, pre-production, scale (batch, mass) and market (customisation, component supplier, products for end-users) of the product.

Figure 1.1 Manufacturing Process and Production Types



Source: Livesey, 2006: 7

Manufacturing in relatively high-cost locations[2], such as the UK, has been forced to adapt to increasing internationalisation. In many cases, labour-intensive elements of production processes have been off-shored to regions with lower labour costs[3], leaving the UK with a distinctly different manufacturing sector to that of earlier decades. The value of the country's knowledge base is considered as a key

[2] High cost location is defined here to be a region of relatively high labour costs.

[3] The term 'labour cost' has been used to reflect the total expenditure for employers, including wages, taxes, training and subsidies.

competitive edge in a global economy (ERA, 2011), where businesses can provide essential services at either end of the mass production stage, such as product development and branding and marketing (Herrigel, 2010). This does not mean that mass production no longer occurs in the UK. Production remains a critical element of UK manufacturing but it is based on proximity to customers, design and the ability to customise products, small production volumes where a price premium can be achieved (Bryson and Taylor, 2010; Bryson *et al.*, 2008) and technologically sophisticated mass production. The distribution of employment in manufacturing reflects this transition, with a decline in production based employment and an associated rise in professional design and service activities, resulting in a roughly equal proportional split (BIS, 2010c). Non-price forms of competitiveness based on these additional services and capabilities, in conjunction with cost control, have supported continued manufacturing activity in the UK (Bryson and Taylor, 2010; Pike, 2010; Tokatli, 2012). By 2009, as much as 20% of total revenue in the manufacturing sector of the UK was attributed to services provided within the sector (BIS, 2010c).

Service functions are inextricably linked to the wider production process (Cohen and Zysman, 1987) and its international context (Massey, 2010). The British manufacturing sector is part of an international production system and the structural position of its manufacturing base is in part a result of its linkages to this system; its role is distinguished against low cost producers (Berger, 2005). It is the industries and functions that create the most value added that are favoured by new policy directives and which are of most strategic importance to the UK. These industries are based on a framework of supply industries that underpin their capacity to manufacture in particular locations (Cohen and Zysman, 1987). Retaining high value elements of the manufacturing process requires retaining capacity in the wider supply chain. Component manufacturers that can produce to short delivery times, have a skill base to meet the sophisticated demands of high technology products and the proximity to engage with the developers of these products provide cost and time-to-market advantages to further manufacturers. Backward linkages and relationships are critical to developing a strong, sustainable and vibrant British manufacturing sector.

1.2 Research Aims and Objectives

Relationships between firms have been a prominent focus in economic geography due to the increased fragmentation of the production chain (Dicken *et al.*, 2001), the need to share tacit knowledge between buyers and suppliers (Bathelt and Gluckler, 2011; Sturgeon *et al.*, 2008) and to remain flexible in dynamic production systems (Castells, 1996). There have been significant changes in the organisation of production in the manufacturing process based on greater interaction between firms. Tasks once undertaken by end-manufacturers are increasingly being absorbed into the functions of suppliers to increase their competitiveness through the provisions of a portfolio of production and service activities (for example, product design, stock management etc) (Bryson and Taylor, 2010; Fields, 2006). As a result, production systems are progressively more interdependent, generating new and complex connections between buyers and suppliers.

This level of *connectivity* within production systems (Saxenian, 1994) generates complex relationships between firms. Current conceptualisations highlight tacit forms of relationship in networked production systems (Bathelt and Glücker, 2011; Brusoni *et al.*, 2001; Sturgeon *et al.*, 2008). Interactions are contextual and relational, based on forms of trust between exchange partners that provide flexibility through information exchange and joint problem solving (Uzzi, 1996). These interactions and linkages between firms create a dynamic network of flows of information and trade that connect firms in a global economy (Castells, 1996; Hudson, 2005).

However, a variety of relationship types are found in empirical evidence. The greater absorption of core tasks by suppliers, and the associated need for increased intellectual property protection (MacPherson and Pritchard, 2007), has required different forms of inter-firm relationships that are often based on explicit agreements. Formal contracts have distinct governance structures that influence the responsibilities, flexibility and repercussions for suppliers involved in these agreements which are not incorporated into current conceptions of inter-firm relationships (Oinas, 2006; Rusten and Bryson, 2010; Taylor and Bryson, 2006).

In addition, and as a consequence of this variety in relationship forms, the firm is comprised of a bundle of relationships, each with distinct power differentials. The influence of power structures in the governance of transaction partners in the supply chain has not been fully explored (Dorry, 2008; Gereffi *et al.*, 2005). Transnational corporations, with large resource and capability stocks, have been the prominent focus of studies on governance in production systems (Christopherson and Clark, 2007). Gereffi *et al*. (2005) have identified instances of suppliers influencing the level of interdependence with their customers through the development of capabilities and product complexity. The exact nature of inter-firm relationships and the capacity for suppliers to have an active role in their own relationship dynamics requires further investigation. The combination of inter-firm connections within the firm, and the associated variety in power differentials, can directly influence the capacity and practice of adjustment.

The review of academic literature on the organisation of production, the nature of the firm and adaptation strategies has identified these two specific knowledge gaps around inter-firm relationships: the hierarchy of relationship types and the bundle of relationships within the firm. In a context of *connectivity* in production systems, this generates far greater complexity in the nature and extent of adjustment in firms. A richer understanding of inter-firm relationship structures and dynamics will allow greater insight into the adjustment capacity of component manufacturers, and their ability to survive, in an advanced economy.

These current research limitations have led to the formulation of four research questions designed specifically to address the role of connectivity and relationships in the adjustment of supplier firms in high cost locations:

(1) How, and through what mechanisms, are firms ***connected*** *with each other in the supply chain?*

(2) What is the ***nature*** *of firm adjustment and how does this vary in different timescales of change?*

(3) What is the ***process*** *of adjustment and how is this shaped by different actors, risks and structures?*

(4) How does the nature of firms external connections affect the firm's ***vulnerability*** *to change?*

These research questions will be explored through the context of a particular industry, intermediate metal processing (IMP), in a particular location, the West Midlands region, UK, and during a specific point in time, the recession that commenced in 2008. This provides a framework for understanding the intricacies of the processes, structures and circumstances of adjustment whilst also identifying wider trends in manufacturing (Lawrence, 1987; Massey, 1995).

1.3 The Intermediate Metal Processing (IMP) Industry

The IMP industry produces metal components that are incorporated in to a range of end-producer markets. The industry has been classified here as comprising two principal production activities: casting and forging (SIC 2003 27.5 and 28.4). These are the initial production activities that create a component, or part, as a functioning unit of a larger, further manufactured end product. Both industries are capable of manufacturing a range of metal components – from basic shapes to complex fabrications of multiple components – for a range of markets and production volumes – from one-off custom products to mass production. Each industry does however, specialise in different capabilities. The casting industry is better suited to manufacturing complex shapes, using customised metal alloy compositions, whereas the forging industry is able to manufacture more standardised products with accurate material products. Although the processes and materials of manufacture differ between the industries, both sub-industries produce the same *type* of product at the same *stage* in the manufacturing process. As such, they are constrained by the same factors: they are highly sensitive to the economic performance of their customer industries and both are making a transition towards higher value products to remain competitive.

Table 1.1 Significance of the IMP Industry to the UK Economy, 2007

Industry	**Number of Enterprises**		**Total Employment**		**Approximate Gross Value Added at Basic Prices**	
	Share of total UK economy (%)	Change in absolute number *(1995-2007)* (%)	Share of total UK economy (%)	Change in absolute number (*1998-2007*) (%)	Share of total UK economy (%)	Change in absolute number (*1995-2007*) (%)
Casting (SIC 27.5)	0.43	-9.29	0.49	-40.14	0.33	-47.77
Forging (SIC 28.4)	0.74	2.64	0.81	-16.48	0.55	-18.57
IMP Total	*1.17*	*-6.65*	*1.3*	*-56.62*	*0.88*	*-66.34*

Data source: ONS (2009)

Table 1.2 Export Activity of IMP Sub-Industries and Significance of Major Markets in UK

Industry		**Average Export Level of Industry (2011)[a]** *(% of total turnover)*	**Share of Manufacturing GVA (2009)[b]** *(% of manufacturing GVA)*	**Share of Whole Economy GVA (2009)[b]** *(% of total GVA)*
IMP	Other basic metals and casting *	38.7		
	Fabricated metal products inc. forging *	17.1		
	IMP sector average	27.9		
Market	Automotive (SIC 07 29)	48.2	4.60	0.66
	Aerospace (SIC 07 30.3)	62.8	4.95	0.71
	Marine (SIC 07 30.1)	20.4	0.98	0.14
	Construction of Buildings (SIC 07 41)	-	-	3.02
	Civil Engineering (SIC 07 42)	-	-	1.32

** Classifications include other processing and manufacturing industries with a higher export level*
Data source: (a) ONS (2012a), (b) ONS (2011a)

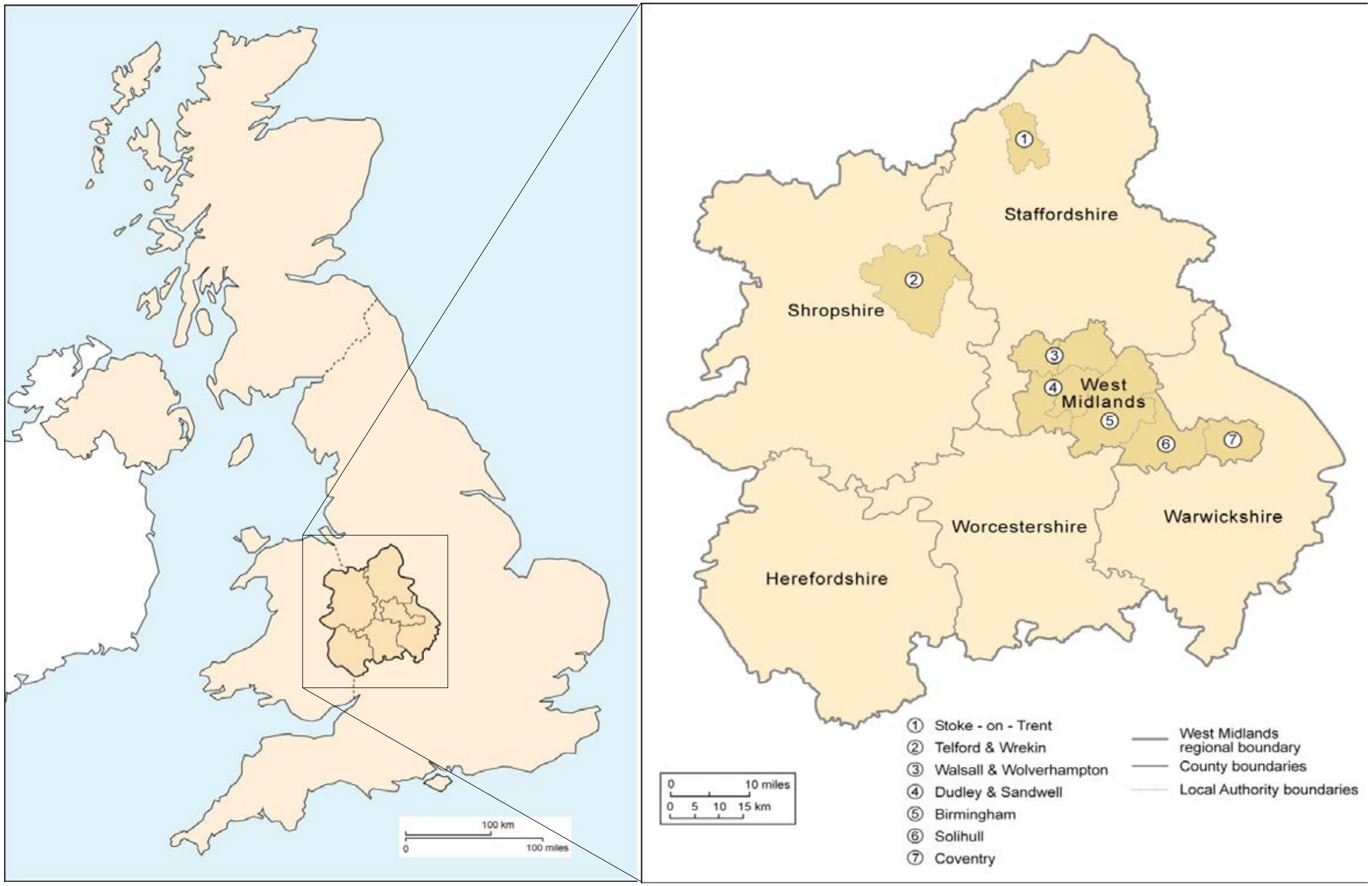
The IMP industry in the UK has experienced considerable decline since the 1970s, continuing over the past 15 years with reductions in enterprise numbers, employment and GVA, as shown in Table 1.1 above. Despite these declines, the IMP industry continues to contribute over 1% of UK manufacturing employment and enterprises and 0.88% of UK GVA (Table 1.1). The industry plays a critical role is supporting other manufacturing activities (Economist, 2012), with 51.1% of outputs from the basic and fabricated metals (SIC 27 & 28) used as inputs in further manufacturing industries (BIS, 2010b). The IMP industry provides key capabilities and services to UK based manufacturers through the provision of development work, low volume production and customisation of components for the automotive, aerospace, marine, construction and engineering markets. These industries are significant contributors to exports and value-added and together account for 5.85% of the UK economy's GVA, illustrated in Table 1.2 above.

1.4 The West Midlands

The region is located in the heart of England and is comprised of six counties, illustrated in Figure 1.2, which vary considerably in population density and industrial composition (Taylor and Bryson, 2008). The West Midlands in 2010 had a population of 5.5 million (ONS, 2011b). The main industrial counties are Staffordshire and the West Midlands metropolitan county, with regional specialisms in automotive, ceramics, food and metal manufacturing (Clayton and Lee, 2009). This region has a long history of industrial activity and the area was known as the 'workshop of the world' during the nineteenth century. Today, the manufacturing sector employs 11% of the region's working population (Medland, 2011), contributes 27% of regional GVA and has a significantly higher GVA per employee than the regional average (30% above average) (AWM, 2008). The region has an extensive supply network characterised by small firms (AWM, 2008). Although the region suffered considerably during the recession (Martin, 2010b), manufacturing firms withstood the downturn remarkably well (Economist, 2008; 2012).

The West Midlands region was selected as a ‘visible’ case (James, 2006: 295) of the IMP industry. The region has a history of specialisation in metal industries (Allen, 1929; Florence, 1948) and retains one of the highest concentrations of IMP firms in the UK despite suffering the largest decline in employment and enterprise numbers (Eurostat, 2011b). In response to the decline, a niche metal industry has developed in the region producing higher value products and diversifying away from a previous dependency on the automotive industry (Bryson and Taylor, 2006). For this reason, the region offers the most accessible insight into restructuring and reconfiguration in the industry.

Figure 1.2 Location of the West Midlands Region within the UK and its Constituent Counties



Source: Author (2012)

1.5 Thesis Structure

The thesis is specifically concerned with the competitiveness of intermediate manufacturing firms through adjustment practices. Although areas of growth are identified throughout the forthcoming discussion, the study does not focus on growth *per se* for three reasons. Firstly, the study is concerned with understanding how an intermediate manufacturing base can be retained in the UK to enable the continued presence and growth of related higher value end-user manufacturers. The decline of the IMP industry over the past few decades threatens this and therefore it is essential to understand adjustment processes in the industry. Secondly, adjustment practices for survival are largely different to those utilised for growth in that they focus on *maintaining* a firm’s existing position, rather than developing it, through *existing*, rather than new, networks of customers and suppliers. The third reason follows this. Survival is an ongoing process of adjusting to dynamic environments; it is not a specific ‘target’ enacted over set period, as growth-specific strategic adjustments may be. A focus on survival allows exploration of multiple and simultaneous adjustment practices that are continually deployed by firms. The industry and location selected for the study reflects this. The IMP industry is in decline, with the West Midlands region suffering the largest overall decline in the industry, but still retains the largest concentration of firms. This indicates successful adjustment for survival and to remain competitive without overall growth of the industry.

The overall framework of the study focuses on the links that organise production over space and how these characteristics shape the adjustment and stability of the individual firm. The research questions are explored throughout the eight chapters, although not specifically addressed. During the research process the initial questions were significantly refined from discussions with study participants. Particular issues, notably customer relationships and energy costs, were prevalent across the industry and required far more intense examination and representation in the thesis if they were to accurately reflect the complexity of firm experiences. For this reason, the empirical chapters are focussed on unpacking the role of relationships and agreements in the industry through two case studies of existing adjustments and a critical examination of the subsequent role of inter-firm relationships.

Chapter Two sets out the theoretical foundations of the project. It draws evidence from three sets of key literature: the organisation of production, the nature of the firm, and adaptation. The framework proposes a way of viewing the firm and its practices as part of a wider, integrated process of flux, where the connections between firms and change itself are inextricably linked.

Chapter Three provides an overview of the research approach, techniques and methods used in the study. A discussion of methodological limitations highlights the particular challenges of undertaking fieldwork during a period of economic turbulence, the peculiarity of elites in manufacturing businesses and the difficulty in using concepts of power in research studies.

Chapter Four outlines the context for the empirical investigation and the refinement of the research questions. It provides an overview of the transitions and challenges being experienced by the IMP industry and identifies the fundamental problem of profitability in the survival of firms. The key challenges which currently face the industry are identified for further analysis in subsequent chapters; the transition to high-value manufacturing, the problem of energy price volatility and the role of existing customer relationships in the stability of IMP firms.

Chapter Five explores the adjustment of IMP firms to continuing pressures from international competition and the resultant structural adaptations made. Particular attention is given to the nature of supplier-buyer relationships, areas of power and the implications of such structures on profitability and value capture for IMP firms.

Chapter Six[4] is a case study examination of the industry's response to radical changes in a key input – energy. Energy represents a volatile input cost, structured through multiple scales, and the discussion identifies the varied strategic approaches of IMP firms to manage the risk from cost increases. The interaction of transient changes to energy price fluctuations and the longer term adjustments identified in Chapter Five are investigated. Both Chapter Five and Six build an understanding of how the structure of trading relationships between transaction partners influences the nature and capacity of adjustment in IMP firms.

Chapter Seven explores the nature, form and stability of the agreement structures identified as constraints and enablers in the previous empirical chapters. Specifically the role of formal contracts in shaping current production organisation and the distribution of risks between firms are investigated. The chapter draws together the role of contracts in value creation, risk transfer and stability from chapter's five to eight and explores the notion of blending as a survival mechanism.

[4] The arguments of this chapter have been published in a separate article (Mulhall and Bryson, forthcoming), which is included at the end of the thesis.

Chapter Eight draws together evidence from the previous chapters to examine the role of connectivity in the adjustment processes and strategies of IMP firms. It illustrates the continued significance of mature industries in understanding industrial structure, innovation and adjustment. Contracts are identified as critical, and are underrepresented in current accounts of structures of economic action in buyer-supplier relationships. The chapter concludes by providing an evaluation of the research study, its value and areas for further development.

2 INTER-FIRM RELATIONSHIPS IN THE ORGANISATION OF PRODUCTION: THEORETICAL FOUNDATIONS

2.1 Introduction

The manufacturing sector encompasses a range of industries and functions. These are arranged through the simultaneous process of fragmentation (Dicken, 1986; Glasmeier and McCluskey, 1987) and connectivity (Saxenian, 1994) within production systems to generate competitive advantage and value. Thus, inter-firm relationships are a fundamental aspect of production systems that enable the separation of production activities whilst retaining a continued connection between firms through exchange, ownership structures and alliances. These ties blur the boundaries of firms, shape the geographical spread of the individual firm or production system and enable coordination across boundaries. The following discussion will draw on four principal streams of literature to build a theoretical understanding of the process of competitiveness within this context; theories of the firm, organisation of production, adjustment and governance. These streams have been focussed on as they underpin the nature and function of inter-firm relationships in production systems. The examination identifies the significance of inter-firm relationships in shaping the competitiveness and adjustment capacity of firms through governance structures.

The discussion is structured as follows; a brief overview of the conceptualisation of the firm is provided, this is followed by an examination of the theoretical foundations of the organisation of production, adjustment and governance ideas within economic geography and management literatures. These themes are reflected in the research context, where an overview of current understandings of competitiveness and manufacturing in high wage rate regions is provided. Finally, a conceptual framework draws together the findings from the review of literatures and identifies current limitations in the understanding of competitiveness and adjustment within linked systems of production.

2.2 Theoretical Foundations

The following section will review three key literatures that underpin the research aim; the organisation of production, adjustment and governance. First, a brief outline of the conception of the firm is provided.

2.2.1 Conceptualisations of the Firm

The nature of the firm is highly contested and debated within economic geography (Maskell, 2001a). The firm is traditionally viewed as an alternative organisation structure to markets in the economy, where production functions can be carried out more efficiently (Coase, 1937; Williamson, 1973). Under this conceptualisation the firm performs distinct functions of organising and transacting, developing a legal (Cheung, 1983; Hodgson, 2002) and transactional view of the firm (Cox, 1996; Eccles, 1981; Grossman and Hart, 1986). An alternative perspective highlights the socio-economic basis of the firm , drawing on Penrose's (1959) resource based view

(RBV) and evolutionary notions of learning and innovation (Nelson and Winter, 1982). Under this notion the firm is increasingly viewed as a socioeconomic entity that acts strategically through bounded rationality (Audretsch, 2000; Maskell, 2001a). More recent work has called for economic geography to incorporate both aspects of the firm, its social and contractual nature (Oinas, 2006; Taylor, 2006), as

> *[t]he firm as a legal entity still matters as contractual relationships are formed between firms and not between individual employees; they are negotiated and formed by social actors embedded in networks, but regulated and governed at the level of the firm rather than the individual (Rusten and Bryson, 2010: 250).*

Current conceptualisations highlight the varied and complex functions of the firm. The firm is viewed increasingly as a set of assets (Clark and Wrigley, 1997a; Clark and Wrigley, 1997b) and resources (Barney, 1991; Maskell and Malmberg, 1999; Teece and Pisano, 1994), through which strategic action is taken to generate value. The political processes within and between firms are a key feature of firm activity (Christopherson and Clark, 2007; Schoenberger, 1997). The firm encompasses many different forms and spatialities (Taylor and Asheim, 2001) through connections and coordination activities. These elements of the firm will be used to understand the organisation of production.

2.2.2 Organisation of Production

The following review provides a broad conceptualisation of the way production is organised over space and in place. The review begins by identifying the classical theories of the location of economic activity, before exploring the development of the field into the geographical spread of industrial activity and specifically the extension of production organisation theories into socio-economic conceptualisations. The scalar conceptualisations of production organisation and the resultant nature of relationships in the production system are depicted through the review.

Classical theories

The classical approach to the spatial organisation of production draws upon Von Thurnen's 1826 model of the spatial distribution of agriculture. Land rent, the optimal price for acquiring land, is a function of transportation costs and revenues, where transportation costs are based upon distance from market, and therefore accessibility to market determines the optimal crop type for a location (Aoyama *et al.*, 2011). Alonso applied von Thurnen's model to other industrial activities, suggesting that the value of access to market varies between industries and, therefore, implied a spatial pattern of industrial location from the market based the importance of accessibility to different industrial activities (Aoyama *et al.*, 2011).

Weber's (1929) theory of least cost location is perhaps the most influential industrial location theory. His concept built upon von Thunen's notion of location based upon transport costs as a function of distance but introduced labour costs as a defined feature in areas where other costs were equal, spaces he termed 'critical isodaplanes' (Weber, 1929). Critically, Weber introduces multiple industries in the location model and agglomeration and diseconomies of such interactions. Weber suggests that the co-location of similar activities occurred because similar activities have the same isodaplanes of locations costs and benefit from shared costs (e.g. skilled labour pool) but also may face diseconomies, such as traffic (Aoyama *et al.*, 2011). Both Weber and von Thunen's models are based on a spatial distribution of raw materials and markets, albeit under the assumption of these being a pre-given factor, and focused on cost based locations. Losch's (1954) model however, did not acknowledge this spatiality and assumed uniform distributions of materials and markets. Losch's focus was more heavily on demand influences on location decisions. He introduced the critical notion of multiple, overlapping markets (Losch, 1938), allowing for fluctuations in demand and associated prices and a framework based on *total* costs and *total* revenues (Aoyama *et al.*, 2011).

Neo-classical theories: industrial location theory

A critical change in approach was the inclusion of variability in factor costs and dynamism in industrial location. Walter Isard's work spurred a new focus, the quantitative revolution, in regional science. Isard moved away from the notions of general models to show how trade, spatial position and the location of resources were connected (Issard, 1956). In particular, Isard examined the role of spatial costs in shaping industrial location and illustrated how changes in industrial location occurred through increasing returns from agglomeration patterns (Fujita, 1999).

There was a particular development of the idea of price and location. Smith (1970) extended Weber's isodaplane concept by incorporating linkages, which he suggested influenced the price of inputs by effectively bringing them closer. Smith proposed the cost-surface notion to incorporate spatial distributions of total costs and total revenues. This reformulation of Weber's model included all associated costs and is not limited to Weber's transport cost based model. Webber (1972) developed the notion of uncertainty in affecting the price of inputs, where links can influence the level of uncertainty about the environment. Under this notion, the variability of prices, not the location of inputs per se, is the important determinant of industrial location. Clark (1985) highlighted the disjuncture between 'centralised' and decentralised' markets of particular factors and the resultant influence of prices in shaping industry structure. However, he suggests the importance of temporal, rather than spatial, changes in labour prices.

These approaches began to identify the significance of multiple cost components within the individual firm in shaping the overall competitiveness and location of activities. In addition, trade based linkages were identified as a key feature in adjusting the nature of these input costs and achieved market values. The focus was on the physical extent of these linkages and the result and impact on cost efficiencies to markets, with little attention given to the nature of linkages. The following section outlines the role of international trade in developing understanding of production organisation. Trade based linkages continue to be a prominent feature of firms capitalising on input cost differences between regions.

International trade: new international division of labour and product life cycle

The increasing prominence of international trade led an approach to understanding the role of trade across national boundaries and the mobility of capital in shaping the location of industrial activity. The approach rejected the notion of pre-existing distributions of resources, as in the earlier approaches, and highlighted the role of differential labour wages in shaping the organisation of production (Walker, 2000). There were two key theories: new international division of labour (NIDL) and product-life-cycle (Schoenberger, 2000). The NIDL proposed by Frobel *et al*. (1977) highlighted the increasing role developing nations played in the production process. Through capital mobility and the multinational corporation (MNC), production became increasingly fragmented between countries as a world market for labour and production emerged. The role of the MNC is particularly significant in shaping this research stream and the assumption of increased locational flexibility, with intra-firm linkages being a fundamental element of maximising geographical cost differences. Hymer's (1972) seminal work on the MNC suggested the decline of traditional state power through the integration of political systems to encourage international business and MNCs that optimised production locations across nations. Critically, Hymer suggested that distinctive differences between the political basis of the core and the periphery were important in shaping the distribution of production organisation through the agency of the MNC. Dicken (1986) also considered that nation states were key factors in shaping the 'permeability' of their borders to MNCs and capital.

The work of Vernon (1966) on the product life cycle model looked more closely at the nature of the product and the role of innovation in shaping trade patterns. Vernon's approach looks beyond input costs for the distribution of economic activity and includes innovation as a factor in shaping the location of particular activities in particular locations. The life cycle influences the amount and nature of the labour required to produce the product, particularly differentiating standardised goods as having a largely price based market that require high levels of investment, and therefore capital availability, in home markets (Vernon, 1966). Vernon (1979) developed the product life cycle approach by introducing two additional considerations based around dynamism: networks and changes in economic circumstances. Essentially Vernon suggests that assumed differences in factor costs and income between countries reduced from the spread of international networks, limiting the gains that can be attained through shifting locations. Instead, he suggests that product life cycle is still based on least cost location but innovation and MNCs strategic action change the nature of these cost differentials.

Both theories are based on understanding the role of increased flexibility in production location. Different location-based cost structures formed the basis of competitive advantage between countries, stemming from the core-periphery conceptualisation of inter-country differences (Fagan and Webber, 1994). Central to these approaches is intra-firm trade in MNC, particularly between headquarters and branch plants in utilising these spatial advantages, initially from cost savings but later for accessibility to resources (Audretsch, 2000). Essentially, both models are concerned with the flow of resources, particularly capital, between locations and within firms (Schoenberger, 2000) in an increasingly complex and interdependent production system (Dicken, 1986). Again, linkages across space are a key feature of generating advantage, however the focus on the MNC in these approaches highlight the significance of *intra*-firm linkages in capitalising on these advantages.

New perspectives

Large scale deindustrialisation, defined as the "…widespread, systematic disinvestment in the nation's basic productive capital" (Bluestone and Harrison, 1982: 6), across the developed economies of the UK and USA gave rise to more critical accounts of the organisation of production. The work of Massey and Meegan (1982) in the UK and Bluestone and Harrison (1982) in the USA are key texts on the deindustrialisation process, particularly focusing on the capital-labour relation within production systems. It was suggested that technology reduced the tie of production to skilled labour, allowing the increased mobility of capital in terms of investment and finance. This mobility gave firms the flexibility to move production to lower cost labour regions, or increasingly, to areas of less unionisation, as Bluestone and Harrison succinctly describe:

> *If labor was unwilling to moderate its demands, the prescription became "move" – or at least threaten to do so. For one enterprise this entailed disinvestment. When entire industries adopted this strategy, the result was deindustrialization (1982: 17).*

The increased mobility of capital was only one aspect of the deindustrialisation process. Productivity improvements drove an overall reduction in employment levels, exacerbated by corporate strategy to utilise regional wage rate differences through capital mobility.

Deindustrialisation also spurred a focus on alternative frameworks of globalisation and particularly the capacity for change, dynamism and diversification in the organisation of production. Social and institutional factors were incorporated as spatial-derived aspects that were significant in shaping the location of production, which expanded more traditional notions of cost and raw material distributions as the primary drivers of location choice. The sociological notion of embeddedness, most notably the work of Granovetter (1985), has been used as a framework for understanding the role of social structures and context in shaping production systems. Granovetter's work depicted the significance of social relationships and institutional structures in shaping economic action as "[a]ctors do not behave or decide as atoms outside a social context, nor do they adhere slavishly to a script written for them by the particular intersection of social categories that they happen to occupy. Their attempts at purposive action are instead embedded in concrete, ongoing systems of social relations" (1985: 487).

A key element of this approach is the focus on diversification in patterns of organisation, from social, political and technological influences. Two prominent schools developed during this period that focussed on socio-institutional factors; UK based work of Massey and the US Californian school (Scott, 1988; Scott and Storper, 1986; Storper and Walker, 1984; Storper, 1989). Massey's seminal work on the social division of labour highlighted the integral role of space in shaping production:

> *The labour demand for a labour process is determined not by the process itself but by a whole host of wider social and ideological traditions. Again, scientific management and Fordism only make spatial separation of control and production possible. They do not, outside of particular circumstances, determine that it will happen. Separation within production does not in itself give rise to geographical separation. Simply to classify by labour processes is not to take account of the historical conditions in which they emerge (1995: 25).*

Here Massey highlights the time and space specificity in the use of labour and capital through the social processes within the production organisation. The geographical pattern of organisation is a central element to the structuring and functioning of production due to the social practices that it engages with.

The Californian School, through Scott, Storper and Walker, simultaneously developed institutional approaches to the pattern of industrial organisation. Territory (Scott and Storper, 1986; Storper, 1989) was a particularly significant characteristic in shaping the diversification of production organisation. Territory is comprised of "…place specific regimes of accumulation" (Storper, 1989: 215), influenced by institutional structures and social action within the location. Spatial concentration of social, political and institutional resources provided a contextually specific basis on which technological changes manifest. Scott's (1988) work on new industrial spaces suggested that technological advances opened new areas of production, shifting capital from traditional areas to these new spaces which allowed for flexibility in production organisation because “[a] social division of labour had not yet begun to form in any major way within most of the sectors composing these ensembles and they had not yet engendered large specialized labor markets; as a result, their locational behaviour was initially relatively independent of external economies and agglomeration forces” (1988: 106-7). Over time the space developed into an “…evolving regime of flexible specialization” (Scott, 1988: 106) where intense social relations generated continued economies of scale. Externalities, defined as “…any occurrence or activity that lies outside the range of control of the individual firm, but that has definite effects on the firm’s internal production function” (Scott, 1998: 8), generate competitive advantage through the combined economic activity of firms within the region. Under this conceptualisation, the relationships between firms, based on collaboration, outsourcing and proximity, are central elements to the competitiveness of the individual firm and the region within a global economy (Scott and Storper, 2003).

The regional approach has generated a dominant stream of work within economic geography over the past two decades. The approach is focussed on the comparative success regions, as opposed to traditional theories of Fordism mass production structures, as an alternative form of production organisation (Leitner *et al.*, 2002). The seminal work of Piore and Sable (1984) on flexible production systems is a fundamental characteristic of regional production systems. The concept was based on the complementary role of competition and collaboration between firms to generate continued innovation in the production system. The notion of industrial districts developed from early work on agglomeration economies. Industrial districts are defined by Markusen (1999a) as a distinctly different form of regional production system as it incorporates geographical and social proximity between firms that generates a distinct ‘cultural homogeneity’ within the space. Regional innovation systems focus upon a social embeddedness that drives innovation through learning between proximate firms (Asheim, 2000). A key feature of industrial districts is their capacity to adapt to changing environmental circumstances through the maintenance and adjustment of inter-firm relationships. Relationships enable the spread of innovation within the region, thereby generating a flexible and resilient network of locationally based firms. The American stream of literature largely focussed on new areas (Saxenian, 1994; Scott, 1988; Storper, 1989), identifying rigidities in older areas (Markusen, 1999a).

Alternative theories based on agglomeration economies were developed by Krugman under the ‘New Economic Geography’ approach. Krugman’s (1991, 1998) model of regional divergence incorporated traditional ideas of location economics by incorporating local interactions between firms of the agglomeration model with transport costs of the least cost location model. The externalities from this interaction generated increasing returns of technology spill-over, generating concentrations of specialisation. The approach has been heavily criticised, particularly by Martin and Sunley (2003), for its neglect of the social foundations of interaction which have been developed into concurrent literatures.

The early work of regional science was based on an industry focus, which Schoenberger (2000) criticises for lack of wider relevance beyond the industry. The regional approach has been criticised for its focus on internal resources and limited attention to external structures and influences (Leitner *et al.*, 2002). Both Amin and Thrift (1992) and Gertler and Levitte (2005) stress the importance of existing structures and connections to wider, global, production system to utilise the advantages of regional agglomerations. They view industrial complexes as part of wider global networks where "…Neo-Marshallian nodes in global networks act, as it were, as a collective 'brain', as centres of excellence in a given industry" (Amin and Thrift, 1992: 577). Markusen (1999a) developed a framework on industrial districts that expands the regional model to incorporate external links and interactions in the formation and functioning of regional structures. The typology moves away from the traditional focus on small firms, including the state and MNC as active players in some models of industrial district, and questions the prior focus of Scott's model of new industrial spaces, suggesting older regions can retain industrial activity through 'sticky elements' (1988). The work identifies inclusion in production networks outside the region as critical to the diversity of industrial complexes found empirically:

> *In reality, sticky places are complex products of multiple forces- corporate strategies, institutional structures, profit cycles, state priorities, local and national politics. Their success cannot be studied by focusing only on local institutions and behaviours, because their companies (through corporate relationships, trade associations, trade, government contracts), workers (via migration and international unions) and other institutions (universities, government installations) are embedded in external relationships – both cooperative and competitive – that condition their commitments to the locality and their success there (Markusen, 1999a: 119).*

More recent work has criticised the regional approach for its lack of consideration of power in inter-firm networks (Bathelt and Taylor, 2002; Christopherson and Clark, 2007; Rutherford and Holmes, 2007). In their seminal work, Christopherson and Clark (2007) highlight the influential role on transnational corporations (TNC) in shaping regions through their ability to distribute risks and costs of production to the local area. A distinction is made in this work which implies firms and regions do not necessarily work towards the same goal (Coe, 2009), particularly stressing the importance of lead firms as powerful agents in shaping the regional economy. The role of the firm as separate to the region is a key distinction from some earlier notions of industrial districts.

The conceptualisation of production organisation over space has generated a rich and diverse literature. Linkages have been a continuing feature within the field, firstly through a focus on trade (Webber, 1972), then the development of interdependent production systems (Dicken, 1986) and the embedding of production systems in a socio-economic context (Granovetter, 1985; Uzzi, 1996; 1997; 1999; Uzzi and Gillespie, 2002; Uzzi and Ryon, 2003). The earlier work on the MNC and the latter focus on the region have distinctly different conceptualisations of spatial organisation. Both approaches highlight the role of relationships in structuring production over space for competitive advantage but operate at different scales. The global perspective of the MNC views relationships over a large scale, based largely on transactions and linkages between plants within an organisation. In contrast, the regional approach draws attention to the notion of proximate relationships between independent firms organised in regional innovation systems, industrial districts and clusters. Taylor succinctly describes the significance of relationships in the performance of firms under the regional conception:

> *The local integration of small firms in agglomerations, yielding benefits of externalities and untraded interdependencies, has thrown into prominence firms' interconnections and idosyncracities, along with their competencies, capacities, and capabilities, and their weaknesses, limitations and vulnerabilities (2006: 4).*

Relationships, based on trade and collaborative linkages between firms, are viewed as a key aspect in the competitive success of organisations. Current debates in economic geography call for a wider appreciation of inter-firm relationships by incorporating a global perspective into regional conceptualisations (Gertler and Levitte, 2005; Yeung, 2009) to develop a more holistic view of the firm and its connections within the production system.

2.2.3 Transformation, Adjustment and Change

Flexibility has been a key aspect of the new perspectives in the organisation of production. The capacity of firms to adjust to changing environmental conditions has direct implications for the sustained competitiveness of the firm (Christopherson, 1996; Hannan and Freeman, 1977; Hughes, 2000; Teece and Pisano, 1994; Uzzi, 1997). The process and capacity for adaptation has a rich and diverse literature across ecology, environmental, risk and management literatures. Smit and Wandel (2006) derive the concept of adaptation from cultural transformations in response to environmental stresses. The concept became concerned with developing human systems to enhance success and survival of societal systems. The two most significant literature streams are organisational adaptation and adaptation to physical environmental factors, specifically vulnerability to climate change (Adger, 2006; Sharma, 2000; Berkhout and Hertin, 2006; Bouvier, 2009; Marshall and Cordan, 2095). Both streams developed somewhat independently and still remain widely detached. The subsequent review focuses on organisational adaptation, with an examination of theoretical perspectives from management and organisational literature and economic geography. An overview of conceptions of corporate transformations is then provided. The discussion focuses on organisational adjustment as it is a fundamental element of the research study, bringing together adaptation theories within the context of firms and production systems.

Management perspectives: the organisation as a learning entity

There are two alternative management perspectives of the capacity of organisations to undertake change: strategic management and population selection. The strategic management approach draws on evolutionary economics perspectives and the role of routines (Nelson and Winter, 1982) and path dependency in the firm (David, 1985; Liebowitz and Margolis, 1990) to understand the capacity of firms to adapt to their environment through learning. Chakravarthy (1982) viewed adaptation as a function of the resources and managerial capability within the organisation, which differentiated firms ability to cope with changes in the economic environment. The degree of 'fit' between firm resources and socio-economic conditions is a central element of the approach and flexibility is seen as the ability to re-orientate resources to new conditions (Levinthal, 1997; Miller, 1992). The notion of 'optimal fit' has been debated within the literature. Denrell and March's (2001) notion of the 'hot stove effect' is critical of this idea of optimum fit. They suggest that orientating the organisation to adjust too quickly to environmental changes, through environmental search capabilities, means that potential adaptation measures may be rejected too early as the organisation is in a state of continual adjustment. A continuum of adaptive abilities between firms, dependent on the organisations ability to expand and align innovations within their economic context, has been suggested within the literature (Ganesh *et al.*, 2004).

Despite the focus on information to generate 'fit' with the environment, the ability of the organisation to absorb and utilise information was not addressed (Bogner and

Barr, 2000; Ganesh, 2004; Siggelkow and Rivkin, 2005). The seminal work by Cohen and Levinthal (1990) conceptualised the need to be able to use the information gathered from the environment as the firms' 'absorptive capacity'. This ability is reliant on prior knowledge to be able to recognise and assimilate new information. As a result, the innovative capabilities of the organisation are path dependent. The internal structure of the organisation and flexibility are shown to be significant factors in adaptive processes. Dessein and Santos (2006) suggest that a loose structure is a key element in organisational adaptation, primarily because information is required to undergo such transformations. Engagement with the external socio-political and economic context of the organisation allows access to information, although the extent of its usefulness and success of adaptations is a result of prior investment in structures and processes for knowledge accumulation (Hansen and Birkinshaw, 2007). Collinson and Wilson (2006) suggest that although a fit is required to gain information for change, this knowledge also needs to be integrated into the organisation. If the information cannot be incorporated into the organisation's structure, the firm remains incapable of responding to external changes. It is suggested that this capacity to integrate information, and therefore the ability to adapt to changes, is a result of the extent of latent resources available to engage knowledge and initiate change.

An alternative perspective has been developed based on the ecological notion of selection. The population ecology approach, developed by Hannan and Freeman (1977), sees the forces of selection and retention across the population of competitive organisations as the primary mode of adjustment to prevailing environmental conditions. The approach is critical of the strategic management focus on single units or organisations and instead proposes that a larger, aggregate population approach can identify large scale changes and account for the diversity of organisational forms. Two key concepts are used to explain variation in organisational form: structural inertia and isomorphism. Hannan and Freeman (1984) conceptualised the notion of structural inertia as the incapacity of change through prior investments, resulting in a synchronisation between the organisation and prior environments, generating inertia coalitions and the standardisation of precedent forms. Successful organisations can often develop inertia from a predisposition to existing and proven production and management systems, without reconfiguring to the current environment (Miller and Chen, 1994). The success of these systems can provide the organisation with a false sense of security in their capacity to buffer environmental change. However, it is suggested that competitive inertia is also a function of strategic actions, which is related to the complexity of the current environment. The uniqueness of each situation renders prior experience not beneficial in helping to shape the response. Here Miller and Chen (1994) strongly suggest that current and prior experiences are significant in determining tactical and strategic responses. Hannan *et al.* (2004) redefine this relationship by suggesting that it is the complexity of the organisation which determines its structural inertia. It is suggested that a change within the organisation leaves it vulnerable because the change can generate a cascade of changes throughout the organisation, thereby increasing the time and extent of reorganisation within the firm. As a result, the firm is in a state of vulnerability for an extended period of time, which increases the costs of reorganisation and may leave the organisation in a poorer financial state than anticipated. Therefore, the firm experiences greater consequences of change than were expected as the process was not fully understood and the costs of change were underestimated.

Organisational form, defined as the structure and practices of the business, is suggested to converge over time through a process of isomorphism (DiMaggio and Powell, 1983). This is because the environment, seen as the institutional context, provides a unified influence upon the firm. This departs somewhat from the work of Lawrence and Lorsch (1967), who denote that adaptation to specific environments within the wider environmental context acts as the driver of change. The intricacies of the sub-environments are regarded as insignificant and the wider institutional context encourages homogeneity of the population. DiMaggio and Powell's (1983) seminal work further developed the theory of isomorphism by suggesting that convergence pressures are related to specific areas of the firm's institutional environment; namely political, professional and security. Environmental change is seen here as a driver of conformity because organisational response to change is similar within the environment. As a result, change drives organisations to conform through institutional drivers, as opposed to diverging as in contingency theory.

The population ecology concepts depart from strategic management perspectives because of a focus on external environmental forces that drive continuity within a population of firms. The role of learning and resources in strategic management instead focuses on change and difference between firms and the ability of a single entity to adjust. The capacity of a single enterprise to adjust is a central element of economic geography perspectives, which are outlined in the following section.

Economic geography perspectives: sunk costs, resources and path dependency

A related stream in economic geography builds on Cyert and March's (1992) behavioural theory of the firm and is an alternative conceptualisation to the agglomeration economies theory of early regional work. This stream focuses on the internal structure of the firm as the mechanism of adjustment and change, unlike the agglomeration approach which focuses on the external benefits of proximity and external economies. Cert and March's theory identifies the contextual nature of decision making by actors in the firm, and specifically states that prior actions constrain the options available to decision makers, making responses to changing environmental conditions not necessarily a single optimum action. They identify 'sequences of behaviour' as a fundamental aspect of decision making. This point is developed by Clark and Wrigley (1995) in their notion of sunk costs as a constraint of firm action and influence in the heterogeneity of spatial configuration of firms. Specifically, Clark and Wrigley suggest that sunk costs can affect the strategic direction of the firm through three means: market entry, development of skills and capabilities. and firm strategy through investment decisions (Clark and Wrigley, 1997b). Prior investments can generate rigidities because the value of the investment is often attained in the context of the particular strategy, thereby deterring the firm from adjusting strategies. Clark and Wrigley (1997a) conceptualise this strategy in the context of firm exit decisions in US and UK manufacturing restructuring. In this they suggest that the decision to exit is part of a series of decisions which shaped the use and accumulation of capital in the firm, therefore creating a cost to adjust, influencing the final decision of exit. Schoenberger (1997) and Glasmeier's (2000) work highlights the influence of context in shaping dominant forms of change and resistance in the firm or industry. Schoenberger viewed adjustment as influenced by the culture of the firm, specifically developed through managerial identities, and 'commitment structures' where "…the kinds of change they were willing and able to undertake were constrained to run in certain channels and not others" (1997: 5-6). In both theories, the firm is viewed as an active strategic decision maker that selects which change is undertake and, in that sense, resist some forms of change and embrace others. The value of existing resources is a critical influence in making significant changes beyond the context in which the resources are valuable. Glasmeier, through her examination of the transformation of the Swiss watch industry, suggests the rigidities to change are encountered at various scales that create lock-in to specific processes and different types of change are reacted to differently:

> *The intensity and speed of change has important implications for coping. The changes that are most readily aligned with the status quo will have a resounding effect within the immediate vicinity of change…. The more far-reaching and episodic changes may have little to do with the targeted outcome, and may therefore exhibit few system-adjusting characteristics (2000: 21-2).*

Path dependency and lock-in are key concepts with economic geography drawn again from evolutionary economics (David, 1985). The concepts highlight the significance of sequences of behaviour which can generate distinct rigidities that restrict the capacity for change. Prior adjustments can narrow the range of possible options for future action (Kirk *et al.*, 2007). Martin and Sunley (2006) suggest that these processes are inherently spatial, tied to the context of a place. Recent work has suggested the contingent nature of path dependence as paths can be adjusted or multiple development paths available (Hudson, 2005).

Approaches to adjustment in economic geography and strategic management highlight the central role of the firm's internal resources in their capacity to change. Learning, sunk costs and resources are key aspects of flexibility. However, the capacity to engage with the external environment is also a key driver of adjustment and is achieved through links and ties that situate the firm within a specific environmental context. Relationships are fundamental to the capacity for organisations to access information to enable corporate learning (Gertler, 1995, 2001; Grabher, 1993; Hervas-Oliver and Albors-Garrigos, 2009). The role of linkages will be examined through a review of empirical evidence of corporate transformation next.

Corporate transformations: empirical evidence

The corporate transformation literature has developed in two streams of work in economic geography: regional adjustment and firm upgrading. Both approaches draw on the specific context of inter-firm linkages in shaping the nature of firm adjustment. Regional approaches are characterised by a focus on innovative and adaptive systems of small firms in a bounded space. Early work on Industrial districts, based on the Marshallian districts, focuses on flexibility of small and locally owned firms adjustment to deindustrialisation through social ties. The American school of regionalism focuses on upgrading and adjustment in new areas, principally through the work of Scott on new industrial spaces (1988), as old regions were perceived to be rigid (Markusen, 1999a). Grabher's (1993) work on industrial networks in the Ruhr valley examined the transformation of the region beyond an industrial district. Here he identifies the role of inter-firm linkages and regional politics as being central to the ability of firms and the region to adjust by generating forms of lock-in from previous adaptations:

> *Adaptation endangers adaptability through processes of 'involution'. Adaptation leads to an increasing specialization of resources and a pronounced preference for innovations that reproduce existing structures. And while the system optimizes the 'fit' into its environment it loses its adaptability (1993a: 265).*

Here, the process of adaptation itself is found to reduce the capacity for future adjustments as firms and regions become increasingly specialised and reduce redundant links to the external environment.

The upgrading literature stems from work on global commodity chains (GCC), global value chains (GVC) and governance. The focus of this set of literature is on the capacity for individual firms to adjust their value added activities within the context of their involvement in wider production chains, and specifically the associated governance structures associated with that. Humphrey and Schmitz (2000) identify three different elements of upgrading, which vary in ability to engage in different activities within the chain, from process improvements to production of higher value products and undertaking new activities. Here, strategic intent is a central consideration, as well as influences from policy and value chain governance structures. Gereffi *et al*. (2002) and Bair and Gereffi's (2002) work on upgrading in the apparel industry after the development of the free trade agreement identifies the significance of local characteristics in shaping the ability to firms to transform their production capabilities. Although power relations in the chain have direct effects on the ability of non-lead firms to transform (Pavlínek and Ženka, 2011), access to lead firms (Gereffi, 1994) and suppliers own strategic intent (Tokatli and Kizilgün, 2004) are key features in enabling transformation.

Both streams of literature in corporate transformation draw attention to the role of relationships in the capacity of firms to adjust. The regional approach focuses on horizontal networks primarily concerned with proximity and the capacity to learn through knowledge exchanges between firms. In contrast, the upgrading literature examines vertical relationships within the production chain, with exchanges confined to within the production system and directed through lead firms. The review highlights the varied role of inter-firm relationships in influencing adjustment capacity of the individual firm. The following section will examine the role of vertical inter-firm linkages in more detail with a specific examination of governance structures.

2.2.4 Governance

The concept of governance has been discussed in several interconnected literature in economics, sociology and globalisation. Although the concept has many origins, the general definition of the term is the ability to influence another entity without direct ownership. The focus in the globalisation body of work has been on the scale of coordination, particularly the contested demise of the nation-state as a scale of control in a globalised economy (for instance see Hirst and Thompson, 1995; Swyngedouw, 2004) and the nature of coordination between firms and the structure of transactions. The latter stream will be the focus of the following review.

Transactional governance is principally concerned with the influence of organisational structure on the ability to coordinate firms without direct ownership (Ruigrok and van Tulder, 1995), that is the coordination mechanisms between buyers and suppliers and the development of inter-firm relationships beyond market transactions. There are three sets of literature on inter-firm relationships: transaction cost economics (TCE), relational contracting and sociological perspectives to network governance (Sako, 1992). The TCE approach, initiated by Coase (1937) and latter developed by Williamson (1973), views the coordination of economic activity as based on the cost of transactions, where the most efficient method is utilised by the firm to minimise costs. Under this approach there are two alternative structures to organise production: markets and hierarchies. The most appropriate, or efficient in TCE terminology, is determined based on three criteria: level of uncertainty, frequency of transaction, and level of asset specificity. Williamson (1973) identifies commercial contracts as mechanisms for managing uncertainty by providing incentives (cost savings) for actors to 'behave responsibly', i.e. minimising the risk of opportunism by the transaction partner. The governance structure is viewed as "…the institutional framework within which the integrity of a transaction is decided" (1979: 235). Williamson draws on the relational contracting theory from contract law, which identifies shared ownership of assets and benefits (such as reputation), as a determining feature of the most cost efficient means of coordination (Berulava and Lezhava, 2007). Recurrent transactions and specific investment in equipment or resources for a specific transaction increase the cost of switching between transaction partners. To minimise these costs, governance structure need to match the level of investment and uncertainty (Figure I and II, Williamson, 1979: 247 and 253). Under the TCE approach, asset specificity (transaction-specific investment) increases the need to continue the trading relationship "…since contractual gaps will be larger and the occasions for sequential adaptations will increase in number and importance as the degree of uncertainty increases" (Williamson, 1979: 259). Governance structures, bilateral or unified, would then allow the most effective development of the relationship to retain the value of shared assets. Cox's (1996) model of relational competencies is critical of Williamson's approach to asset specificity. Instead, Cox proposes that the value of transaction specific assets needs to be incorporated into transactional models because their value is dynamic, dependent on the context of the environment and, therefore, so too is their significance in governance relationships. In particular, Cox develops a broader range of medium levels of asset specificity to reflect the complex nature of transaction specific investments in inter-firm relationships.

The TCE approach has been criticised for its lack of appreciation of the reciprocal nature of inter-firm relationships (Taylor, 2006; Taylor and Asheim, 2001). The process of trust building over repeated exchanges, generating a distinct form of efficiency in transactions is not incorporated into the transaction cost approach. The relational contracting approach, developed within contract law primarily by Macaulay (1963) and Macneil (1985), views transaction as having inherently both a contractual and sociological basis as they are utilised within a wider sociological context. The implicit forms of contract are based upon the value of future relationships (Eccles, 1981), which influences the coordination of the relationship, as Baker *et al*. describe:

> *Relational contracts within and between firms help circumvent difficulties in formal contracting (i.e., contracted enforced by a third party, such as a court). For example, a formal contract must be specified ex ante in terms that can be verified ex post by the third party, whereas a relational contract can be based on outcomes that are observed by only the contracting parties ex post, and also on outcomes that are prohibitively costly to specify ex ante. A relational contract thus allows the parties to utilize their detailed knowledge of their specific situation and to adapt to new information as it becomes available. For the same reasons, however, relational contracts cannot be enforced by a third*

> *party and so must be self-enforcing: the value of the future relationship must be sufficiently large that neither party wishes to renege (2002: 40).*

The value of future transactions generates a form of trust between transaction partners that mitigates against the risk posed by opportunism (Macaulay, 1963; Nooteboom, 1996; Nooteboom *et al.*, 1997). This is an alternative form of protection against opportunism to the role of asset specificity identified in TCE.

Trust as a governance mechanism has been utilised extensively in sociological conceptions of inter-firm relationships. Trust is defined here as an "…informal mechanism for coordination of economic activity, alternative and supplementary to price and authority, based on the belief of one party in honest and predictable behavior of the other party, and which allows for more effective and flexible mode of transaction governance" (Berulava and Lezhava, 2007: 12). Here, the evolution of the relationship over time through shared experience and knowledge build up between transaction partners is a critical element of governance. Trust is seen to be present to some degree in all relationships as exchanges inherently have some level of uncertainty (Nooteboom, 2002).

The trust perspective developed in response to the increasingly complex and alliance driven nature of production systems, where the focus on control was adjusted to incorporate cooperation (Nooteboom *et al.*, 1997). Sako's (1992) interpretation of buyer-supplier relationships is a continuum of relationship forms based on the need for tacit information to build over time and, hence, stability to develop from obligation and control over each other. Sako's conceptualisation of trust is based on three levels: contractual – meeting obligations, competence – ability to fulfil commitment, and goodwill – moral commitment. The obligatory element of goodwill trust is based on mutual dependence between transaction partners and is the defining feature of obligational contracting relationships (OCR). At the other extreme of Sako's continuum is arms-length contractual relation (ACR), which includes elements of contractual and competence trust to undertake the transaction rather than moral obligation. Nooteboom (2002) is critical of Sako's typology of trust and argues for a far more complex relationship between trust and governance, which takes into account significance and the characteristics of relationships. Instead of the frequency of transactions, as in the TCE approach, Nooteboom suggests that learning and knowledge built up from relationships that developed over a period of time are the critical factors in shaping transactional governance by forming alternative coordination mechanisms. Although he states there is a role of switching costs and hostages (elements that are strategically important and in the possession of one transaction partner), he suggests that knowledge and institutions shape relationships and these relationships act as a governance mechanism through trust. To Nooteboom, trust "…reduces incentives to utilize opportunities for opportunism on the basis of some degree of loyalty, which may be based on ethics, friendship, empathy, kinship or habituation/routinization" (2002: 113).

The role of institutions, suggested by Nooteboom above, is a critical element of the trust framework. Sako (1992) and Helper (1993) have identified the significance of location in shaping the types of governance used in transactions in specific places. For Nooteboom "…institutional differences yield differences in the viability and efficiency of different instruments for governance, and thereby yield different forms of inter-firm relations" (2002: 128). Ettlinger (2003) supports a context-driven approach to trust in relationships but is critical of the inter-*firm* approach. Instead, she suggests that relationships, and therefore trust, are built through inter-*personal* ties. Building on sociological themes and particularly Granovetter's weakness of ties argument (1973), Ettlinger stresses the role of bounded rationality in shaping decision making, resulting in multi-rationality from various personal contexts, creating various types of trust. The types of networks and connections are important and particularly the process of network development. Murphy (2006) develops the notion of context in shaping trust through his proposition of a relational understanding of trust formation. In particular, he suggests that trust is inherently contextual through the *process* of building trust by agents in specific contexts.

The network approach is a key conceptual tool in understanding inter-firm relationships in economic geography. The approach is based on the sociological notions of trust and embeddedness in coordinating and shaping relationships (Bair, 2008). The network approach was considered as an alternative to the market and hierarchies model developed by Williamson, where power is considered to be a necessary feature in shaping and determining the structure of production. The relative position of actors in networks is considered an influential factor in coordination (Leitner *et al.*, 2002). The network view is based on Granovetter's (1985) concept of embeddedness of economic action in social structures. Network approaches offered alternative conceptualisations to governance than an industry or enterprise focus. Håkansson and Johanson (1993) developed a network framework based on dependency as a control structure. In their model multiple actors had the potential to influence the actions of others by altering their resource set through their own activities:

> *The industrial network … consists of the actors and the relations among them, but it also consists of certain activities/resources and the dependencies between them… Each actor controls certain activities and resources directly, but because the dependencies to some extent mean control, the actor has an indirect control over the counterparts' activities and resources (1993: 36)*

The network approach focuses on the nature of inter-firm connections rather than specifically location. Humphrey and Schmitz (2000) identify the nature of cooperation between firms as the central element of the competitiveness of network structures. The types of inter-firm connection, between strong and weak (Rowley *et al.*, 2000) and the duration of ties, particularly work on temporary networks and project ecologies (Christopherson, 2002; Grabher, 2002; Grabher and Ibert, 2006), has been the focus of attention rather than locational influences. Economic geography has utilised the network methodology to incorporate a locational perspective to network organisation (Dicken *et al.*, 2001; Dicken and Malmberg, 2001). More recently, context, through market and institutional governance mechanisms, has been highlighted as influencing the effectiveness of transaction structures. Christopherson's (1999, 2007) work is critical of the focus on transactional governance without consideration of the wider context within which the transactions occur, stating that "[a]lthough we have theories that attempt to explain how firm networks interact to reduce costs and increase production flexibility these theories focus almost exclusively on production cost variables (neglecting other sources of competitive advantage) or on governance at the local scale" (1999: 171).

Critically, networks have a limited appreciation of other forms of inter-firm relationships, specifically, contracts. The relational contracting perspective incorporated both contractual and sociological relationships in conceptualisation of governance. This approach has continued to develop a rich literature of the interaction of both explicit and implicit forms of relationship. Trust is increasingly seen as a supplement to contractual agreements that influences the functioning of contracts as both control and coordination tools (Mellewigt *et al.*, 2007; Woolthuis *et al.*, 2005). The legal nature of the firm continues to be significant, as contracts remain a fundamental element of transactions (Hodgson, 2002; Rusten and Bryson, 2010). However, this aspect is not included in the network approach or models of transactional governance. The following section will explore how network approaches and sociological notions of dependency and trust are used in conceptual models in economic geography.

Spatial models of transaction governance

Several models of buyer-supplier governance have developed based on the network methodology. Ruigrok and van Tulder (1995) developed a model of governance based on a dependency scale from five key areas of control between buyers and suppliers: (1) the labour process, (2) supply of materials, (3) distribution within the value chain, (4) the ownership of core production technologies and (5) supply of finance. They suggest that each element is a potential control problem and hence "[t]he more a firm depends for these essential activities on other parties which it cannot fully control, the more it will have to take the strategies of these parties into consideration, and hence the less independent the firm is" (1995: 37). Under this assumption inter-firm relations, and the governance they construct, are bargained based on investment levels and control of core technology and strategic competencies. Christopherson (1999) criticises the approach for its limited inclusion of institutional influences on the activities of firms. Instead, Christopherson suggests the fundamental basis of coordination between firms is power and "…power is established and maintained through social, political, and legal institutions" (1999: 156).

The notion of dependency is a continuing feature in the GCC and GVC approaches. The GCC framework developed by Gereffi and Koreniewicz (1994) uses governance as one of the central features in structuring buyer-supplier relationships. The approach applies a spatial focus to understanding of governance mechanisms (Sturgeon, 2008), particularly moving from the local perspective of single transactions to a broader industry conceptualisation of the global structure (Aoyama *et al.*, 2011). Critically, this perspective focuses on the influence of an enterprise over the many tiers of suppliers within the industry. Gereffi (1994) developed two alternative models to governance, buyer-driven and producer-driven, based on the principal agent of coordination within the chain. The buyer-driven model viewed governance as directed by retailers and consumers through key areas of power for the buyer. The relatively open access in the supplier market reduced the buyer's dependency on individual enterprises, allowing buyers to have a more active role in shaping supplier practices (Aoyama *et al.*, 2011). The alternative model, producer driven, was characterised as chains where manufacturers have higher levels of control over the supply chain because of higher investment requirements (Aoyama *et al.*, 2011). Approaches based on GVCs developed a more complex model of governance to reflect the increasingly intricate inter-firm linkages within the production system (Rainnie *et al.*, 2011). The GVC model took a firm-centric view of production linkages. Both the approaches had a relative static perception of governance due to the linearity of models, focussing on particular chains, with little consideration of external governance structures and institutional frameworks of their locations (Rainnie *et al.*, 2011).

Sturgeon and Lee's (2001) model of modular production networks is based on the assumption of stability within the production network from relational contracting. The model is developed through a case study of large scale contract manufacturers in the USA's computer industry. The model proposes that the evolution of outsourcing non-core production tasks to suppliers has in some cases developed a new breed of suppliers; turn-key suppliers (Sturgeon, 2002) who, through economies of scope across customers, have developed increased capabilities, low asset-specificity and consequently, increased scale across customers. These capabilities become so good and cost effective that inter-firm links with buyers need only be relationally structured: there is limited need for additional mechanisms of control. In this notion, the standards achieved by turn-key suppliers act as trust relations: the standards imply an associated level of trust in capability and behaviour (Bair, 2008). Gereffi *et al.* (2005) extend the notion of asset specificity in shaping power relations through their typology of governance forms. The model is based on three elements: complexity of transaction, the ability to codify information, and capabilities in the supply base. Under this model the governance structure is influenced by the nature of the relationship, rather than solely based on product type features. The typology expands network governance into three distinct, although not mutually exclusive, types: modular, relational, and captive production networks. Both approaches are dynamic, based on the evolution of relationships between firms during the course of their transaction(s). The critical departure from Sturgeon's single model is that Gereffi *et* *al.* (2005) suggest that variance in governance structures exists and will continue due to the complexity of individual inter-firm relationships.

Herrigel's (2010) model is based on the interdependency of design and production tasks, and specifically the required collaboration between buyers and suppliers for iterative rounds of co-product design. This notion of interdependency of core functions between buyers and suppliers is characteristically different from earlier dependency approaches based on asset specificity and particularly the modular production network, which makes clear distinctions between firm roles. The sustained competitive collaboration (SCC) model is suggested to be a further evolution of Gereffi *et al*.'s (2005) relational approach. Ongoing collaborations in the SCC allow for specialisations but also diversification up and across value chains to develop multiple customer contracts and develop a 'know-how' from experiences across the customer base to develop cost-saving knowledge as well as traditional capabilities (Herrigel, 2010).

The heterogeneity in governance structures has been developed further by the recent work of Murphy and Schindler (2011) on the Bolivia wood industry. The approach suggests the role of relational factors in shaping access to large scale international trading networks, implying relational proximity is a network element that "…should not be conflated with deep trust or horizontality but is instead based on common interest, familiar practices and routines, shared identities, and mutual recognition of each other's positionality in a relationship"(2011: 65). The evolution of the relationship over time allows agents to constitute the relationship in different ways, generating far more complex development and power asymmetries than prior work on governance structures.

Empirical examinations of buyer-supplier network relationships have been undertaken in the automotive (Rutherford and Holmes, 2008; Sturgeon *et al.*, 2008), computer (Fields, 2006; van Egeraat and Jacobson, 2005) and retail-based (Collins, 2002; Hughes, 2000) sectors. The studies highlight the use of governance structures for the transfer of risk and costs from lead firms to suppliers and particularly the cost-squeeze facing suppliers. The role of context in shaping governance structures is an enduring feature, leading to heterogeneity in the utilisation of mechanisms. Sturgeon *et al*. (2008) particularly emphasises the contrast in governance approaches between American and Japanese automotive production systems. American-based lead firms are characterised as opportunistic, where mutual dependency is managed to the advantage of lead firms through utilisation of relational and contractual agreement structures at various points in the relationship. In contrast, Japanese lead firms typically develop long term, stable relationships with their suppliers which are characterised by limited lead-firm dependence. The retail industry studies are characterised by the economies of scale of retailers as a source of influence (Collins, 2002; Hughes, 2000). However, Murphy and Schindler's (2011) discussion of the Bolivian wood sector highlights the variety of applications of retail power and diversity within networks from the activities of small scale suppliers in their local context. These studies are relatively limited to a focus on lead firms. Alternative conceptualisations, such as Murphy's recent work on suppliers in the Bolivian Wood industry, are required to understand the role of suppliers in influencing governance structures and responses to the frequently identified cost-squeeze from lead-firms.

The chain approaches are based on structural links rather than the embeddedness of networks (Bair, 2008) but they continue to illustrate a focus on relational notions of governance based on dependency between transaction partners. The models identified above are limited in their conceptualisations of supplier's role in shaping governance structures. Although suppliers are conceptualised in the models, their role is largely determined by the lead firm's direct influence in sharing technologies or core functions (such as the modular value chain models). The focus on the lead firm limits the understanding of governance structures because it has neglected the influence of multiple and variable forms of governance: a single actor is involved in multiple value chains and each relationship is shaped by the specific characteristics of both transaction partners. Gereffi *et al.*'s (2005) model and its development by Herrigel (2010) includes a conceptualisation of supplier competence in governance structures but still fails to incorporate a strategic role of suppliers in shaping these relationships. As such, a more nuanced understanding of the range of governance relationships and the interaction of multiple types of relationship within the individual firm is required.

GPN and relational understandings of power

The global production network (GPN) theory, principally developed by the Manchester school, stems from the GCC and GVC approaches but incorporates territorial and network embeededness (Coe *et al.*, 2008), through actor-network theory (ANT) and sociological theories of embeddedness. The approach stems from criticisms of the GCC/GVC firm centred approaches (Smith *et al.*, 2002) and is aimed at incorporating the variety of production organisation structures through a network approach. Critically, a consideration for the variable roles of economic actors, both firms and external entities, on the structuring and governance of the production system, as well as its increasing complexity, were incorporated.

Henderson *et al*. (2002) identified three elements to GPN: value, power and embeddedness. Value has been discussed extensively by Hudson (2004, 2005, 2008) as an organising element based on social conceptions of worth embodied in a product that can be exchanged. Hudson's (2005) work on flows identifies economic structures as largely shaped by socially constructed circuits of such value. The cultural and political determinants of value (Hudson, 2008; Lee, 2006) are useful concepts in understanding the system of production. Following this conception of economic structure, the concept of power is a useful framework in GPN. Coe *et al.* (2008) highlight the interdependencies within the network and the consequential role of power. Power is seen to be "…complex, contingent and variable over time …[where]…relationships between firms and their suppliers are rarely as simple as the conventional wisdom tends to suggest whereby the large automatically dominate and exploit the small. Size does not always matter" (Coe *et al.*, 2008: 276). Coe *et al.* (2004) suggest that the approach allows for the integration of the local and regional scale, which they see as the critical scale of organisation because labour is organised at this level. Their notion of strategic coupling identifies the interaction of global and regional assets into the formulation and performance of production networks for a more contextual and embedded perspective on integration in production systems.

The relational approach draws on several streams in economic geography, although specifically on network conceptualisations. The approach is defined by Bathelt and Glücker (2011) as bridging gaps in previous work by linking scales between global-regional-local through a focus on micro processes in a socio-institutional context. The approach essentially focuses on relationships between firms in a network, as opposed to purely structural or organisational frameworks (Dicken *et al.*, 2001). Territories thus become critical elements in the analysis as relationships are seen to be embedded in socio-institutional contexts (Dicken and Malmberg, 2001) in which social agents act (Boggs and Rantisi, 2003). As a result, power is seen as a 'collective endeavour [where]…governance based on trust and relational forms rather than just command and control/hierarchy or market transactions' (Hess, 2004: 456).

The relational approach has been criticised for its focus on the agent. Sunley (2008) suggests a more inclusive treatment of power to include institutional structures outside the networks. He suggests that there does not necessarily have to be a connection for it to influence the operation of the production system. Both Jones (2009) and Yeung (2005) also suggests the need for a fuller conceptualisation of power within the framework by examining the 'relational geometries' generated from the network structures, rather than a complete focus on agents as definitions of power. The relational view assumes benign social interrelationships, to paraphrase Taylor (2006), within the production system, neglecting other forms of relationships with distinct power asymmetries. Contractual agreements are entangled with various determinants of power and therefore contracts are "…clearly matters of power and control" (Hodgson, 2002: 55). As such, the legal structure of inter-firm relationships is a critical aspect in understanding corporate power, governance and the resultant capacity of individual forms to change.

The review of governance literature has highlighted a key limitation to current understanding of inter-firm relationships. Contractual arrangements are a key aspect of coordination between firms but have a limited incorporation into the growing network and relational approaches within economic geography. Firms themselves are key aspects of contractual relationships, based on legal entities, but the focus within models of governance structures has largely been on lead firms in shaping the nature of the relationship. A more nuanced understanding of inter-firm relationships that incorporates alternative forms of transactions and power is required to more fully conceptualise relationships in economic geography. Contracts, power and the strategic input of non-lead firms in production organisation are important for understanding change.

2.3 Research Context: Competitiveness in High-Cost Locations

There are three principal literature streams focused on firm competitiveness: cost, collaboration, and resource-based competitiveness. The need for firms to purchase inputs, or resources, in markets external to the firm generates price differentials between competitors based in different locations. The localisation of some factor inputs highlights the difference that geography makes to firm competitiveness. Globalisation acts to converge capabilities across space through a process of 'ubiquitification' (Maskel and Malmberg, 1999), generating an evenness of some input prices which are relatively less related to location. However, in doing so globalisation amplifies the differentiation of other costs, namely labour, which are tied to specific locations. Even those inputs traded on global markets, which theoretically are less spatially sticky and therefore should generate relatively even price for any buyer, can create price differentials between locations based on availability and the purchasing structure of the location and of the buyer (Giarratani *et al.*, 2006). As a result, the market context of production inputs/resources, the political economy of individual firm's dependence on such inputs and their interaction with wider strategic decisions determine the significance of these price differentials (Clark, 1985; Clark and Wrigley, 1997a; Coe *et al.*, 2004; Dicken and Malmberg, 2001). Local institutional structures around purchasing markets and the organisation of production activities generate a more complex structuring of costs over space, particularly for cost inputs that are strongly localised.

A supplementary stream of literature has developed in both management studies and economic geography concerning the influence of costs on strategic decision making, specifically through past investments (Clark and Wrigley, 1995; 1997b) and the restructuring behaviour of MNC in response to wage rate differences (Christopherson and Clark, 2007; Hymer, 1972). Christopherson and Clark's work has highlighted the critical role of costs in shaping location decisions and adjustment through their model of the 'three Rs': relocation, restructuring and redistribution. These mechanisms, it is suggested, allow firms to transfer a proportion of costs outside the firm and to the regional economy:

> *…whether firms threaten to relocate production or slowly reorganise work processes to redistribute the risks and costs of production to the region – the strategic goal is the same: to shape a landscape of production where places bear an increasingly larger share of production costs and firms gain more of the benefits (2007: 47).*

More recently, the role of cost in competitiveness has been suggested to be specific to the nature of the organisation (Ouma, 2010) and market (Zabin, 1997). The significance of costs is framed through a more contextual understanding of external influences on the local environment, such as institutional structures and technology influences. Giarrantani *et al*. (2006) examine the role of technology in influencing the input and resultant cost structure of an industry, suggesting that the role of costs differs between individual firms through product orientation and strategy. Although the studies highlight the role of context in understanding cost competitiveness, they fall short of incorporating the significance of costs within the wider production systems. Birch (2008) draws attention to the wider implication of factor costs on the production chain as a whole. Here, cost advantages are weighed against cost disadvantages to construct the most competitively suitable production chain, rather than specific restructuring of elements of the chain.

The two other streams, collaborative and resource-based competitiveness, build on 'strong' forms of competitiveness (Hudson, 2005). The collaborative approach focuses on competitive advantage generated through collaboration and relationships with other firms, particularly drawing on the collective assets idea of regional agglomeration theories (Scott, 1998; Storper, 1997) and Burt's (1995) notion of the social structure of competition, based on networks of relations. In this approach, collaboration provides benefits beyond price through mutual interdependence and learning between horizontal linkages and networks. Porter's (2000a; 2000b) work identifies competitive advantage built through the whole value chain and therefore influenced by activities and relationships with suppliers and distributors. Under this conception the performance and growth of an individual firm is linked to external agglomeration benefits and social capital in the local environment (Porter and Solvell, 1998). Research on knowledge networks has developed a large stream of work on the competitive success of regions specialising in particular industries or activities (Cooke, 2004, 2005; Maskell, 2001b) and regional innovation systems that link local and global networks (Bathelt *et al.*, 2004; Huggins and Johnston, 2009). The approach has been criticised for the assumption of open knowledge exchange between traditional competitors, the lack of appreciation of power asymmetries in the relationship (Bathelt and Taylor, 2002; Christopherson and Clark, 2007) and a limited global perspective (Gertler and Levitte, 2005; Sturgeon *et al.*, 2008; Yeung, 2009).

Burt's (1995) work on structural holes builds upon the notion of links between firms and particularly Granovetters' (1973) work on the strength of ties by viewing social capital, and its use through socially constructed networks, as benefiting the rate of return on investments. Importantly, Burt adds to the weak ties argument by suggesting that it is not the strength of tie but the 'structural hole's' between ties that is important. Structural holes generate inefficiencies in information exchange and control. Control is the central element for competitive benefit in a firm's network as it shapes the information structures of other firms, such that "…players with networks optimized for structural holes – players with networks providing high structural autonomy – enjoy higher rates of return on their investments because they know about, have a hand in, and exercise control over, more rewarding opportunities" (1995: 49).

These collaborative approaches imply the role of interdependence between traditional competitors, where firms exchange knowledge and learn through the social and transaction connections they may have. Hudson (2001) suggests that this is an element of the competitive position of firms: long term collaborations, through strategic alliances, mergers and acquisitions and supply strategies, use networks based on mutual dependence and collaboration between partners. Bowen and Leinbach (2006) propose that these connections, in the context of GPNs, can aid upgrading by sharing the competitive success of vertical relationships.

The third stream, resource based competitiveness, focuses on the role of markets in shaping competitiveness through differences in individual firm resources and capabilities, as opposed to factor differences in cost approaches. The approach was developed from work by Wernerfelt (1984) and Barney (1991) who suggested that firm's competitive position could be influenced by its resource configuration. Resources are heterogeneous and imperfectly mobile, which generates differentiation between competitors. The role of inimitability is central to the idea; firms are competitive if their strategy is difficult to copy in the short term, providing advantage against others. The ability to influence the competitive position of others firms is again essential to the approach.

The notion of sustainable competitive advantage differs from Porter's (1991; Porter and Solvell, 1998) model which is based on holding advantage for a period of time, unlike the resource-based view of inimitability. The notion of core competencies, defined by Prahalad and Hamel (1990), suggests that the resources of the firm should be focused on competitive competencies in order to gain and sustain competitive advantage. However, the focus on a finite set of competencies, developed with little regard for the external conditions, was shown to leave organisations inflexible and vulnerable to changes within the environment (Eisenhardt and Martin, 2000). Collis (1994) suggested that this was a result of the core competencies being spatially and temporally specific as they are susceptible to erosion, substitution and being superseded. Changing external markets were incorporated into competitiveness ideas in organisational studies through work on organisational learning (Cohen and Levinthal, 1990) and dynamic capabilities (Horne, 1997; Teece and Pisano, 1994; Teece *et al.*, 1997). Prior literature on capabilities focused on developing the strengths of the company, neglecting to some degree of the external competitive environment and its fit with the firms capabilities (Leonard-Barton, 1992). Teece *et al.* (1997) suggested that the organisational capabilities, or strengths, should change with the external environment for sustained competitive advantage. Porter's (1991) notion of dynamic strategy criticises the resource-based view for not considering the role of the local environment and the abandonment of product market factors. He suggests that resources are an essential element of competitiveness but are a result of past managerial actions and, therefore, resources and activities are 'duals of each other' and need to be considered together. Resources are valued by the market price. This engagement with the local environment has featured in later resource-based conceptions of competitiveness through internal and external learning for innovation (Schroeder *et al.*, 2002) and 'performance heterogeneity' from price and cost differences between regions as well as other factors (Hoopes *et al.*, 2003).

Flexibility to adjust to changing circumstances and maintain a competitive advantage is a fundamental aspect of competitiveness. The manufacturing sector is comprised of many and varied industries and production structures. The sector is faced with increasing international competition, from both advanced economies and lower wage regions, that requires intricate competitive strategies (Christopherson, 2009a; Clark and Clavel, 2012). Inter-firm relationships, both within a region or global production system, have been identified as key aspects of generating competitive advantage (Schroeder *et al.*, 2002). The following section will examine current understandings of these strategies within the context of manufacture in a high wage region.

2.3.1 Manufacturing Competitiveness in High-cost Locations

Competitiveness in relatively high cost locations is focussed on alternative ways to create added value to avoid direct price competition, largely drawing from resource development and collaborative forms of competitiveness in the value chain. These locations, such as the UK, are suggested to have made a transition to the knowledge economy (Drucker, 1993), where innovation, knowledge and complex products (Davies, 1997) are central to competitiveness. Several models of adjustment in high-labour cost regions have identified innovation as a means of non-price competitiveness through new forms of flexible production organisation in creative economies (Florida, 1996) and phoenix industries (Christopherson, 2009b, 2009c). The approaches build on the flexible specialisation idea developed by Poire and Sable (1984). Firms in these regions have established technologically advanced specialisms whilst retaining the flexibility to adjust to changing markets. Christopherson suggests that this flexibility stems from the range of organisational roles, incorporating many different but compatible skills bases. European based studies on adaption in old industrial regions suggest the role of national policy directives, in combination with regional characteristics, in shaping the adjustment capacity of these firms and regions (Birch *et al.*, 2008). Here, the adjustment path is influenced by larger scale national trajectories, in addition to the regional characteristics.

The work on producer services in advanced economies has highlighted the role of differentiation as a competitive strategy, moving away from prior focus on cost towards a performance based advantage (Lindahl and Beyers, 1999). This work has prompted the development of a stream of literature suggesting manufacturing is becoming increasingly composed of a mixture of production and service activities (Bryson, 2009). Livesey (2006) identifies the various roles within production, suggesting that production only forms one task in the manufacture a product. The work of Bryson (2009; Bryson and Taylor, 2010) and MacPherson (1997b) posits that the role of services in manufacturing is increasing, providing competitive differentiation through the ability to provide additional and vital supplementary activities associated with the product manufactured. A set of interrelated services and production functions come together to add value both in the production process and product itself (Bryson, 2009). MacPherson (1997a) has highlighted the role of external services based on technical support for product development as a primary force in driving innovation in small manufacturing firms in the USA.

Following this, the role of differentiation is increasingly based on intangible assets, particularly design and branding activities. Design provides additional value to manufacturing based on technical expertise which differentiates firms and adds value to products. Place-based associations are a central element in both design and branding literatures. The relationship between place and design is complex, drawing on historical skill developments and cultural assets in regions (Bryson and Rusten, 2011), legal structures to support inimitability and design protection (Bryson and Taylor, 2010) and modifications of product to meet the requirements of particular locations (Rusten *et al.*, 2007). Brand literature has identified location as a direct generation of value through spatial associations that differentiate producers (Pike, 2010; Tokatli, 2012).

There is increasing convergence on the idea that competitiveness in high cost locations is far more complex than cost verses non-cost forms of advantage. This distinction does not reflect the increasingly intricate division of tasks between locations in the production chain, where high cost regions are undertaking a range of strategies to reflect the variety of products manufactured, of both high and low value (Bryson and Rusten, 2011; Christopherson and Clark, 2007; Herrigel, 2010; Hudson, 2001). Shorter product cycles and rounds of product innovation have encouraged the transfer of knowledge between firms (Casson, 1991a; 1991b; Vanchan and MacPherson, 2008) and prompted increased collaboration within the production chain. Research on competitive strategies has identified a distinct area of value associated with additional services, capabilities and skills based both on place- and non-place-based associations. The evolution of firms into design, branding and collaborative production activities to capture value in an increasingly international market gives rise to the role of formal legal structures of property rights and formal contracts in protecting these competitive advantages, if even for a time-limited period (Bryson and Rusten, 2011; MacPherson and Pritchard, 2007). Inimitability is a central competitive strategy under these value creating methods, where collaboration within the supply chain and the transfer of valuable knowledge between manufacturers is increasingly important for competitive advantage. Maintaining the value of this knowledge is vital to sustain differentiation and generate advantage from design and branding (Bryson and Taylor, 2010; Bryson *et al.*, 2008; Monk, 2009).

2.4 Conceptual Framework: Contractual Relationships

The review of literature has identified the central role of relationships in current understandings of production organisation and adjustment in economic geography. Relationships have become a prominent focus due to increasingly fragmented production through outsourcing of both production (Angel and Engstrom, 1995; Glasmeier and McCluskey, 1987) and, increasingly, core tasks (MacPherson, 1997b; MacPherson and Vanchan, 2010). The absorption of functions in the supply base has required knowledge exchange, particularly tacit, between firms and their suppliers (Bathelt and Glücker, 2011; Sturgeon *et al.*, 2008). This network approach to production has given rise to a more flexible system based on specialisation and integration between firms. The need for responsive, lean and adaptable systems of production requires 'loosely coupled networks' (Brusoni *et al.*, 2001), where inter-firm ties connect firms in an integrated system of production allowing the individual firm to remain flexible (Grabher, 1993; Uzzi, 1996; 1997; 1999). Flexibility, defined as the ability to respond and adjust to changing environments, is a central element of the approach. Continuous innovation is a key source of competitiveness in global production systems (Casson, 1991b). The speed of development and innovation requires immediate response to product development or production demand changes, enabled through flows of information and knowledge within the network. Cooperation and trust between transaction partners, who are unable to specify and formalise all production activities under these rapidly changing environments (Casson, 1991a) is a key competitive strength (Uzzi, 1997).

In line with the development of the network approach, there has been a focus on relational contracting in economic geography. Relational contracting, based on non-contracted forms of interdependency and reciprocal trust between transaction partners [developed as an alternative to formal contracts in contract law (Berulava and Lezhava, 2007; Macaulay, 1963)], has been drawn on heavily in economic geography in conceptualisations of networked production systems, governance structures (Gereffi *et al.*, 2005), upgrading (Bathelt and Kappes, 2009) and competitiveness through collaboration, capabilities and learning. The relational approach highlights inter-personal ties, informal trust and internal working of the firm in shaping the interplay of relationships between firms (Taylor, 2006). Trust and cooperation are cornerstones to the learning approach of competitiveness (Bathelt and Glücker, 2011) and the organisation and performance of networks (Bathelt *et al.*, 2004; Gertler, 2003; Maskell, 2001b). The focus has been primarily on social inter-personal relationships as structures of economic activity such that:

> *[g]lobalization, then, is obviously not a process of disembedding based on mere market transactions and impersonal trust, but rather a process of transnational (and thereby translocal) network building or embedding, creating and maintaining personal relationships of trust at various, interrelated geographical scales (Hess, 2004: 176).*

Trust is seen as a resource in economic systems (Bathelt and Glücker, 2005) and "…fundamental characteristics of business networks" (Murphy, 2006: 428) which is socially embedded, allowing the maintenance of value in the relationship (Gaur *et al.*, 2011). The focus has been on understanding relational ties between economic agents through socio-economic context and mutual understandings (such as in relational proximity work, see Bathelt and Glücker, 2003; Murphy, 2011), such that trust "…enables structures such as networks, clusters or commodity chains to emerge and be stabilized over time" (Murphy, 2006: 429). This approach has led to a focus on inter-firm relationships (interactions) rather than specific entities (firms, industries) or spatial scales in understanding production complexes through the network approach (Castells, 1996; Dicken *et al.*, 2001).

The transaction cost literature has developed a far more complex understanding of inter-firm relationships based on a hierarchy of relationship types between market exchanges and vertical integration (Cox, 1996; Eccles, 1981; Hodgson, 2002; Williamson, 1973), with relational contracting itself having many forms depending on the nature of the asset and ownership structure (Cox, 1996; Grossman and Hart, 1986). The interaction of formal contractual and informal trust structures has been a key aspect of this debate (Connelly *et al.*, forthcoming; Mellewigt *et al.*, 2007; Vlaar *et al.*, 2007; Woolthuis *et al.*, 2005). Contracts have traditionally been seen as a substitute to trust in specific circumstances where trust is either inadequately developed or there is a limited prior history to the relationship (Macaulay, 1963). However, more recent debates have introduced the notion of contracts as a complement to trust in inter-firm relationships, where contracts are used as forms of coordination rather than purely as control mechanisms (Mellewigt *et al.*, 2007; Woolthuis *et al.*, 2005). Empirical examinations have also highlighted the complementary nature of contracts and trust within the same relationship, where each undertake different functions of governance over different elements of the development of the relationship (Fuller and Lewis, 2002; Mudambi and Helper, 1998). This complexity, illustrated through the existence and multiple functions of contractual arrangements, suggests the significance of formal agreements in production relationships in addition to tacit based conceptualisations. There have been calls for work on the complexity of relationship structures from both TCE school (Woolthuis *et al.*, 2005) and increasingly in economic geography (Taylor, 2006; Taylor and Bryson, 2006). The TCE approach seeks to understand the impact of the social context in the use of contracts and the non-legal uses of formal contracts in structuring relationships over time (Woolthuis *et al.*, 2005). Rusten and Bryson, in contrast, are critical of the focus on social, as opposed to legal, aspects of inter-firm relationships:

> *Economic geographers may have become too fixated on unravelling the complex geographies of relational social networks at the expense of placing such relationships in the wider legal and governance structures that both constrain and enable the behaviours of social actors embedded within firms (2010: 249).*

These critiques highlight the need to marry together these approaches to inter-firm relationships and, particularly for economic geography, the incorporation of formal relationships into current understandings of production organisation. Additional forms of relationship based on formal contractual structures have begun to be identified through empirical analysis but have yet to be incorporated into conceptualisations of relationships in economic geography. There are three types of formal relationship structures that are currently under conceptualised in economic geography:

Strategic alliances

Strategic relationships have been identified as a key aspect of interaction in knowledge intensive industries (Casson, 1991b; Powell *et al.*, 2005). They facilitate access to markets (Casson, 1991b), cooperation between transaction partners (Beuve and Saussier, 2012) and act as a significant element of firm boundaries (Baker *et al.*, 2008). The transition towards knowledge and learning as a competitive differentiator suggests the increased significance of these forms of organisation.

Trust as a dynamic and historic feature

Stable and repeated relationships between firms are a key aspect of relational contracts (Baker *et al.*, 2002; Eccles, 1981). The focus on trust aspects of relational contracting in economic geography has neglected the significance of future exchanges in sustaining trust based relationships. Distinct forms of implied contract from repeat transactions, such as email exchanges, develop and generate an obligation based on firm, rather than personal, linkages that have tangible ramifications.

Contractual agreements

There has been increasing attention to the role of inimitability maintaining competitive advantage (Bryson and Taylor, 2010; MacPherson and Vanchan, 2010; Poon and MacPherson, 2005). Outsourcing technology and strategic elements of the production process has highlighted the use of contractual agreements in protecting firm assets and value areas (MacPherson and Pritchard, 2007). The formalisation of inter-firm relationships through property rights (Monk, 2009) and legal structures (MacPherson, 2009) is increasingly evident in empirical examinations.

An appreciation of the complexity of relationship structures between firms is important for understanding how firms adjust and remain competitive. Prior focus on interactions has conceptualised the relationship as the primary influence in the structure and dynamic of production organisations, where "…the power of flow takes precedent over the flows of power" (Castells, 1996: 469) and power and trust resources are the property of relationships rather than strategic entities (Bathelt and Glücker, 2005). According to Castells, "[n]etworks are open structures, able to expand without limits", where the "…structure is a highly dynamic, open system, susceptible to innovating without threatening its balance. Networks are appropriate instruments for a capitalist economy based on innovation, globalization, and decentralized concentration; for work, workers, and firms based on *flexibility*, and *adaptability*" (emphasis added, 1996: 470-1). The ties between firms, and their structure, have been identified as a vital element of a firm's ability to adjust (Christopherson, 1996; Grabher, 1993). By incorporating formal interactions, such as contractual agreements, alliances and trust based on prior experience, the firm becomes a central actor in the interaction through strategic action, coordination of relationships (Dicken and Malmberg, 2001) and its legal structure (Rusten and Bryson, 2010). This conceptualisation ***adds*** to the complexity of the firm, integrating other approaches and functions, where the firm is seen as a 'multidimensional coordination problem' (Oinas, 2006: 249). Thus the firm can be thought of as;

(1) *a set of assets that are historically developed (sunk costs (Clark and Wrigley, 1995), brands (Pike, 2010))*;

(2) a *hierarchy of production relationships ranging from those formed entirely on trust to those which have no aspect of trust*;

(3) *a blend of many, and often various forms, of relationships*;

(4) *set of geographies and spatialities (Taylor and Asheim, 2001);*

(5) political processes (Christopherson and Clark, 2007).

Under this conceptualisation the complexity of the firm is maintained. The firm is more than a nexus of contracts (Jensen and Meckling, 1976) or a site of activities (Dicken and Thrift, 1992), instead conceptualised as a site of value creation based on capabilities (Audretsch, 2000) and the sets of assets, spatialities and political processes incorporated within the firm. This complexity is reflected in the firms' ability to shape relationships and where relationships vary according to their different histories (Hodgson, 2002), development over time (Taylor, 2006), nature of product (Cox, 1996) and the power that the firm itself can attain. The specificity of the firm and its history, resources, capabilities and spatiality generate a range of interactions between firms. How these forms of coordination come together in the context of the individual firm has received little academic attention (Oinas, 2006; Taylor, 2006) despite their significance in understanding adjustment.

The thesis will address limitations in understanding in the hierarchy of relationship types and the conceptualisation of the firm as a bundle of relationships. The conceptual approach draws on current work in economic geography and management, marketing and procurement literature to generate a holistic view of the firm and its relationship structures. In doing so, it will aim to develop a more nuanced understanding of relationships between firms and how this complexity of interaction affects adjustment practices in a specific context of the IMP industry. Under this conceptualisation the firm is a strategic actor in the formation of relationships and organisation of production tasks. But the firm acts within a framework of interactions, transactions and connections that constrain and enable decisions. The connections are complex, based on multiple and varied relationships that together influence the adjustment capacity of the firm.

2.5 Summary

The review of literature has identified a research gap in the current understanding and conceptualisation of inter-firm relationships in economic geography. Through an examination of production organisation, adjustment and firm literature it can be seen that the current conceptualisation of network relationships is based on informal ties of trust, collaborative working and knowledge exchange. By incorporating alternative views of interaction, largely drawn from the transaction cost and relational contracting approaches, it can be seen that a more nuanced understanding of relationships is required in economic geography that includes formal agreement structures and reflects the complexity of inter-firm relationships.

Two specific research gaps have been identified;

Hierarchy of relationship types

Bundle of relationships within the firm

Formal agreements built from strategic alliances, reputational trust and contracts are missing elements in the conceptualisation of both relationship types and the multiple relationships within the individual firm.

The empirical chapters will examine relationship structures within the industry and the role of formal contracts in profit generation (Chapter Five), adjustment (Chapter Six) and the interaction of formal and trust based coordination between transaction partners (Chapter Seven). The next chapter details the tools and techniques used in the study's methodology in order to understand change in the context of connectivity and relationships.

3 RESEARCH TECHNIQUES

3.1 Introduction

The research methods are designed to allow a detailed exploration of adjustment in IMP firms, with a particular focus on inter-firm relationships. Qualitative methodologies were used to generate a contextually rich data set, based primarily on corporate interview techniques. The fieldwork was undertaken in two stages: first an intensive industry study of 45 IMP firms and then a smaller scale study of key transaction partners of IMP firms.

The following discussion will outline the research techniques used to undertake the study. The overall research approach is provided, followed by a detailed description of the sampling, data collection and analysis techniques used. The implications and challenges of these strategies are then discussed and finally a summary of the key methods undertaken.

3.2 Research Approach

The study is designed around three aspects: change and adaptation, the firm as an economic actor, and the importance of context in economic action. *Change* is defined here as a gradual practice, influenced by multiple ongoing processes that combine within the specific context. As such, change is viewed as a continuous process of transformation. The approach, therefore, is explorative to allow for diversity in triggers, processes and contextual influences on the properties of change (Pain *et* *al.*, 2011; Sayer, 2007) and the nature of the decision making process in structuring change (Lloyd and Shutt, 1985; Massey and Meegan, 1985). The focus is on allowing the respondents to identify their own instances of change and does not trace the responses to any particular event. The approach invites variety and aims at exploring the practices of economic activity, both everyday and under stress, to examine the fundamental causation in many different firm and event contexts. Undertaking research during the global economic crisis (2007-) had two key benefits: it provided a consistent change event (Hughes, 2012) and an element of dynamism into the study. As a change event, the recession acted as a common evaluative framework from which adjustments could be compared across the sample from the same causation (Sayer, 2000). A common criticism of studies in economic geography is the static nature of insights (Bryson *et al.*, 1999; Markusen, 1999b). This study has been able to introduce an element of dynamism by using the recession as an 'event' – a distinct transformative period where the entity of study (in this case the firm) moves from one state to another. Although research on change is traditionally done through longitudinal studies, the critical element is the ability to identify change (Pettigrew, 1990), which is achieved here through a consistent event - recession.

The research uses the *firm* as the unit of analysis. The firm is viewed as the fundamental agent of economic action through strategy and practice (Amin and Thrift, 2000; Dicken and Thrift, 1992; Dixon, 2011; Markusen, 1999b). Practices, defined by Jones and Murphy as "…stabilized, routinized, or improvised social actions that constitute and reproduce economic space" (2011:1), allow the researcher to observe the process of change through actions and events. The firm acts as a site for the integration of multiple scales of processes, relationships and their implementation at the micro level (Jones and Murphy, 2011; Yeung, 2003). By focusing on the practices that occur in and through the firm the research can engage with these multiscalar dimensions, thereby avoiding a binary conceptualisation of causation (Pain *et al.*, 2011) and retaining the transitionary processes that occur during change (Jones and Murphy, 2011). Although there is considerable debate over the role of the firm as an economic actor (for instance Walker's (1989) critique of the significance of large firms or O'Neill and Gibson-Graham's (1999) account of the diverging attitudes within the firm), it is considered here to be the most appropriate research scale as the study is primarily concerned with *firm-firm* relationships. The assumption is made that the firm is a unified entity[5] because the firm acts as the agent of economic action (Markusen, 2003).

The role of *context* in economic action is a key aspect of the research. An intensive analysis was undertaken as it "…seeks out substantial relations of connection and situates practices within wider contexts, thereby illuminating part-whole relationships" (Sayer, 2000: 22). The method allows exploration of challenges among a range of firms in the sector to provide a wide explanatory framework that includes variation among firms (Massey and Meegan, 1982; Sayer and Morgan, 1985). The relatively large number of firm interviews allowed for a comparison between companies in a similar situation to understand but also to highlight alternative strategies. The 'space for choice', to utilise Berger's (2005: 34) phrasing, is an important consideration in evaluation of firm strategy and change process. By incorporating a larger number of

[5] The firm is viewed here as an economic actor because production agreements are based, and accountable to, the 'firm' and not individuals within it. It is acknowledge that this representation does not fully encompass the complexity of the firm but is an appropriate representation for the purpose of this study. For further discussion of the conceptualisation of the firm see Taylor & Asheim (2001).

cases, the capacity of actors and variety of options is maintained. This explorative stage was followed by a more in-depth analysis of key themes through case studies, which provided detailed analysis of situated examples (Yin, 2003b).

The critical realism approach, outlined by Sayer (2000), has been used as the ontological framework as it incorporates the role of *context and change* through its basis of explorative theory building. By engaging with firms and their representatives through qualitative interviews, the assumption is made that the access to business informants and their knowledge is restricted and based on the participants own situated and partial knowledge (Gibson-Graham, 1994; Hughes, 1999a; Rose, 1997). As such, the critical assumption is that "…what has happened or has been known to have happened does not exhaust what could happen or have happened" (Sayer, 2000: 12). With this in mind, the approach is focussed on unearthing the structures and mechanisms that drive causation from its effects, rather than the occurrence of the event itself. Building theory through comparative analysis allows for diversification of outcomes without reducing the validity of the research. The research does not need to focus on specific occurrences (e.g. 'successful' firms or best practices), which are difficult to refine in a firm based study where the resource and capability configuration of each firm differs, but rather on the diversity derived from the influence of such contextual 'conditions' (Amin *et al.*, 2002; Del Casino Jr *et al.*, 2000). The final assumption of the study is that change occurs through the interaction of one entity or event with another. By following a critical realism approach, the 'emergent' factors are acknowledged as a critical part of the study.

There are several limitations to this approach. Firstly, the nature of that which is being studied is transient and dynamic. Law (2003) suggests that the researcher should engage with the ‘mess’ and acknowledge the ‘vagueness’ of knowledge around the subject. By utilising an explorative approach the study aims to acknowledge variety and contradictions through theory building. Secondly, using the firm as the analytic unit suppresses other view points (Fuller and Moran, 2001; Glasmeier, 2007). Although this is acknowledged, it is believed that a focus on the firm provides the greatest ‘methodological fit’ between research questions, design and current theoretical understandings on adjustment and change (Edmondson and McManus, 2007). Thirdly, the focus on practices can give credence to insignificant and transient processes.

3.3 Sampling Strategy

A purposeful sampling strategy was used to target a specific type of economic activity – production for further manufacture - which was also undergoing significant change. The criteria of the sample are shown in Table 3.1. The sample was targeted to optimise the capture of relations and events to meet the research aims within limited time resources (James, 2006).

Table 3.1: Sample Criteria

Criteria	Reason for Inclusion
Product type: intermediate component	To ensure the firm is encased by relationships with other manufacturers
Actively trading with external firms	Inter-firm relationships specifically examined
Intense competitive pressure	Ensure a need for change

Although the recession was a consistent and significant event across the sample, the study does not focus on a particular change event as the research is interested in overall ongoing *transitions*, rather than specific adaptations to a particular event. As such, it was important that the study sample was under intense competitive pressure from an increasingly international market and therefore continuous and ongoing adjustments required throughout the sector. The focus is on relationships with firms; ownership structure and size were not predetermined factors but remained open to the sample to retain diversity of resource influences (Sayer, 2007).

3.3.1 Industry

The industry was determined through preliminary analysis of linkages between sectors through Input-Output Analysis. This was done to identify those sectors that were fundamental to further manufacturing in the UK by measuring the number of forward and backward linkages through key sector analysis (Lenzen, 2003). Two types of linkage were examined; traditional economic relationships and environmental flows of materials, energy and waste. For further explanation of the technique see Appendix 9.1.

Several sectors were identified with both economic and environmental significance (Appendix 9.1). The results were dominated by the primary production (e.g. electricity production and distribution) and service based (e.g. banking and finance) industries. Metal manufacture was found to be the only significant manufacturing industry in this analysis. Metal manufacture encompass several stages of production (Wood, 1976) and further refinement through desk based research was undertaken to identify component-based sub-industries, finally refined to basic and fabricated metals (SIC 27 & 28), illustrated in Table 3.2 below. This industry is again very diverse in terms of product and process. Further refinement identified foundry and forging sub-industries (SIC 27.5 and 28.4) as they have common products (metal components) and markets (further manufacture), with a high level of linkages in the wider economy (Taylor, 1978; Taylor and Wood, 1973). This provided a suitable sample industry with a high level of homogeneity in terms of the product type and engagement with the wider economy.

Table 3.2: IMP Industry Classification

Industry (SIC 2003)	Sub-industry	Description
27	27.1	Manufacture of basic iron and steel and of ferrous-alloys
	27.2	Manufacture of cast iron and steel tubes
	27.3	Cold drawing, rolling and forming
	27.4	Precious metals and non-ferrous production
	27.5	Casting of ferrous and non-ferrous metals
28	28.1	Manufacture of metal structures and parts of structures
	28.2	Manufacture of tanks, reservoirs and containers of metals (inc. central heating radiators and boilers)
	28.3	Manufacture of steam generators
	28.4	Forging, pressing, stamping and roll forming of metal; powder metallurgy
	28.5	Treatment, coating and machining of metals
	28.6	Manufacture of cutlery, tools, locks and hinges
	28.7	Manufacture of fabricated metal products

Source: Index to the UK Standard Industrial Classification of Economic Activities 2003 (ONS, 2003). Clear rows indicate sub-industries used in study.

3.3.2 Location

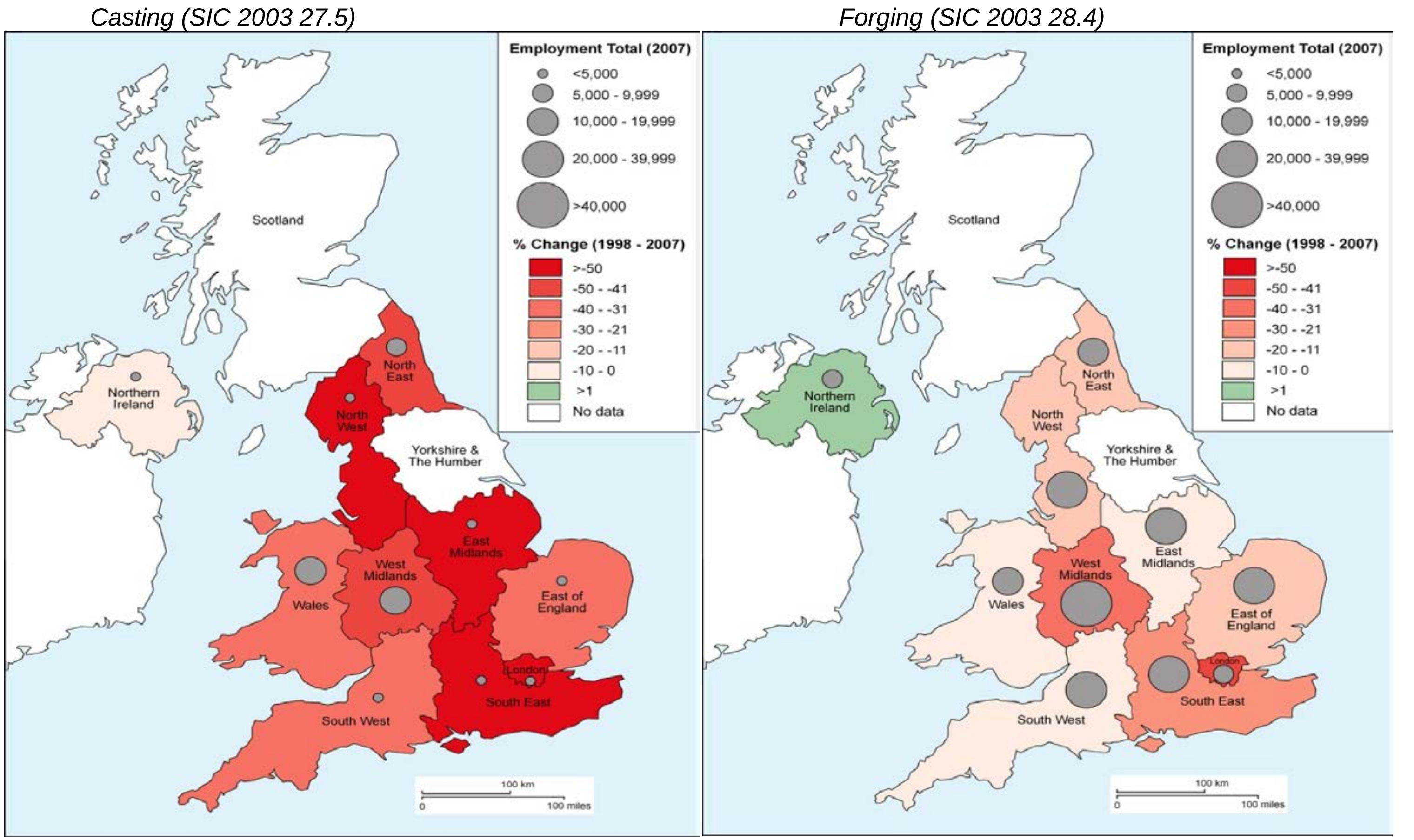
The study was based in the West Midlands region, UK. A single location was used to isolate the influence of place in firm behaviour through common historical and political structures (Amin *et al.*, 2002).

The region comprises six counties (see Figure 1.2), with the majority of IMP firms located in the West Midlands county (76% of IMP firms from the FAME database).

Despite the low concentration of IMP firms in sub-region 1 (Hereford, Worcester and Warwickshire) and sub-region 2 (Shropshire and Staffordshire), the counties were retained within the study's classification to facilitate firm sampling and inter-comparison with published data on the industry, both at European and national administrative levels. In addition, these areas have been identified as having innovative, niche metal manufacturers (Bryson and Taylor, 2006; Taylor and Bryson, 2008). The purpose of the research is not to target specific 'clusters' of firms but to site the study within its governance/institutional framework (Amin *et al.*, 2002). As such, it was important to define the study location against formal boundaries.

The region was chosen for both methodological and practical reasons. The West Midlands has one of the largest concentrations of foundry and forging employment and enterprise populations, but has also experienced substantial decline. Figure 3.1 and Figure 3.2 show the proportional decline of the IMP industry within the UK. Despite this, the IMP industries continue to be significant forms of manufacturing employment in the region [4.9% foundry, 18.7% forging in 2007 (Eurostat, 2011b)]. Targeting a large population of firms with significant decline, and therefore conditions for change, allowed for the most efficient use of limited time and resources to capture the required study data (James, 2006).

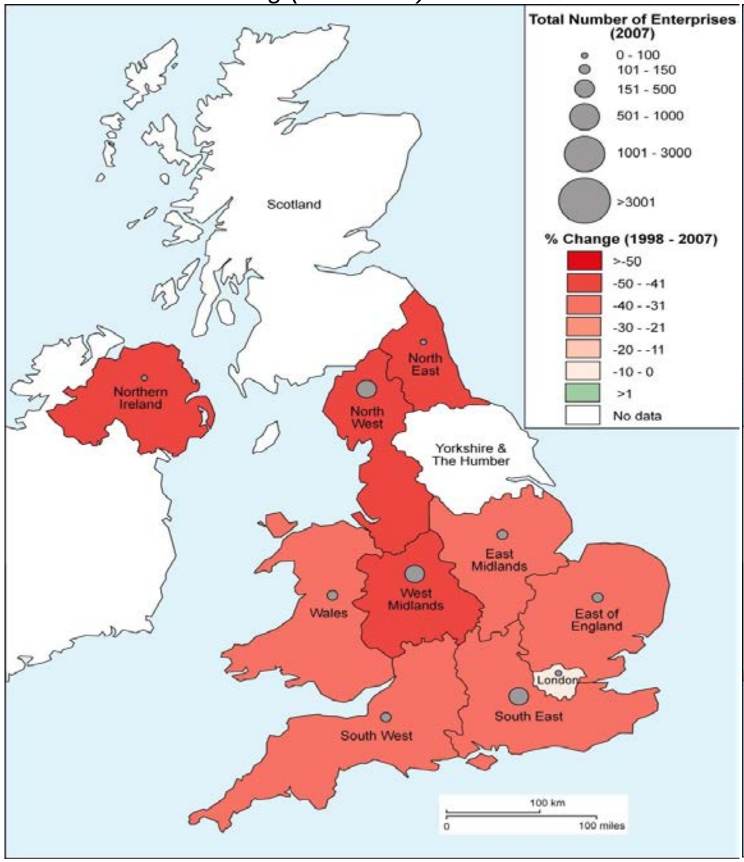
Figure 3.1 Employment Distribution and Change, 1998-2007



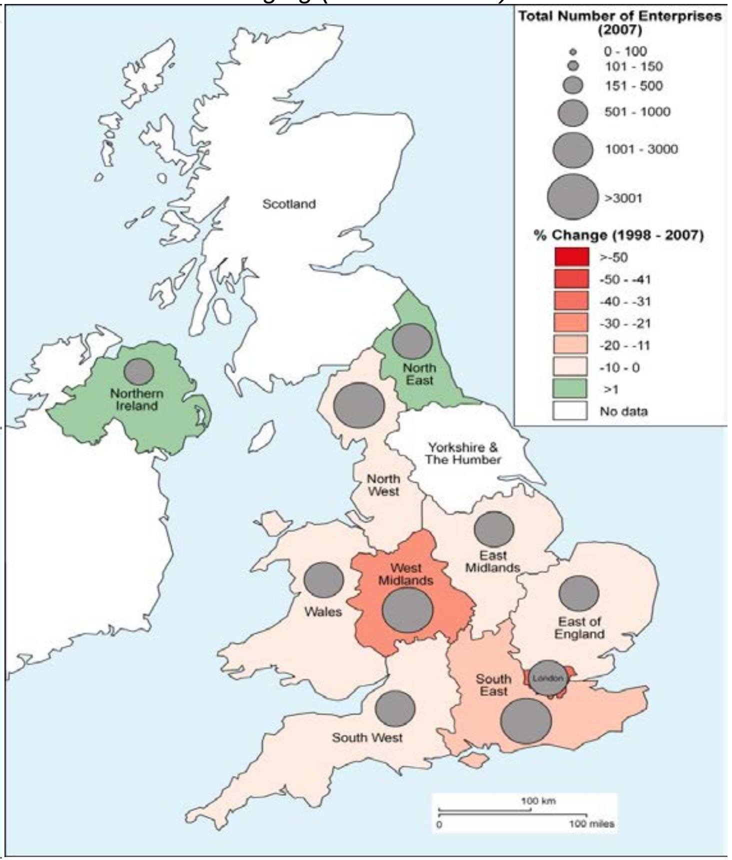
Source: Author (2012) based on data from Structural Business Statistics: Regional (Eurostat, 2011b)

Figure 3.2 Enterprise Distribution and Change, 1998-2007

Casting (2003 27.5)



Forging (SIC 2003 28.4)



Source: Author (2012) based on data from Structural Business Statistics: Regional (Eurostat, 2011b)

3.3.3 Firm

The sample was generated initially from a database of UK VAT registered firms: Financial Accounts Made Easy (FAME) and based on the Standard Industrial Classifications (SIC) (2003). The FAME database uses Companies House records (legally required reports of all VAT registered companies in the UK) and identifies key organisational and financial characteristics. It is considered the most effective method of generating a business population (BERR, 2009). However, the information recorded varies between firms due to legal requirements (BERR, 2009) and the level of detail the firm chooses to record beyond a legal requirement. A locational based population was originally constructed based on registered address (applicable to all VAT registered firms), active status (financial transactions within the past financial year (BERR, 2009)) and primary SIC. This was then sub-divided by firm employment size. There were several data limitations in this approach. Employment levels are not required for firms classified as micro-small by turnover, therefore an estimation function was applied by the database to classify this population. The information can be up to 23 months old (based on annual accounts or the anniversary of firm establishment), therefore firms which were not actively trading at the present time were included in the population. Additional sources (trade association membership lists and web searches) were used to validate and update the population against the primary SIC classification and to include those firms which were either not VAT registered or not correctly represented by their primary SIC code.

A data cleansing process was then undertaken to limit inaccuracies and refine the sample population according to study criteria. This is outlined in Table 3.3 and Table 3.4 below. The prolific merger activity made it difficult to generate a population of working firms. Dormant firms were identified by examining trading history (the last three years were provided) and tracing merger and acquisition activity (through historic profiles available). In cases where there was no trading activity in the last available year the firm was removed from the population. Multiple firms at the same postcode were investigated to remove double-counting. It is common practice to establish ‘paper’ subsidiaries and holding companies – to financially protect assets and liabilities – that were not production operating companies. As such, the facility which had operational data (purchase and sales) was retained in the sample and the remainder removed from the population but retained as linked entities. This created difficulties with the SIC classification as some of the multi-registered firms that remained did not have the desired SIC but were retained in the sample as their owners engaged in production processes. The population was checked against the required SIC codes. However, inaccuracies in status and production process were discovered when undertaking specific research on sample firms, at which point they were removed from the sample.

Originally the sampling strategy was targeted at generating a subgroup of firms based on their financial stability and vulnerability, using credit ratings from FAME[6]. The intention was to construct a comparative analysis of ‘stronger’ and ‘weaker’ firms to assess the determinants of such vulnerability and the impact of risk on the firm. The credit rating, termed ‘quiscore’ in FAME, is based on statistical analysis of current and past financial stability and likelihood of closure within the following twelve

[6] The FAME database provides financial information on UK and Irish businesses based on records from Companies House reports. Information can be sought on individual firms and collections of firms based on location or industry to provide comparative business intelligence. The database is published by Bureau Van Dijk.

month period. It classifies businesses into five categories of stability: secure, stable, normal, caution/unstable and high risk. The proliferation of merger, acquisition, closure and reopening in the industry has generated a high level of dormant subsidiaries (registered firms without economic activity). It was predominately these businesses which had ‘high risk’ and ‘caution’ ratings, which, because of the non-use of the business were not useful for the study. As this did not generate any useful classifications the ‘normal’ firms were re-entered into the population (Table 3.3). There was an access problem with the forging subsector (see section 3.6) and as a result, the sampling criteria had to be widened to include a larger population (Table 3.4). This was achieved by a web search of forging business, which uncovered several additional firms.

Table 3.3: Firm Identification from FAME Database, Small and Medium Sized Enterprises (SME)

Stage	Criteria	Number identified	Sample number
1	West Midlands, SIC (2003) 27.3, 27.5, 28.40, 28.51 Active, Active (receivership), Active (dormant) Below 250 employees (with estimate)	314	314
2	Missing Quiscore variable	35	279
3	Inclusion of other database sources	24	303
4	Removal of firms with non-primary SIC	157	146
	Exclusion of normal categorisation	39	107
	Exclusion of dormant subsidiaries	17	90
Total sample			**90**

Table 3.4 Additional Sampling Procedure

Stage	Criteria	Number Identified	Sample Number *
5	Inclusion of firms with a 'Normal' quiscore classification	39	129
6	Recommendations from industry specialists	18	135
7	Inclusion of large firms (above 250 employees) to meet FAME sampling procedure	10	145
	Removal of firms with non-primary SIC	3	142
	Media/internet search	2	143
	Recommendations from industry specialists	3	146
8	Web-based search for additional SIC 28.40 (forgings) (all sizes)	7	153
Total number of firms in sample			**153**

** Sample number reflects running total- firms identified in subsequent methods are in some cases already included in sample.*

Due to the limited information available through financial records, it was difficult to target any particular group of firms and therefore the most suitable strategy to generate a cross-section of organisational success would be to follow a random sampling procedure. Under this approach, it would avoid the limitations of a 'best practice approach' and determine success from analysis of the individual organisation rather than by set criteria (Amin *et al.*, 2002; Hanson and Pratt, 1995). Based on this strategy 20% of the population was selected to contact (every fifth firm). This continued through the outstanding working population until the desired number of firms had been interviewed (overall response rate of 44.4%). Through discussions with industry specialists (eight) and fieldwork interviewees it became apparent that there were key firms in the sector that were leading innovators in process and business practice. As a result, it was decided that it was important to include these firms in the sample and they were targeted independently from the random sample. It should be noted that this was a biased selection based on engagement with the associations. For this reason, these recommendations formed only a small part of the selection and were only included if they were also in the working population.

3.3.4 Participant

Despite the assumption of the firm as the economic agent, the selection of individual participants remained an important step determining the management structure of the firm and to access the appropriate knowledge. Participants were selected to optimise access to information about the strategic and operational decisions of the organisation. As such, operating managers were targeted as it was believed that these roles held the greatest decision making capacity. Identifying the operating manager proved difficult for two reasons. Firstly, information was limited. Initial leads were taken from the registered contact on the Companies House record; however these were often out of date (particularly due to the increased employment change during the recession). Secondly, the identification of 'managers' is difficult in small to medium sized manufacturing firms as often the manager undertakes several other roles.

3.3.5 Representativeness of Sample

The final study sample comprises interviews with 45 IMP firms, which represent 0.9% of the region's estimated IMP population. The distribution of the sample between IMP industries, firm size and representativeness to wider population is illustrated in Table 3.5 below.

Table 3.5: Structure of IMP Industries at National, Regional and Respondent Group Level

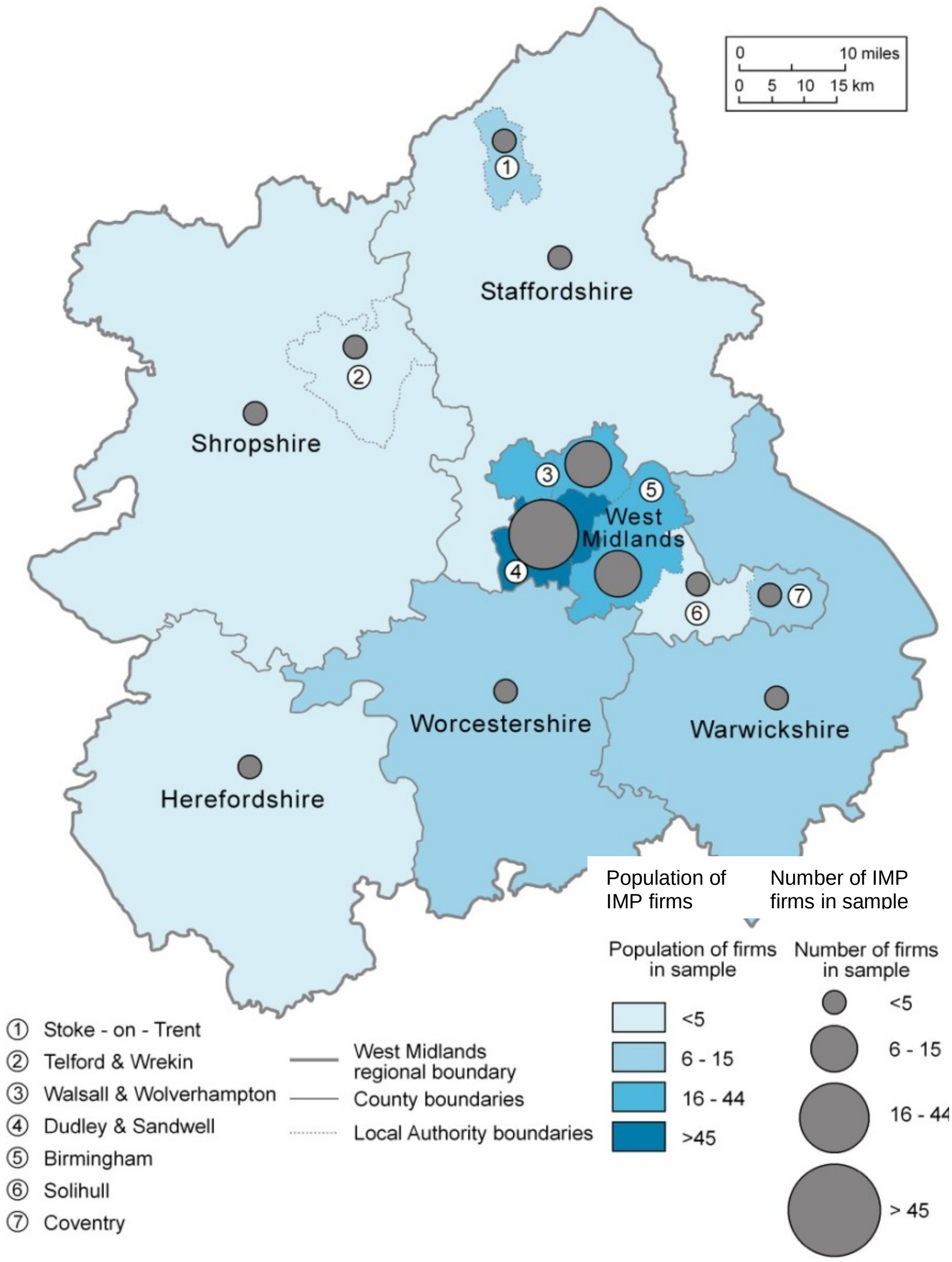
		Foundry *(SIC 03 27: Manufacture of basic metals)*			**Forge** *(SIC 03 28: Manufacture of fabricated metal products; except machinery and equipment)*			**IMP Total**
		SME	*Large*	*Total*	*SME*	*Large*	*Total*	
UK Population [a]		1165	*10*	1175	19880	*20*	19900	**21075**
UK Population of which IMP sub-industry [a]		*SIC 275*			*SIC 284*			
		470	5	475	695	10	705	**1180**
West Midlands Population [b]		365	10	375	4395	25	4420	***4790***
Respondent Group	Number of firms	26	2	28	14	3	17	**45**
	Number of interviews*	30	3	33	16	5	21	**54**

Note: SME (1-249 employees), large (250 or more employees)
**Multiple interviews conducted in some firms*

Source: (a) BIS (2009b) (excludes sole proprietorships and partnerships with only owner-manager) (b) Wetherill (2009)

Firms were classified according to their size (based on employment and turnover levels), ownership structure and process. The sample is predominately SMEs (40/45) (classified as below 250 employees and £22.8million turnover) (BERR, 2009). Size was used as a manageable distinction of resource differences and to reflect the conventional use of such classifications in policy and industry studies. It was felt that large firms were significant strategic actors in the industry, particularly with the trade association and in political lobbying, and as such they were deemed important to be included in the sample (Glasmeier, 2007). In addition, they have a far larger resource base and structural power in comparison to smaller firms and, therefore, provided a comparative case of these factors. The sample is over represented in large firms due to the very low proportion of large organisations in the industry. This was mitigated by analysing the groups separately. The distribution of sample firms in the region reflects the general locational pattern of the wider population, with the majority in the West Midlands county and Dudley and Sandwell in particular, which is illustrated in Figure 3.3 below.

Figure 3.3: Population and Sample of IMP Firms in West Midlands Region



Source: Author (2012) using population estimates from FAME

As single interviews were the primary source of data collection, the information collected was representative of only the specific plant visited. Although the sample is predominately composed of single site enterprises (35/45), there is some diversity in the ownership structure of firms within the sample. Firms with multiple ‘paper’ subsidiaries (firms where there were no other physical sites but subsidiaries existed for accounting purposes) (2 firms) were represented as single sites. Multi-site organisations are represented according to the level of data collected: if the group managers were interviewed, the firm is represented as a group (Larsson, 1999); if only a subsidiary site was interviewed, they were represented as a subsidiary part of a larger organisation. This distinction is important for two reasons. Firstly, in several cases the interviewed sites were the only part of the group to engage in IMP activities and therefore it was inaccurate to reflect the whole organisation as an IMP firm. Secondly, the sites act as autonomous business units and therefore the decision making capacity (that of the interviewee) reflects the particular site. However, these sites also have access to resources within their group (Clarke, 1985; Taylor, 2000), which must be reflected in analysis by reference to the sites position within a larger organisation (e.g. SME X – group subsidiary).

There is a prominence of foundry firms in the sample due to access difficulties with forging organisations. In addition, SIC classification was not always an accurate reflection of current production processes. As such, a sub-group of firms were identified as primarily undertaking fabrication activities (a distinctly different process to that of casting or forging). This was predominately found in forging enterprises (6:2 forge: foundry ratio) that had diversified into higher value fabrication activities. These firms remained classified under their formal SIC code but were acknowledged during analysis as a sub-group.

3.4 Data Collection

Date was collected over a 13 month period (September 2009-October 2010) through qualitative interviewing and desk based research. Fieldwork was divided into two stages: an intensive survey of IMP firms (45 firms, 55 interviews) and a case study of buyer-supplier relationships (10 firms, 11 interviews). The second stage emerged during data collection, when the importance of transaction relationship dynamics was particularly evident and quickly became a central theme in the study. All interviews were digitally recorded but one firm was unwilling to be recorded. Field notes were taken throughout the fieldwork process to record any significant perceptions or events, and used, in particular, to record the changing economic climate during the fieldwork period.

3.4.1 Data Sources

The study was primarily based on corporate interviews, although other primary data sources were used, which are outlined in Table 3.6. Secondary data sources were also used: financial records, corporate brochures and aggregate published statistics from European and UK based statistical bodies. These were used to prompt interviewees on specific issues and for background information on larger processes, such as industrial energy pricing. The additional data also provided some level of verification of interviewee accounts through questioning their accounts (for instance from financial records of events) and gaining greater clarification from such prompts (Kvale and Brinkmann, 2008; Rubin and Rubin, 2005). Interviews were undertaken at the business premises to prompt factory tours and to situate the respondent in their most comfortable setting (Elwood and Martin, 2000). Second stage interviews were telephone-based due to access difficulties (respondents were not based in the study region).

Table 3.6 Primary Data Sources

Data source	Number	
	Stage 1	Stage 2
Number of enterprises	45	10
Number of interviews	54	11
Multiple interviews at firm	7	1
Number of multiple person interviews	4	1
Number of face-face interviews	53	7
Number of telephone interviews	1	4

3.4.2 The Corporate Interview

The corporate interview allows access to deeper understanding of the decision making process and context of events in the organisation (Boons and Wagner, 2009; Ekanem, 2007; Miller *et al.*, 2004; Schoenberger, 1991). The consistency and representation of voices that represent the firm in the interview has been questioned (Healey and Rawlinson, 1993; McDowell, 1992; O'Neill and Gibson-Graham, 1999; Oinas, 1999). Clark (1998) acknowledges the role of data construction by the interviewee in shaping the type of 'truth' that is shared suggesting that the advantages of accessing experiences and context through this method are critical to developing understandings of corporate practices (Clark, 2007). The assumption of the decision-maker as knowing and open to disclose information is of particular relevance to this study. Due to the highly contextual nature of information it was perceived that interviewing was the most suitable means of access. As the majority of firms in the study were small with a single owner/manager it was assumed that there would be a single decision-maker and their involvement with multiple areas of the organisation (managerial, production, sales) would increase the depth of information and reasoning. However, the assumption did prove problematic in larger firms where there were multiple decision-makers. Multiple interviews were undertaken where possible to mitigate partial understandings (multi-person interviews proved particularly useful for this). In three cases this was not achieved due to access difficulties.

Criticisms of the interview method focus on the taken-for-granted nature of data, which can be misrepresentative (Block, 2000) and heavily descriptive. The idea of 'performance' as part of the interview data, as *how* something is said as well as what is said, has gained credence as a part of the qualitative interviewing approach in recent years (Crang, 2002; 2003; 2005b; Davies and Dwyer, 2007; 2008). The interviews in the study were primarily focused on content. However, an engagement with actions, examples, and step-by-step processes were used to identify clear structures and actions that could be traced and verified (Savage and Burrows, 2007; Silverman, 2001; Sminia, 2009).

Questioning procedure

Discussions were held with five industry experts to establish overarching issues in both manufacturing and more specifically the IMP industries. Experts were identified through desk based research on dominant trade associations for the manufacturing and metal component sectors and interviews held with the sector representative. This was an important step in determining current challenges, particularly as the study period occurred at the beginning of the recession and economic circumstances were changing rapidly, making other sources (particularly grey literature) quickly dated. Desk based research was combined with industry discussions to identify potential interview topics. Three key topics were initially identified based on the current issues in the industry, the wider economic context and the research aims: (1) the firm’s relationship to the wider environment, (2) challenges facing the firm, and (3) the firms understanding of success and survival. During fieldwork these topics became refined and particular sub-topics evolved that were not initially targeted (embedded topics) (Briggs, 1986), as illustrated in Figure 3.4. Initially, interview topics were purposefully kept broad to allow individual firms to identify their specific issues (Holstein and Gubrium, 1995). Once these had been identified, interviews with case study firms followed a more purposeful questioning procedure directed at a specific research theme - transaction and relationship characteristics (Figure 3.4b).

Figure 3.4 Interview Topic Guide

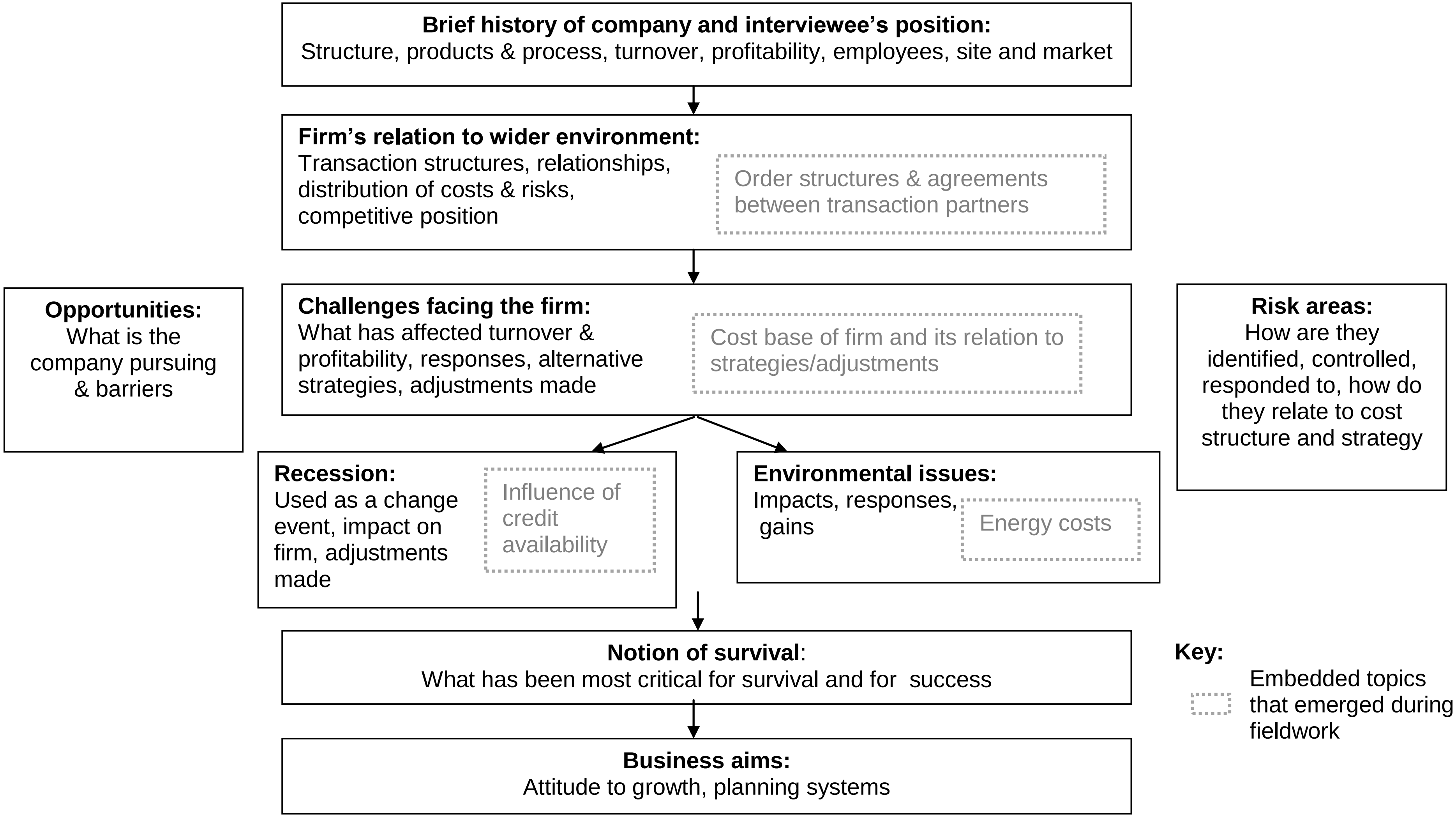
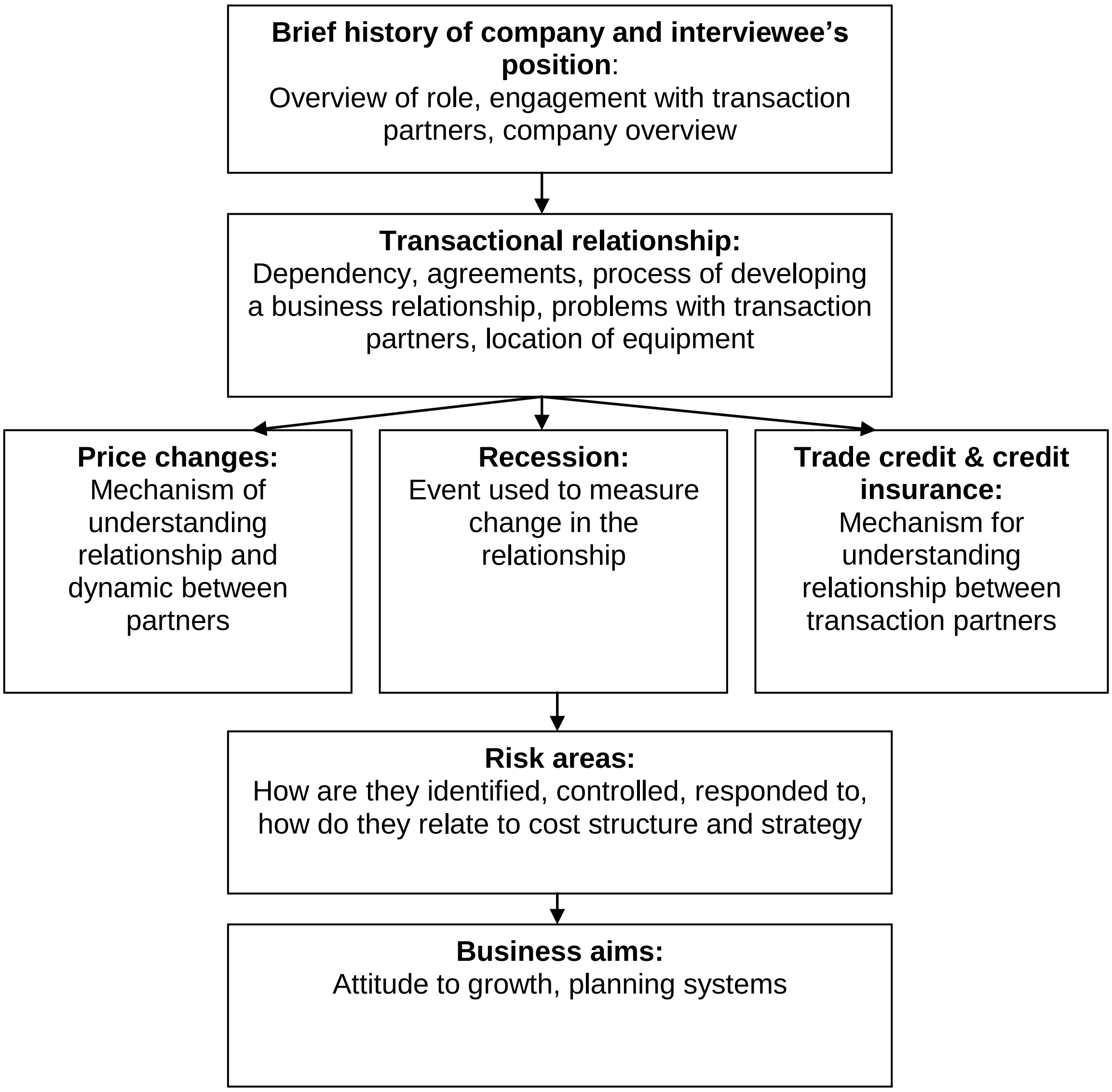


Figure 3.4b Interview Topic Guide: Stage 2



Although the interviews were explorative, a semi-structured approach was used and topic guides established to prepare for potential avenues of discussion whilst retaining flexibility for topic divergence (Berry, 2002; Healey and Rawlinson, 1993; Kvale and Brinkmann, 2008). A conversation flow was maintained and interviewees encouraged to use their own frame of reference by keeping questions unstructured and open-ended (Aberbach and Rockman, 2002). Questions were derived following Mason's (2002) methodological approach from research aims to interview questions. An example of the process is provided in Figure 3.5. The questioning procedure followed that outlined by Markusen (1999b) to develop levels of events that centred on changes in the global economy to structural changes and finally to management changes. The questions focused on generating interviewees' experiences and practices as this retains the actors (in this case firms) in the causation processes (Berger, 2005) and captures transitionary, rather than purely structural, processes (Murphy, 2011).

Particular attention was paid to question phrasing and clarification of meaning/terms used to avoid misrepresentation and in to ensure research topics were explored fully during the research process. In addition, five pilot interviews were conducted (and later incorporated into the analysis dataset) to test the questioning method and broad topic selection. It became clear from these interviews that key words, particularly 'recession' and 'resilience', had a significant impact on the interview. These words had strong popular rhetoric from the media at the time of study, making it difficult to assess participants own experiences and they often dominated the interview. A set of key words/phrases that were particularly powerful were determined and avoided early in the interview to prevent premature closure of interview. Interview questions were continually evaluated and evolved throughout the fieldwork process to optimise the success of data collection (Briggs, 1986).

Figure 3.5 Procedure for Developing Interview Topics and Questions

Research aim: The big question
Understanding adjustment

Stage 1: Research objectives
How does the organisation change?

Stage 2: Break down of research objectives into questions
How was change in the organisation funded/achieved?
How difficult is it for the organisation to change? How long does it take?
Do organisations continually change or change to meet only significant pressures?
What is the form of change: significant restructuring or minor alterations?
Are there formal mechanisms for dealing with change/adaptations?

Stage 3: Emergent themes
Costs of change
Capacity to change
Rate of change
Change process

Stage 4: Potential interview topics
Rate of change
Transition period
Innovations

Stage 5: Potential interview questions
How often does the firm engage in change?
How quickly is change initiated?
How long does it take to initiate and implement change?
How quickly does the firm respond to changes?
What are the drivers for innovations?
What innovations has the firm put in place - an example?

Stage 6: How questions relate to objectives
Speed & frequency of change

Source: Adapted from Mason (2002:72)

Data Consistency and Accuracy

The interviewing approach taken did generate several issues. Although exploration was initially driven by interviewees, probing and encouragement of topics by the researcher influenced the topics which were discussed. Interviews during the later stages of the fieldwork were more targeted at the topics that had emerged from earlier interviews. To mitigate against selection bias a results matrix was maintained to document topic selection and emerging themes. In this, interviews were thematically coded and a content analysis undertaken to quantify emerging themes during the fieldwork period. Exploration was maintained until theoretical 'saturation' was reached (Bowen, 2008; Glaser and Strauss, 1967), whereby recurrent topics were being brought up by interviewees. After this point, subsequent interviews were more focussed on collecting data on these topics.

As a result of the exploratory approach there was a high level of data inconsistency between interview topics. This was particularly the case for early interviews as not all the final topics had been discussed at this early stage in the fieldwork. Although some level of data inconsistency is always generated by following a semi-structured approach (Hanson and Pratt, 1995), it was felt that key topics needed to be revisited with the first group of participants to maximise data analysis and the representativeness of conclusions. This group was re-contacted by email to complete a short questionnaire on two fundamental themes of the research - buyer-supplier relationship characteristics and the composition of their cost base. The response rate was 52% and significantly improved the completion of the data set. To reflect the incompleteness of data on each topic, reference to frequencies during the analysis are made in respect to the number of explicit responses rather than total number of firms interviewed. Despite the limitations identified with an explorative questioning procedure, the method did allow the emergence of key themes that were directly determined by the interviewees themselves and reflected the firms' current situation. The recession provided a consistent event across all interviews to frame responses.

To increase the validity of the data two key checks were put in place. Firstly, key questions were approached from multiple angles and with prompts from desk-based research to measure consistency of accounts (Healey and Rawlinson, 1993; Kvale and Brinkmann, 2008). Due to the conversational approach taken during the interviews, interviewer interpretation of accounts was particularly critical as quantifiable data was often minimal. To mitigate misinterpretation, responses were summarised back to informants both during the interview (Schoenberger, 1991) and summary accounts provided post interview to verify interpretation and for additional comments (Arksey and Knight, 1999). This was a very successful approach with all firms responding to the email. It also provided an opportunity for additional information to be gathered in instances where questions had not been completely followed up during the interview.

3.4.3 Relationship Case Studies

The case study method is a common approach in organisational research (Perren and Ram, 2004; Piekkari *et al.*, 2009) as it incorporates historical actions, dynamism and a rich understanding of processes within the firm (Gummersson, 1999). Case studies were used in the second stage of fieldwork to examine causal relationships in the data that were identified during the intensive interview stage (Healey and Rawlinson, 1993). The key theme (relationships and transactions) was highly variable in the initial data set and therefore further investigation was required through ‘explanatory case studies’ (Yin, 2003a; 2003b) and specifically to examine the phenomena from another view point (the transaction partner) (Chetty, 1996). A further cross-case analysis was undertaken by using several matched transactions (IMP firm and customer of supplier).

Mapping and examining relationships

Buyer-supplier relationships were identified following the procedure outline in Table 3.7. Initially, interviewees were probed during the interview to identify key customers. These responses were combined to provide a database of potential relationship case studies. This was followed by requests for further information on direct transaction partners to a small number of IMP firms where a particularly strong rapport was established. Limited information was found in interview results as company names were often omitted. It was difficult to identify supplier transaction partners from the interview results, so a web based search was used to identify firms which were significant suppliers to the industry. These relationships were not used as case studies but provided additional information to contextualise the transaction-specific data. The case study sample is not representative of the broader population of IMP customer or supplier firms. They were selected based on the strategic significance of the transaction partner to either the specific IMP firm or the IMP industry generally (Table 3.8).

Table 3.7 Mapping Relationships

Stage	Mechanism	Number identified
1	Probing during interview	35
2	Network mapping of relationships	
3	Purposeful sampling from interview transcripts	
4	Email sent to 5 participants to request information on direct transaction partners	4 (1 firm responded with information)
5	Web search for suppliers (unable to access any found in purposeful sampling)	2 (prominent suppliers in industry)
Total identified		29 customers 10 suppliers 2 subcontractors
Exclusion of firms not able to find contact information or decipher which plant the firm had the transaction link with		*8 customers* *2 suppliers*
Total accessed (response rate %)		**7 customers (33.3)** **2 suppliers (25.0)** **1 subcontractor (50.0)**

Table 3.8 Significance of Transaction Partner in Study

	Transaction Link		
	Customer	**Supplier**	**Subcontractor**
Significant for firm (value of spend)	5	0	0
Significant in industry (identified as a 'key player')	2	2	1

There were several limitations to this approach. Although the relationships uncovered were verified by desk-based research (to investigate the product and potential use of an IMP industry supplier/customer), inconsistencies in the mapping of transaction relationships occurred in one instance. In this case, IMP firms were suppliers but they no longer dealt with the specific IMP firm identified in the sample. The case was removed from the direct transaction set and used instead as framing information.

This highlights the potential role of interpretation in framing the case study choices. The interview topics were very specific on transaction and relationship practices, which were viewed with particular caution by potential respondents. No reference was made to specific firms during interviewing (to maintain confidentiality) and as such, details about specific relationships were only probed and left to the interviewee to choose to discuss. The method did prove successful in generating an account of the transaction relationship which was not censored to protect future trading. It did mean that some portions of the interview were not specifically addressing the case study relationship. Finally, only single interviews were undertaken with the transaction partners, many of which were MNEs, due to time and access constraints but also because the study had identified the significance of site-site relationships. The interview was conducted with the specific trading site and purchasing/sales managers to maximise access to information on the specific IMP firms involved. To mitigate bias in identification or interview topics, comparative case studies were developed around multiple transaction partners where possible and non-direct relationships (industry significant interviews) were used to frame the information.

3.4.4 Access: Methods and Response Rates

Several methods were employed to access interviewees. These are outlined in Table 3.9. In the first stage interviewees were predominately contacted through recommendations from industry specialists, random selection from the database and snowballing. The success rate of each of these methods varied considerably through the sample (Table 3.10) and particularly between large and small firms. Success was greatest in small firms through recommendations (73.3%) and internet searches (71.4%). Despite these high success rates, random selection from the FAME database comprise the vast majority of small firm access (23/40 firms in sample), all be it with a much lower response rate (40.4%), due to the limited number of introductions from these specialists. Large firms were predominately accessed through snowballing from current participants (5/6). The second stage case studies were identified predominately through relationships with IMP sample firms (8/10 firms). This was supplemented through an internet search for suppliers, which were more difficult to identify and access from stage one interviews.

Table 3.9 Identification Methods

Approach	Stage 1			Stage 2		
	Number Identified	**Number Contacted** (% from those identified)	**Number Successful** (% from those contacted that resulted in interview)	**Number Identified**	**Number Contacted** (% from those identified)	**Number Successful** (% from those contacted that resulted in interview)
Industry specialists	19 (SME) 3 (large)	15 (SME) *(78.9)* 3 (large) *(100.0)*	11 (SME) *(73.3)* 0 (large) *(0.0)*			
FAME database	129 (SME) 10 (large)	57 (SME) *(44.2)* 7 (large) *(70.0)*	23 (SME) *(40.4)* 1 (large) *(14.3)*			
Internet search	7 (SME) 0 (large)	7 (SME) *(100.0)* 0 (large) *(0.0)*	5 (SME) *(71.4)* 0 (Large) *(0.0)*	2	2 *(100.0)*	2 *(100.0)*
Media Reports	1 (SME) 0 (large)	1 (SME) *(100.0)* 0 (large) *(0.0)*	0 (SME) *(0.0)* 0 (large) *(0.0)*			
Snowballing	6 (SME) 9 (large)	1 (SME) *(16.7)* 5 (large) *(55.6)*	0 (SME) *(0.0)* 5 (large) *(100.0)*			
Relationship mapping from interview data	-	-	-	39	29 *(74.4)*	8 *(27.6)*

Table 3.10 Response Rates

	Number in sample	Number successful	Response rate (%)
Cold call letter	100	39	39.0
Introduction from industry specialist	18	11	61.1
Snowballing	6	5	83.3
Average response rate			*61.1*

Snowballing proved particularly useful in accessing large firms and particularly in accessing three firms which had been unresponsive to prior methods of contact (database and recommendations). Here, contact through an existing participant directed my interview request to the correct person (something which had been difficult to identify in large firms particularly due to the more complex organisational structure and greater use of personal assistants). Interestingly, however, is that the firms which were recommending these large firms were actually customers or suppliers (contacted in the second stage of the study) and not competitors in the same industry. This was a critical point to the success of snowballing in this study as it provided a lead into the discussions of relationships with these other firms. The snowballing technique was not successful with any small firms as they would be recommending their direct competitors (there were no direct competitors between the large firms in the study area as all were differentiated on product or material type).

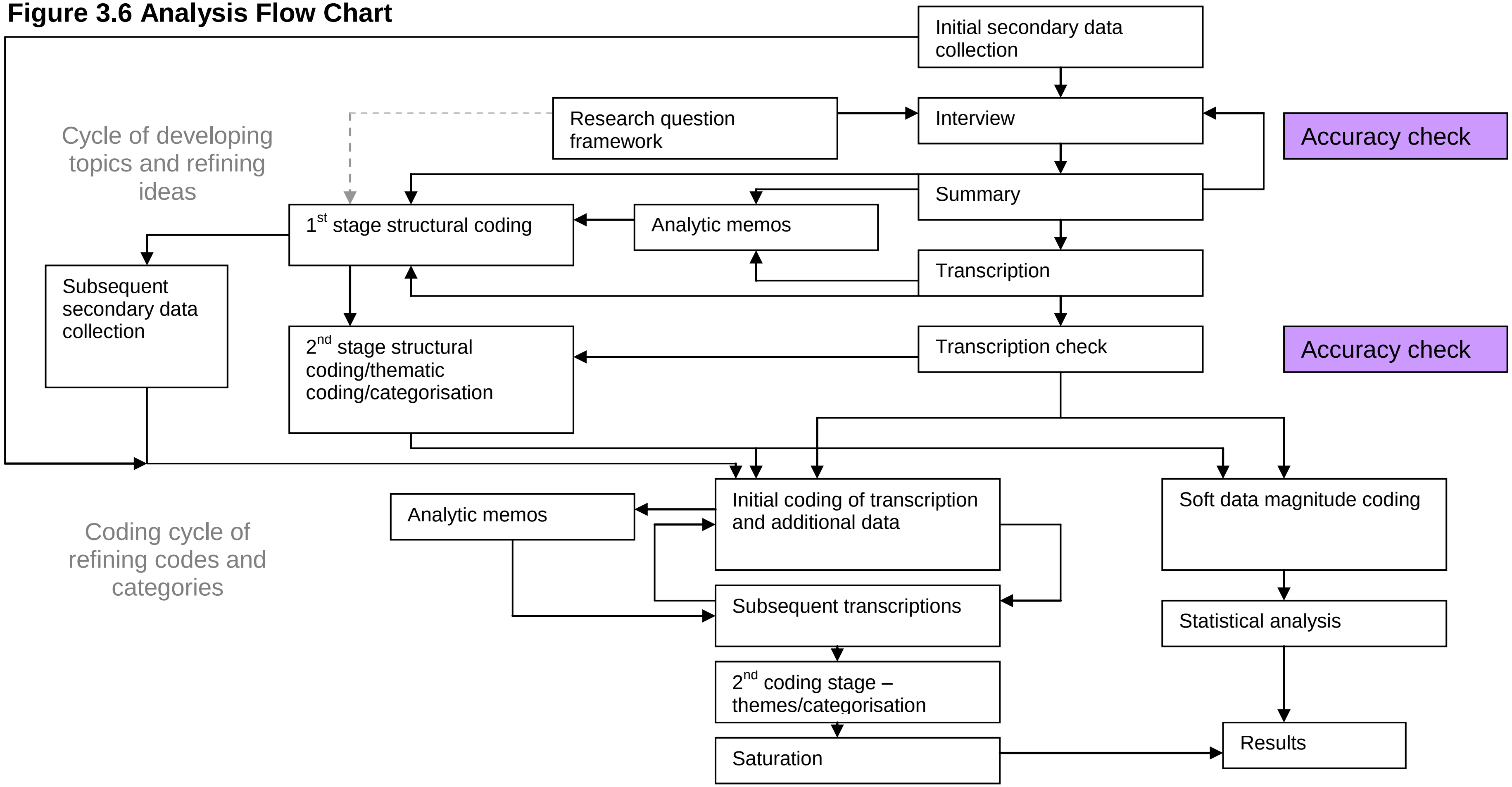
Forging firms proved particularly difficult to access despite their considerable number in the working sample. To increase the response rate two additional methods were employed: web searches and existing links between the industry and university. Firms identified through these methods tended to have diversified into fabrication, particularly those recommended from university contacts as they were actively engaging in process developments. Although this sample did have a bias towards innovative firms i.e. those who had diversified, the other organisational characteristics (structure and resources) were similar to the wider sample and therefore they were included in the study.

Access to transaction partners proved particularly difficult, both to firms and information, as confidentiality between transaction partners was maintained. As such, snowballing could not be used and potential respondents were cold-called. The range of industries restricted the amount of engagement and reputation building and the large size of many of the transaction partners (MNE) made finding and accessing suitable interviewees a challenge. The respondents that were identified were extremely useful in that they were purchasing or selling representatives that could proficiently discuss their transaction relationships.

3.5 Data Analysis

The analysis followed a grounded theory approach using analytic induction to build emergent themes and theories from an iterative process of challenging assumptions through deviant and comparative case analysis (Bryman, 2008; Silverman, 2005), as illustrated in Figure 3.6 below. All data (both primary and secondary) were analysed using a qualitative data analysis program (QSR NVivo 9.0). Computer-aided qualitative analysis has been criticised for the reliability of results, particularly from theorising and search functions (Humble, 2012; Welsh, 2002). However, the NVivo package was used in this study as a storage facility to manage, combine and store a relatively large quantity of data. The facility provided easy retrieval of data extracts and its associated raw data, actually increasing the ability to expand and refine coding themes (Humble, 2012; Lu and Shulman, 2008). Interview transcriptions were transcribed and checked for accuracy (Figure 3.6). The analysis process is outlined in Table 3.11, following that of Saldan (2009).

Figure 3.6 Analysis Flow Chart



Source: Adapted from iterative process of Edmondson and McManus (Figure 3, 2007:1174)

Table 3.11 Analysis process

Stage	Technique/method	Purpose
1	*Holistic and thematic coding on interview summaries and fieldwork notes during fieldwork*	To provide an overview and identify themes to pursue during fieldwork Generated a matrix of events and processes for case comparisons
2	*Initial coding*	To break down and explore data Used multiple coding types to capture all data (both from existing themes identified and new) Generated 256 codes
3	*Categorisation*	Build concepts through linked codes (tree codes) Generated tree codes
4	*Case study comparison*	Comparative coding of both transaction partners based on coding structure already developed

Source: Adapted from Saldan (2009)

In the first stage a content analysis was also undertaken to keep a record of occurrences of events and features. This proved particularly useful for identifying groups of cases and possible deviant cases (Fielding and Fielding, 1986; Silverman, 2001, 2005). Comparison between cases allowed an 'explanation-building' technique to build a 'profile of behaviour' (Ekanem, 2007) and link concepts and events within the data. The initial coding stage used four coding types, outlined in Table 3.12, to capture all information within the data.

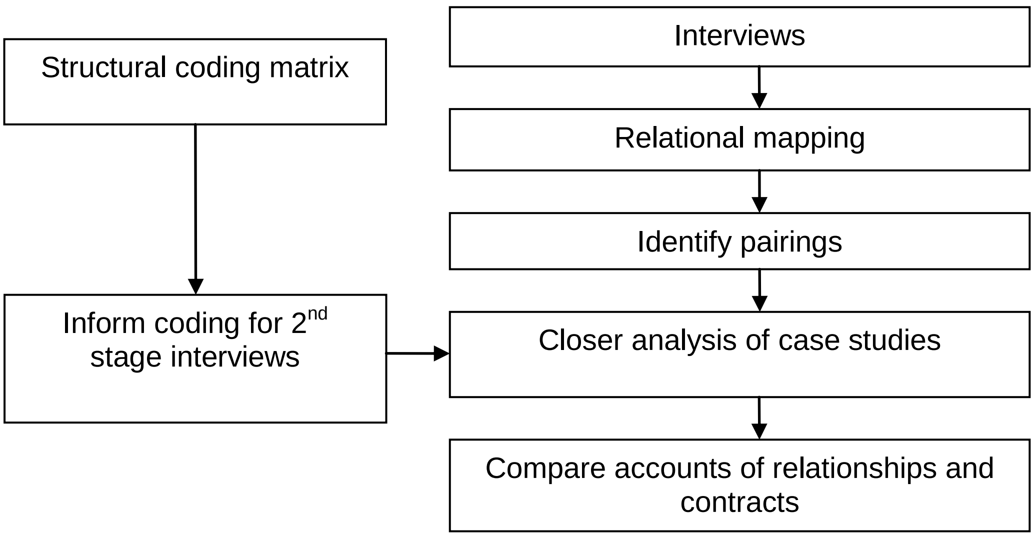
Table 3.12 Coding Types Used in Analysis

Code Type	Purpose
Process	To identify strategies
Attribute	Descriptive elements of firms (also added to matrix to generate frequency of events)
In Vivo	Extracted codes to ensure representation of behaviour, process and mechanisms
Structural	To retain context around concepts

Source: Adapted from Fielding (2008)

This was initially done on a line-by-line basis but this removed the contextual nature of the data and often misrepresented its meaning. Therefore, subsequent coding was based on a point-by-point basis to retain overall meaning. However, it created a vast number of codes (256) which required refinement through multiple coding cycles to establish conceptual clarification of codes and merging of code groups (Crang, 2005a; Rubin and Rubin, 2005). Analytic memos were a key tool during this process to record concept development and linkages. NVivo provided a useful tool for linking codes though relationships, aiding theory building through the phases of coding (see Appendix 9.2 for coding map example). Key stages were included in the fieldwork and transcription process to interpret and assess the data (Bird, 2005; Miller *et al.*, 2004; Schiellerup, 2008). Analysis was undertaking until consistency in codes was achieved. Case studies were coding using existing codes developed from stage one. All transaction partners' interviews were re-coded together in a comparative process to identify the variant view points (Figure 3.7).

Figure 3.7 Flow Chart of Stage Two: Case Studies



Typologies were used to identify broad strategic groups in the data. The typologies were based on common mechanisms and structures, following the research approach laid out by Sayer (2000), rather than frequency of occurrence or general applicability. This allowed for links to be made between concepts and identify deeper causal structures. To reflect the approach, firms were only included in the typologies if they clearly demonstrated the properties of the particular structure and were represented in the study with reference to these groups rather than overall frequencies.

3.5.1 Measuring Slippery Concepts: Power

Indicators were used to indentify power relationships during the analysis (Fredrickson, 1986; James, 2003). These are based on theoretical understandings of the topic and the study's own conceptualisation of power as an explicit and implicit form of influence in specific contexts. The indicators used reflect the practices and impacts of instances of power (such as dependency, vulnerability) outlined in Table 3.13. Under a critical realist perspective, power can only be explained in relation to other entities enacted on (Jones, P., 2010) and as such, the process of identifying power was critical in the case studies where experiences of both parties could be related to each other to deepen the understanding of the concept. The identification of power was limited by the study's focus on decision-making representatives and supply chain dynamics and as such, only certain forms and utilisations of power were conceptualised (Hughes, 1999b; Lukes, 2005).

Table 3.13 Observable Indicators of Power: Practices, Impacts, Dependency

Dimension of Power	Indicator
Practices	Everyday Under stress – recession
Impacts	Competitive position Risk/vulnerability Strategy formulation
Dependency	Proportion of turnover Supplier status (sole, preferred) Position in supply chain Ownership Diversity (number of customers/sites, sectors, product types, capabilities) Contract type Customer structure: size (employment and revenue) and ownership structure of customer
Firm Vulnerability	Financial security (revenue, profitability) Performance (turnover per employee, value added per employee)

Source: Author (2012) based on conceptualisations of power from Taylor (2000), Fields (2006) and Gereffi et al. (2005).

The measurement of power was difficult in traditional coding methods because intensity could not be captured. To overcome this, magnitude analysis was used as a method of quantifying the intensity of the example (Fielding, 2008; Saldana, 2009) and provide levels of measurement (D'Cruz, 2004). This was undertaken through a comparative analysis of instances of power between cases, an approach common in the analysis of business strategy (Harrigan, 1983; Snow and Hambrick, 1980) and social research (Fielding and Fielding, 1986) to provide a spectrum of cases. A quantitative analysis of change was attempted through principal component analysis (Clarke, 1985; Taylor, 2000) using indicators of risk, power and financial stability within the qualitative data. However, the level of inconsistency and lack of factual data limited this approach (see Appendix 9 for an outline of proposed indicators for statistical analysis).

3.5.2 Mining or Unpacking the Data?

During the fieldwork and analysis process there were instances of significant conceptual development from particular transcripts or data. Although these events are noted by others (Schiellerup, 2008), to ensure that data were not 'cheery picked' from a particularly succinct and fruitful interview checks were put into place. Comparative case analysis was undertaken until sufficient explanation could be given for each variable case through cycles of coding (Silverman, 2005) and counter-examples were used in the presentation of examples. The NVivo tool proved particularly useful for this as it allowed easy retrieval of all related data (Welsh, 2002), therefore increasing the reliability of comparisons and concept development. The relative weight given to the concept/evidence was based on its 'completeness' of a concept i.e. if all the building blocks and cases of the process could be accounted for and theoretically discussed (Fielding and Fielding, 1986). Particular weight is given to the case studies because of the multiple viewpoints available that allowed a comparative analysis of specific instances. The process of categorising and building concepts resulted in a loss of specificity (Hanson and Pratt, 1995) for the sake of a more complete overview of the process.

3.6 Access, Positionality and Validity: Some Methodological Considerations

The timing of the study has significant influence over accessibility to firms, participants and information (Desmond, 2004; Ward and Jones, 1999). The recession was generating increased dynamism in the industry, with large scale redundancies, closures and restructuring. As a result, it was particularly difficult to access accurate information on firms and employees prior to contacting them. This made the sampling process more difficult (for both firm and participant) and the interviewer less informed prior to the interview. However, it also supported the explorative approach as there was little current knowledge about the firm or its situation. Telephone contact to arrange interviews provided the only access to up to date information. In addition, short-time working (partial closure during the week) was common during the period. This seemed to help *and* hinder access. Some firm representatives were busier and more focussed on the survival of the business during this period and therefore less interested in engaging in research. However, there were also firms which were more inclined to get involved because the significance of the research was more apparent (survival) and they had more available time on their hands. The content of the interview was framed by the recession (both as a current event and its significance) and made it difficult to diverge from this subject.

The study targeted firm elites, defined here as decision making representatives. Conceptions of elites have centred around power, particularly from hierarchical position (Cormode and Hughes, 1999). This definition proved difficult in this industry as the structure and nature of roles differed considerably between firms and managers. This contrast was particularly evident between elites of the IMP firms and those of their customers in the second research phase (corporate MNEs), which had more clearly defined roles and knowledge bases. This variability in ‘elites’ is acknowledged by Woods (1998) and more contextualised notions have developed around the local characteristics and influence (Cochrane, 1998; Parry, 1998; Richards, 1996), exclusivity (Desmond, 2004) and connectedness (Oinas, 1999). The role definition was important in both the sampling of participants and the methods of access to firms and knowledge. Terminology, particular ‘strategy’, was not commonly used by all interviewees. There was a particular subset of firms (micro businesses with older managers) which did not regularly engage in this type of analysis. As such, the topics had to be introduced more carefully. In addition, it was clear that overall business awareness (such as customer portfolios) and planning was not necessarily formally undertaken or business terminology used in all organisations. Therefore, to reflect the diversity of ‘elites’ the questioning practice had to be carefully judged prior and during the interview to access the most information possible.

The role of positionality was an ongoing issue for access to participants and knowledge (Cormode and Hughes, 1999). The ‘checking out process’, as termed by Ostrander (1993) was ongoing, particularly during initial telephone contact and ‘quizzing’ of consent forms and study information provided prior to the interview. Being in a male dominated environment (only two interviewees were female) highlighted the gender difference between interviewer and interviewee. However, being a ‘geographer’ undertaking a ‘business’ study also generated clear perceptions to interviewees. It became clear during the research that interviewees needed to define the researcher as ‘something’ whether that be ‘the lady’ or the ‘geographer’ or the ‘student’ (McDowell, 1998). It was difficult to challenge these perceptions and instead the approach taken was to attempt to capitalise on these perceptions for greater access to certain aspects of knowledge. A set of assumptions were intentionally implied about the researcher, based on *the researchers* assumptions about the respondents and their attitude towards academic research (Oinas, 1999). The most common approach was to designate researcher as a *student* conducting a research *project* at an established *institution* and with a *local* accent. By doing this it was hoped the researcher would be positioned as a semi-academic, perhaps more approachable, less able to threaten the reputation and credibility of the business, with an understanding and compassion towards the industry from local ties (Harvey, 2010). These perceptions helped 'sell' the research, phrasing the interview as an informal 'chat', by clearly defining positions of power in the interview. The micro-politics during the interview process meant that in many cases the power balance shifted and fluctuated between 'elite' and 'researcher' (Rice, 2009; Smith, 2006).

On the reverse of these positionalities lie other interpretations: inexperience, unworthy of time, unable to comprehend complex information, and inferior to the participant, both in status and knowledge. As such, the classification of the researcher as 'something' involves weaving in and out of positionalities to access information (Harvey, 2010; McDowell, 1998), dependent on the participant, the context of interaction (i.e. letter, telephone call or interview) and the timing of such. Under this interpretation the research process becomes a minefield of navigating barriers and *active* constructions of data by the participant to shield or protect their business. During the research process the use of positionality as a tool was effective, prompting access to several firms of the basis of age ('I only agreed to speak to you because my son is doing a similar project at university') and local connections ('I have found memories of the University of Birmingham', 'I used to play golf close to you'), and being female (after being approached by an interviewee the researcher was able to get print outs of sensitive data). However, it also proved restrictive and difficult (almost impossible) to challenge. At least in part this inability to contest interpretations of ability, knowledge, and experience was restricted because of the short interaction: predominately a telephone call, email and single interview. Instead, the researcher learnt to use perceptions of positionality as an advantage; as a young researcher they were seen as unable to understand strategy and legislation but, on the other hand, unlikely to use information to damage the company; and participants often started at a basic level to make their explanation more understandable to a novice. Both these elements meant that the researcher was able to develop fundamental understandings of participants approaches and often navigate through strategy formulations after illustrating competency (Harvey, 2010). However, the limitations to this positionality remained, albeit to varying degrees between participants, and certain topics (e.g. financial data) or complexity (e.g. strategic direction) remained off-limits in certain cases.

A further complication was the association with a *geography*, rather than *business*, department and therefore an assumed preference to environmental, rather than economic, considerations by several respondents. When environmental topics were broached interviewees were reluctant to divulge information and quickly followed with a defence of their actions. In these situations it was clear the respondent felt the I was seeking a particular answer because of my position at a geography department (Gibson-Graham, 1994). The impact of these positionalities and inferences on the research data is difficult to define, although it was clear that access affected the data constructed (Clark, 2007; Cochrane, 1998). As such, the results are specific to the study firms and framed in reference to the methodological and theoretical approach used.

Validity and Reliability

Several measures were implemented to ensure the validity of the research throughout the study; multiple data sources were combined to provide additional information (Yeung, 2003), the questioning procedure tailored to include redundant questions (Rubin and Rubin, 2005) and include collaborative checks from desk research, accuracy checks undertaken for interview transcription and an analytic induction method utilised during analysis (Silverman, 2005). The use of these mechanisms has been outlined above. However, there are two specific measures which require further discussion: reliance on single interviews and the use of member checks. The use of single interviews has been criticised for difficulty in determining the validity of single representations as a result of partial knowledge/perspectives (Healey and Rawlinson, 1993; Markusen, 1999b) and the hidden agendas of interviewees (Berry, 2002). In order to minimise respondent bias multiple interviews were attempted within each firm. However, this proved difficult due to the limited number of suitable respondents per firm (often in the smaller firms only one person – usually the owner/manager – was responsible for operational decisions) and ongoing access. Large firms were particularly susceptible to such bias because of the increased segregation of roles. To mitigate this error, multi-*person* interviews were conducted where possible (see Table 3.6) and a larger sample of firms used to provide a higher number of comparable cases (Hanson and Pratt, 1995). The second consideration is the use of member checks. Interviewees were provided summary accounts of the interview to check interpretations and provide opportunity for further clarification. A difficulty with is approach is the potential disagreement between interviewer and interviewee (Turner and Coen, 2008). All interviewees responded and verified the interpretation, implying a high validity rate. The summary accounts were selective of potentially sensitive information, an issue highlighted by Bradshaw (2001) and Locke and Velamuri (2009). The accounts were ‘summaries’ and therefore did not warrant detailed information, some of which may have been deemed too sensitive in retrospect by the interviewees (the recordings and full transcripts were available to the interviewees should they wish for full disclosure but none were requested).

The reliability of data was achieved through a reflexive approach to data collection and analysis (Baxter and Eyles, 1997), integrating check points for reflection (Miller *et al.*, 2004) and an audit trail (Bailey *et al.*, 1999) from a research diary and the use of computer-aided analysis. Again, these measures have been detailed above. Due to the nature of data collected, through single representatives and topic evolution, the findings are highly time and space specific. Although this has been suggested to be a weakness of qualitative research (Markusen, 2003), the process approach enables a wider conceptualisation of mechanisms and structures (Hudson, 2003; Yeung, 2003). To reflect the representativeness of the data, frequencies are indicated in the presentation of results to acknowledge the partial interpretation of certain topics (Silverman, 2005).

3.7 Generalisations

The sample broadly represents the structure of the population of the IMP industry in both the West Midlands and the UK. However, the number of firms in each particular classification can be relatively low and therefore broad generalisations are not intended to be constructed from this study. The structures and mechanisms that underlie processes of change may be applied to other industries and at other times (Pain *et al.*, 2011). As Lawson (1997) and Sayer and Morgan (1985) note, it is these causation properties which are the most useful outcomes of research and not necessarily its wider applicability. Sayer and Morgan suggest;

> *…actual concrete patterns and contingent relations are unlikely to be 'representative', 'average' or generalizable. Necessary relations discovered will exist wherever their relata are present, e.g. causal powers of objects are generalizable to other contexts as they are necessary features of these objects (1985: 151)*

By focussing on the processes which generate cause, and not necessarily aggregate effects, the research retains the diversity found in the field. As Rigby (2007) and Sayer and Morgan (1985) state, the diversity in the study agents is more useful than typologies as a means to conceptualise processes. Although typologies have been used in the study to identify broad strategic approaches that fundamentally differ, these only include those cases in which clear evidence was found and therefore they acted as 'representational agents' (Rigby, 2007: 183). Representational agents or process that retains diversity may allow for some generalisation beyond the immediate study group. However, the application of these processes to other contexts may inform understanding but are not fully generalisable because of the specific interaction of causation and contextual factors (Sayer and Morgan, 1985). As such, the findings of this study are intended only to represent the specific workings of the firms under study and only directly relate to their context.

3.8 Ethical Considerations

An ethical report was submitted and approved by the university. The focus on business organisations generated two ethical issues: confidentiality of information and sensitivity to current tough global economic conditions. Confidentiality of firm, participant and information was maintained throughout the research by the use of pseudo names (for both firm and participant). All firms were keen to remain anonymous. Consent forms were used to reinforce the confidentiality agreement, between the participant and researcher, which included the clear identification of research aims, process and use of information gathered from interviews, as well as a formal agreement to maintain confidentiality. There was a mixed reception to the formalisation of the interview. Overall the consent forms were felt to be unnecessary and restricted the 'informal' nature of the interview as it was promoted. However, as the consent forms were a stipulation by the university they were used in all interviews. They were presented to the respondent once an interview had been arranged to provide time for the respondent to raise any questions. They were then re-visited at the end of the interview, once the interviewee was fully aware of the information they are disclosing, and asked to complete the approval with the interviewee. Only one interviewee refused to sign the consent form as he was uncomfortable 'signing papers', although provided explicit verbal consent that his interview could be used in the research. All data has been stored securely in accordance with university practices and ethical codes of conduct.

At the time of the study there was considerable uncertainty in the global economy and upheaval in the IMP industry. The vast majority of firms contacted for participation were suffering huge reductions in demand, engaged in redundancy programs and several entering administration or permanent closure. Due to the timing and focus of the research, the interview process touched on very sensitive and topical issues which required careful handling to ensure respect and compassion for their circumstances. In several cases topics moved into the personal issues raised by the difficulties in the business. It was felt appropriate to remove these personal comments from the interview transcripts as the participant had not provided consent for this type of information (i.e. personal, not directly relate to the business). The topics were identified to the participants prior to the interview, although a complete interview schedule was not provided unless requested. This provided context to the interview and made the interviewee aware of what they were agreeing to engage in prior to the interview, whilst retaining flexibility in the participant's interpretation of the broad topics for their own firm's circumstances.

3.9 Summary

A comprehensive research methodology was undertaken to generate a contextually rich and detailed data set and results. This comprised of two key stages (1) an intensive industry study of 45 IMP firm and (2) a case study analysis of ten transaction relationships. Corporate interviews were the primary research tool, incorporated with supplementary evidence from financial records, industry data and aggregate statistics. Analysis of data was primarily undertaken using coding techniques through an iterative process of analysis.

The fieldwork results will be discussed in the subsequent empirical chapters. The results begin with an industry overview, provided in the following chapter, outlining the key transitions and challenges in the IMP industry. This overview highlights the key areas of adjustment currently undertaken, transitions to high value-added products and services and increasingly volatile energy prices, which will form subsequent empirical discussions.

4 INTERMEDIATE METAL MANUFACTURE: TRANSITIONS AND CHALLENGES

4.1 Introduction

The IMP industry is complex, diverse and undergoing continued transformation and adjustment to a range of challenges. The industry has experienced a sustained period of decline in the UK and at the time of fieldwork was facing extreme competitive difficulties. An industry analysis has been undertaken to identify the most significant areas for further research.

This chapter provides an overview of the industry, identifying key issues and provides the context for the subsequent empirical chapters. The discussion begins with an outline of the industry's historical development and its current position in the global economy. Profitability is highlighted as a fundamental issue, resultant from an extended period of restructuring and limited investment. A cost-price squeeze is evident: the residual return between input costs and output prices is reducing. This is investigated through an account of the outputs of the industry, and its competitiveness against international competitors, and the input structure. A brief summary of the current position of IMP firms in the wider macro economy is provided, with a particular focus on the adjustment methods during the recent economic downturn. The chapter concludes by identifying the areas that require further research in order to understand the competitiveness and survival of IMP firms in the West Midlands.

4.2 The IMP Industry

The IMP industry produces metal based, semi-manufactured components for a variety of engineering and construction industries. The industry is a diverse set of processes and capabilities, manufacturing products that vary in size, complexity and material composition. The components are traditionally semi-finished, requiring further processing through machining and treatment applications before inclusion in final products by end-manufacturers. The largest proportional sales in the industry are to further manufacturers, with over 50% of products used as inputs in other industries in 2008 (BIS, 2010b). IMP firms usually perform the manufacture of customer-designed products and have limited formal ownership of products or designs. There is limited direct access to final consumers or the end market and as a result, the IMP industry is particularly vulnerable to the performance of their customers and the wider economic stability of key manufacturing industries (Bryson *et al.*, 1996).

The IMP sub-industries, casting and forging, are distinctly different production processes, as shown in Table 4.1 below. Overall, the casting process lends itself to the production of lower volumes of more complex shapes and materials due to the ability to specify the metal composition and create more intricate moulds for complex shapes. In contrast, the forging process is capable of producing more standardised and consistent components but of a simpler design and metal composition. The industries have several production methods which provide a range of component characteristics suitable for various end-user preferences. These are outlined comprehensively in Table 4.2. Both sub-industries shape the metal against tooling: casting moulds and forging dies. The tooling characteristics again define the type of product and volume of production which can be most economically achieved. Casting moulds can be made from several materials (sand, wax, metal) depending on the required volume of production. This means that the casting process is able to manufacture a range of production volumes at defined accuracy levels. Forging dies are generally more expensive than casting moulds because they require more durable materials. They are able to produce more consistent and accurate material and shape properties. As such, mid-large production volumes are the most economical manufacturing volume. Both processes are characterised by the heterogeneity of products, markets and processes. Although the range of techniques varies, both industries are capable (and increasingly orientated) towards high value added products, albeit for different markets or product types.

Table 4.1 Industry Characteristics

	Casting (SIC 03 27.5)	**Forging (SIC 03 28.4)**
Product	Capable of making more complex shapes	More standardised material properties
Process	Shapes formed by pouring molten metal into a mould	Pressure forming of components
Tooling requirements	Less durable but cheaper aggregates	Expensive due to resistant materials required for recurrent impact shock
Market type	Ability to customise metal alloy composition Low volume/batch production Poor surface quality	High level of standardisation and consistency of material quality Higher strength-weight ratio (particularly useful for aircraft)
Value adding processes	Heat treatment Machining	Heat treatment Machining

Source: Interview data (2009-10)

Table 4.2 Production Methods

Process	Use
Casting Industry	
Non-expendable moulds – repeatability and accuracy, metal mould	
Die casting Forcing molten metal through two dies to create a cavity, expensive tooling so orientated towards high volume	Non-ferrous metals Small and medium sized castings Repeat production runs
Centrifugal casting Metal poured into rotating mould to spread metal	Accuracy Small passages
Expendable mould – inexpensive, less accurate	
Sand mould Moulding from a shell case rather than filling a cavity with sand	Small volume moulds, cheaper to produce Most common as allows for range of sizes
Investment casting/lost-wax Oldest technique	High quality castings (accurate, precision and repeatability) Suitable for complex alloy materials More expensive but high quality output that requires little rework
Forging Industry	
Drop forge Impact from above – 'dropping the forge'	Used for surface imprints/shaping Open-die short runs and orientating the grain Large strength-weight ratio compared to casting and machined
Press forge Continuous pressure to slowly force metal into shape	Forms entire piece of metal More accurate material properties because can control force More suitable for higher volumes
Upset forging Squeezes wire or rod into shape	Suitable for mass production
Roll forging Rolled into shape	Strengthens grain structures
Net-shape forging/precision forging	Lower waste

Source: Interview data (2009-10)

4.2.1 *History of Sector*

The metal industry is traditionally characterised by strong local linkages between small, specialised firms acting as a vertically integrated manufacturing process across the West Midlands region (Florence, 1948; Taylor and Bryson, 2008).

Rodgers (1980) describes this as a unique feature of the region's metal processing cluster where;

> *[m]ore than in any other British industrial region there is here close integration in the locational sense accompanied by disaggregation in the organisational sense. Processes performed by the same firm and in the same factory elsewhere are here performed in separate factories by different firms (1980: 215-6).*

The interdependence between metal working firms acting across the manufacturing process (from basic metal production to finished products) generated stability in the region and the industry experienced significant growth during the early part of the twentieth century, with metal processing being an area of industrial growth for the west Midlands (Allen, 1929; Florence, 1948). Since the 1960s the IMP industry has declined substantially through two distinct periods (Massey and Meegan, 1982). The first stage was related to overcapacity, particularly in the castings industry, after a reduction in domestic markets following the post-war construction boom. Due to the low value to weight ratio of castings products it was uneconomical to export products and therefore the industry was largely reliant on domestic markets at this stage (Massey and Meegan, 1982). There was a transition towards concentration of production in larger firms to benefit from increased automation and to capitalise on economies of scale over smaller, more labour intensive firms (Taylor and Bryson, 2008), and firms moved towards more standardised production, particularly for the automotive industry (Massey and Meegan, 1982). This process left IMP firms increasingly dependent of a decreasing number of customers and markets (Bryson *et al.*, 1996), a significant departure from the earlier stability of IMP firms. Although local linkages remained a persistent feature of the industry (Taylor and Wood, 1973), the nature of the inter-firm links was dynamic and largely influenced by organisational responses to wider environmental changes (Taylor, 1978). During this period sales links in both casting and forging made a transition towards non-local markets (Taylor, 1978; Wood, 1976).

The second period of decline in employment and enterprises, during the late 1970s to 1990s, was a result of increasing competition from low-cost producers internationally. A sustained lack of investment left the industry technically uncompetitive (Bewick, 1982; Bryson *et al.*, 1996), which prompted a government aid scheme to encourage investment in modernisation through external finance (Bewick, 1982). The recessions of the 1980s and early 1990s had particularly devastating effects on the industry, particularly for those firms which had specialised in automotive supply and taken out modernisation loans with crippling interest rates (Bewick, 1982). There was contraction of large firms, encouraged by the government's rationalisation scheme in 1982, which paid foundries to mothball capacity (Baden-Fuller, 1989). Small, independent firms proved far more resilient during this period. Profitability dropped significantly due to competition from low-cost manufactures abroad. However, it was not necessarily the least profitable firms which closed. Baden-Fuller (1989) suggests that due to the relative high costs of closing plants, some of the least efficient or profitable remained open, even whilst making losses. The impact of sunk costs continues to influence the profitability and nature of the IMP industry today, which will be discussed in more detail in the following section.

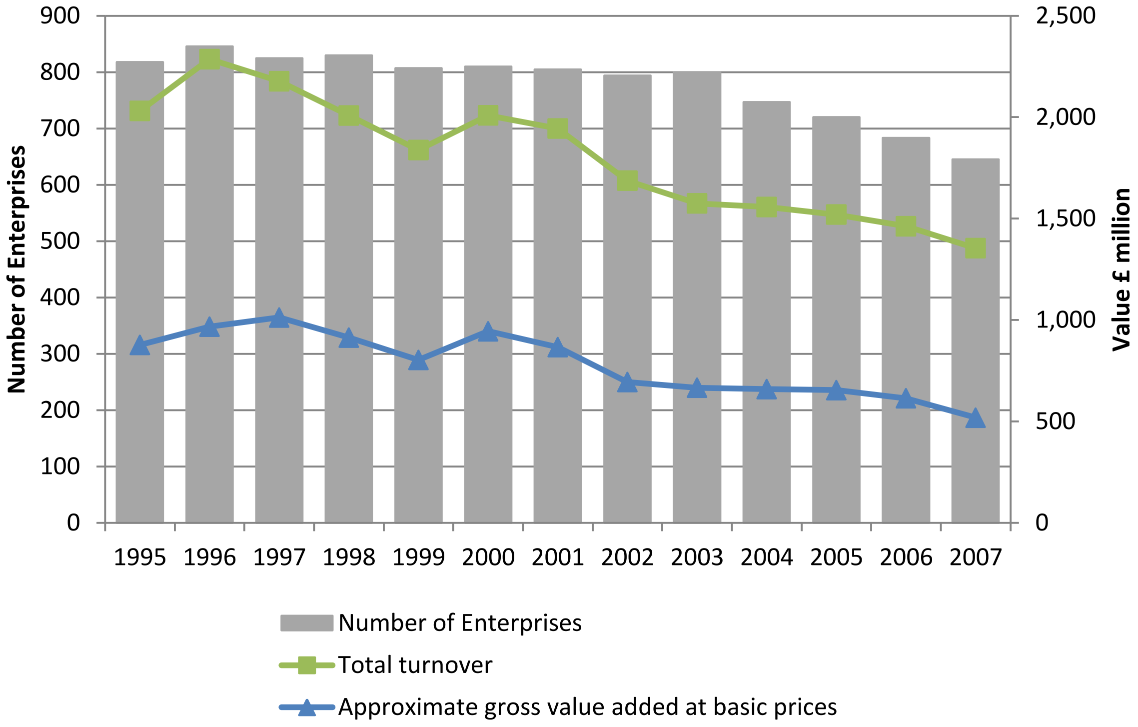
Over the recent period (mid-1990s onwards) the IMP industry has continued to decline in employment, enterprise and turnover levels and to a greater degree than the manufacturing industry average, as illustrated in Table 4.3. The lack of growth in turnover and GVA is particularly evident; see Figure 4.1 and Figure 4.2 for an overview of IMP sub-industry decline since 1995. This is most apparent in the casting industry, which has suffered the largest decline in turnover (one third). The forging industry has retained a relatively stable turnover level despite an almost 40% reduction in employees. However, both IMP sub-industries have experienced a larger reduction in GVA than turnover (by around 7% in each industry), indicating a reduction in operating surplus (an indicator for profitability). In contrast, the manufacturing industry overall has seen growth in both turnover and GVA of 18.16% and 13.08% respectively. The forging industry's stable turnover level, despite vast reductions in employment (~40%), suggests a substantial transition towards automation, further implied by a smaller reduction in investment levels than the manufacturing average (Table 4.3). Small and medium firms continue to dominate the industry, primarily due to closure of large firms but also growth in micro businesses in the forging industry (in both new firm formation and turnover), as illustrated in Table 4.4 below. This structural pattern is markedly different to that of the wider manufacturing industry as a whole, where declines are relatively consistent across size bands for enterprise numbers but focussed in small firms (10-49 employees) in turnover.

Table 4.3 UK IMP Industry, 1995-2007

	Number of Enterprises[a] (%)	**Total Turnover**[a] (%)	**Number of Employees**[a] (%)*	**GVA at basic prices**[a] (%)	**Investment**[b] (%)*
Casting (SIC 03 27.5)	-21.15	-33.33	-57.14	-40.94	-37.87
Forging (SIC 03 28.4)	-10.77	-0.26	-39.02	-7.92	-18.89
Manufacturing average	*-13.07*	*18.16*	*-29.44*	*13.08*	*-27.76*

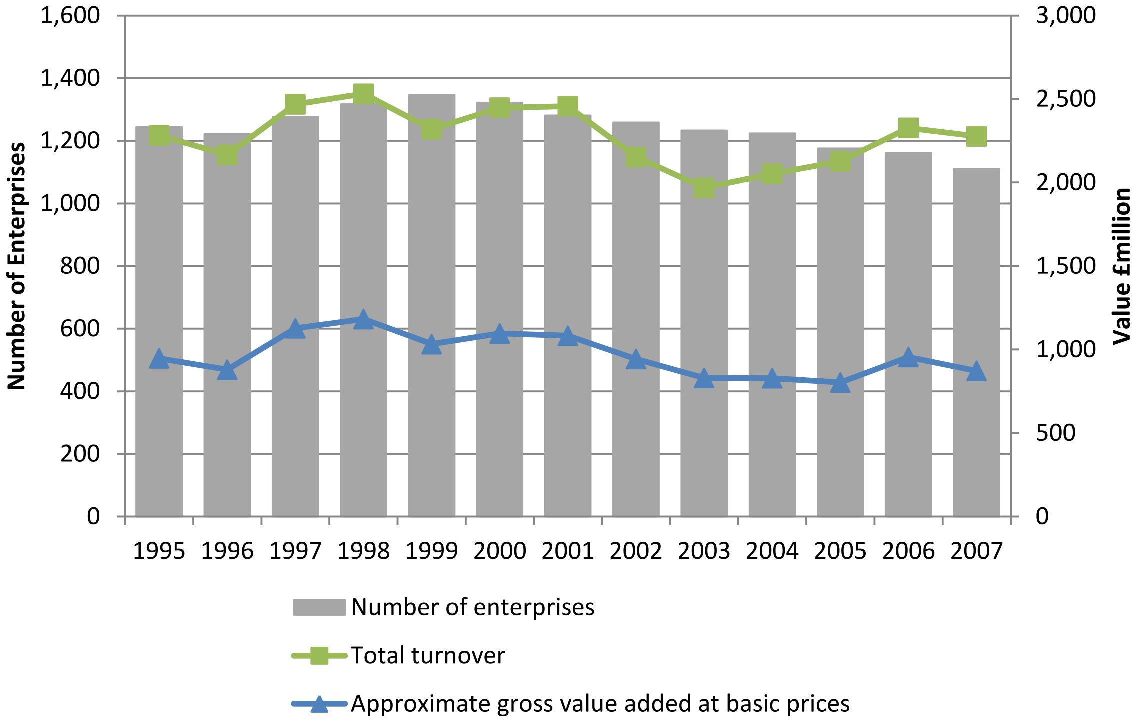
** data from 1998*
Source: (a) ONS (2009) (b) Eurostat (2011b)

Figure 4.1 UK Casting Industry, 1995-2007



Data source: ONS (2009)

Figure 4.2 UK Forging Industry, 1995-2007



Data source: ONS (2009)

Table 4.4 Percentage Change in Enterprise and Turnover Distributions by Employment Size Band, UK, 2002-2007

Sub-Industry	**Number of Enterprises (%)**					
	1-9	***10-19***	***20-49***	***50-249***	***250+***	***Total***
Casting	-15.66	-20.24	-21.85	-18.09	-77.78	-18.77
Forging	5.12	-29.26	-30.96	-30.97	-33.33	-11.69
Manufacturing Average	*-2.76*	*-22.02*	*-21.65*	*-18.64*	*-21.17*	*-8.05*
	Turnover (%)					
	1-9	***10-19***	***20-49***	***50-249***	***250+***	***Total***
Casting	-1.72	-13.26	-30.88	3.28	-70.39	-26.24
Forging	59.70	-18.20	-20.44	2.04	-12.89	-2.88
Manufacturing Average	*0.87*	*-7.69*	*-7.86*	*1.52*	*5.83*	*20.14*

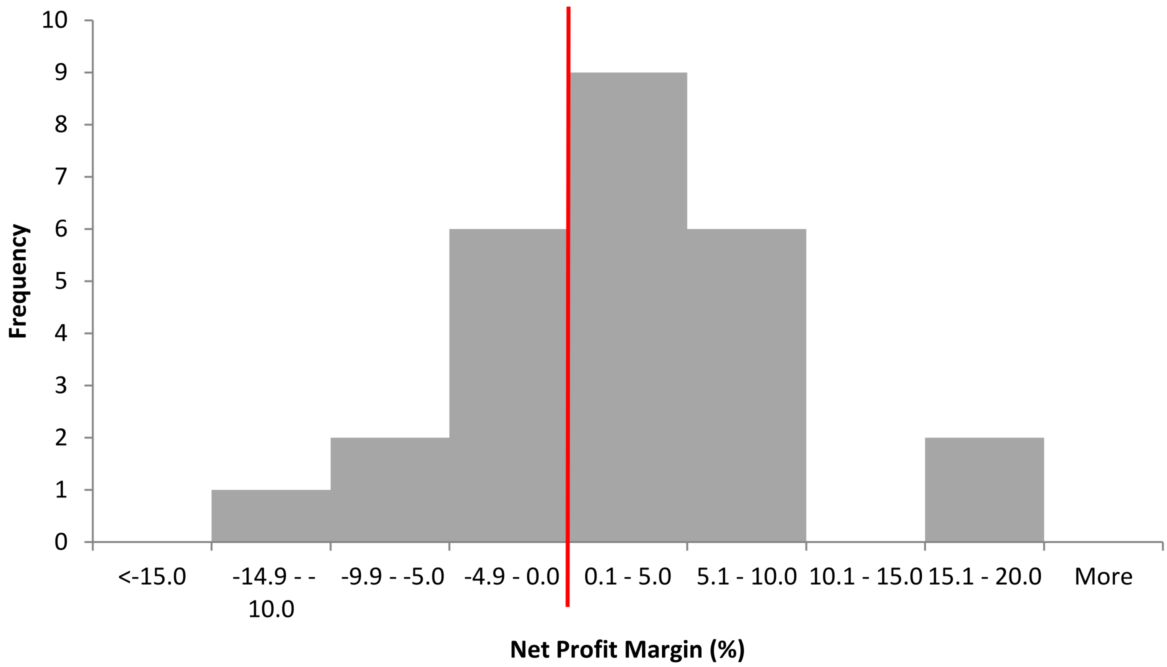
Note: Green indicates largest growth areas, pink largest areas of decline.
Data source: Eurostat (2011a)

The industry has a low-medium technology base (BIS, 2010d), with innovations predominately orientated around process improvements through increased automation (Hansen, 2010; Heidenreich, 2009). This is a result of several interrelated factors. Principally, IMP firms do not usually design or own the products they produce, limiting the capacity for product innovations which can be undertaken solely by the IMP firm. The industries are sensitive to production volumes and require a sufficiently high volume of work to remain profitable. This can either be from large volume production of a single component or combined across several customers and markets, both of which encourage process improvements to achieve a higher profit rate. The limited product innovation that has occurred in the industry has meant that cost remains a critical competitive consideration (Heidenreich, 2009). However, Taylor and Bryson (2008) have identified some evidence of increased research and development and miscellaneous metal manufacturing occurring in the West Midlands, indicating the development of high-value niche metal manufacturers. In addition, their work on the associated metal industries of jewellery and lock manufacture has identified the capacity of metal manufacturers to transition to specialised, high-skilled and value-added products through additional services provided by firms used to orientate themselves to customers and engage in co-innovations (Bryson and Taylor, 2010; Bryson *et al.*, 2008). This has played an important role in protecting firms from price-based competition through a series of 'inimitability' strategies where product based competitive advantage is combined with locational advantages to move away from price based competition with low cost producers. The role of inter-firm linkages in generating competitive advantage in the metal industry continues to be cited as an important feature (Littunen and Tohmo, 2003; Tully and Berkeley, 2004; Watts *et al.*, 2006) and is reinforced by Bryson and Taylor's work on customisation of products and services.

4.2.2 Profitability

The IMP industry has a low profit margin, with 24 firms (92.3% of known firms; Interview and FAME data, 2010) having a single digit profit margin or lower and an average rate of 2.5% across the sample. The distribution of profitability in the fieldwork sample is illustrated in Figure 4.3. Significantly, nine firms (34.6% of know cases) were making losses in 2010. These results illustrate the fundamental weakness in the IMP industry of chronic low profitability. The majority of firms in the sample were established between ten to 150 years ago, with only two 'young' firms (age 6-10 years). The 'young' firms are the results of ownership change and restructuring caused by financial difficulty (administration and management buy-out). Disney *et al.* (2003) suggest that productivity growth in the wider UK manufacturing industry is a reflection of entrants into the industry rather than restructuring success in existing firms, particularly single-plant establishments which showed no productivity growth. This could explain the relative low profitability levels of older firms with a history of profit erosion and limited investment. There were only two instances of firms making the standard benchmark of 'double-digit' profit margins in the fieldwork data: *Foundry SME 21* (17%) and *Foundry Large 1* (16.17%). *Foundry SME 21* is an SME, manufacturing batches of complex components whereas *Foundry Large 1* is a public limited company (PLC) manufacturing medium volume, complex but standardised products for the commercial vehicle industry. Both cases are starkly different and outliers to the overall profitability in the IMP industry.

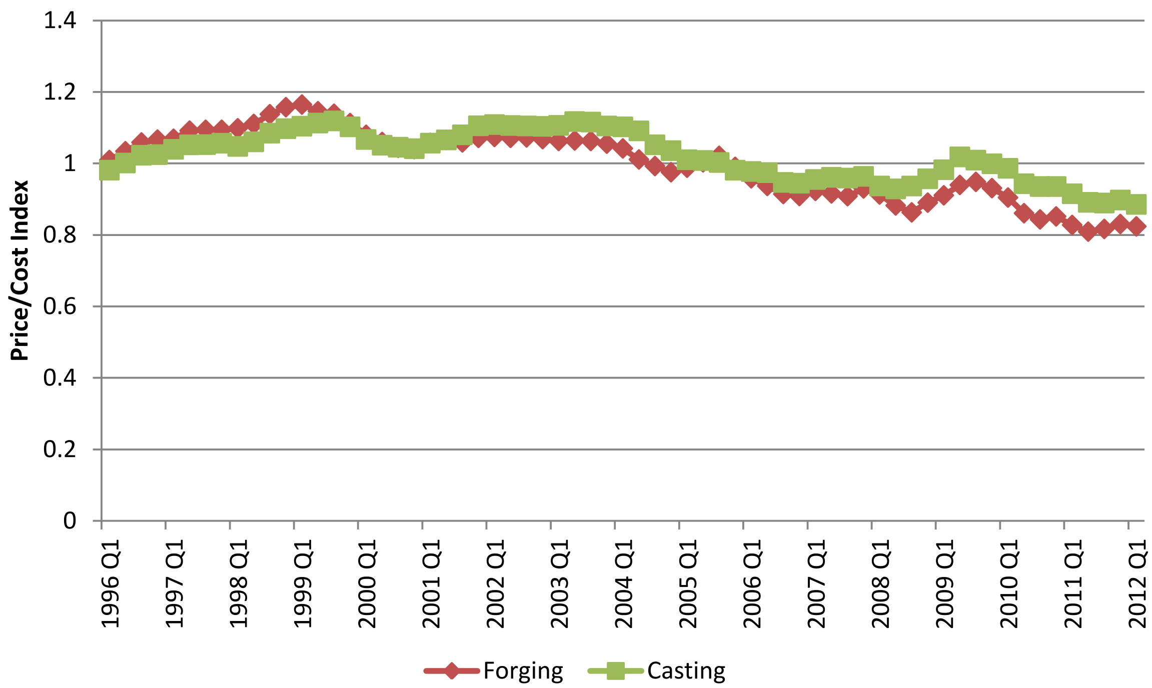
Figure 4.3 Profitability Distribution in Sample



Source: Interview data (2009-10), FAME (2010)

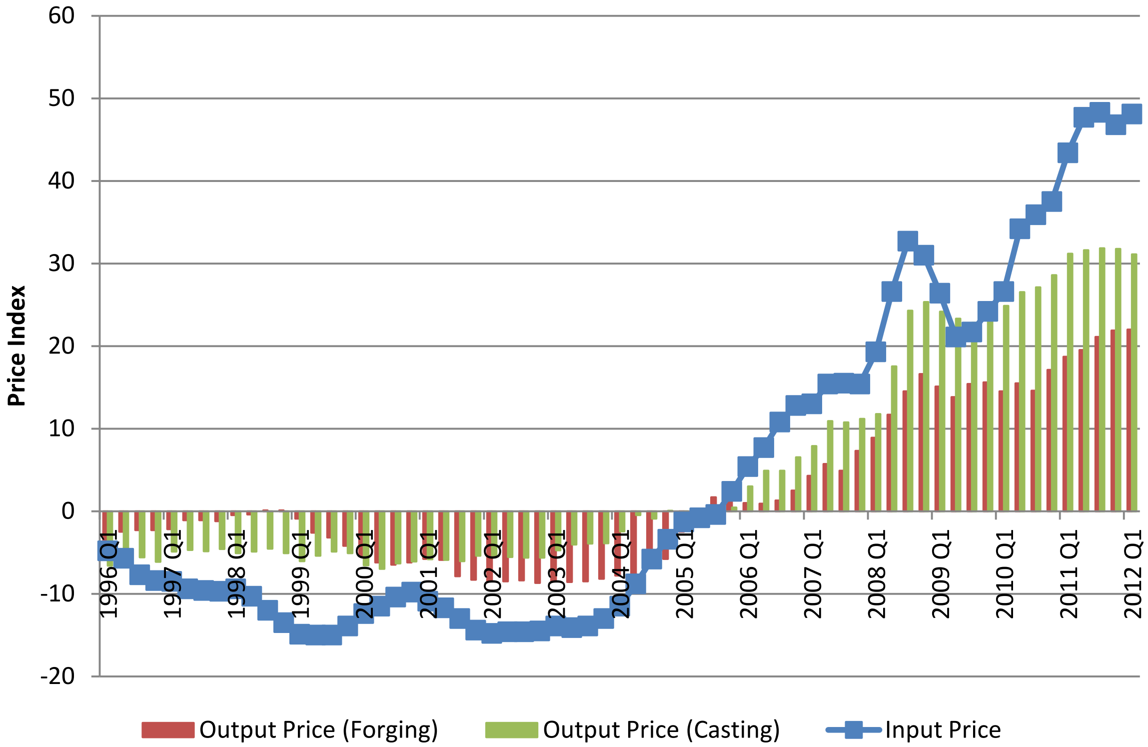
There has been an overall reduction in operating surplus, an indicator of profitability, over recent years (post-1995) despite the transition in the IMP industry towards higher value products. This can be seen as an index of output prices to input costs shown in Figure 4.4, illustrating the cost-price squeeze on the industry (Lawrence, 1987). From the mid-1990s to early 2000s the price-cost ratio was above one, indicating that the industry's outputs sold at a higher price than the inputs cost to make them. However, since this point there has been a drop in ratio to approximately 0.8 (2010), indicating a relative loss of operating surplus. From Figure 4.5 it can be seen that there are two inter-related factors contributing to this loss. Firstly, input costs have risen significantly since the mid-2000s. Secondly, this rise has not been associated with an equal increase in output values. Although the value of outputs in both industries has steadily increased over recent years, input costs have increased at a faster rate. In addition, the value of casting outputs, which were higher than forging outputs in the early 2000s, have not increased to the same extent as forging output values since the mid-2000s. It should be noted that this is only a broad indication of trends in the industry because the range and proportion of inputs varies considerably between firms and their product portfolio, however it does illustrate a wider trend for rising input costs and fluctuating output values. There appears to be a staggering cost-price squeeze on the IMP industry. This pressure is likely to absorb operating surplus, potentially eat into the financial resources of firms and is ultimately an unsustainable environment.

Figure 4.4 Ratio of Index of Prices Received for Outputs to the Index of Prices Paid for Inputs by IMP Sub-Industry, UK, 1996-2012



Data source: Producer Prices Index ONS (2012b)

Figure 4.5 Price-Cost Ratio: Input and Output Price Index, UK, 1996-2012



Data source: Producer Prices Index (ONS, 2012b)

4.3 Output Structure

The IMP industry supplies a wide range of further manufacturing industries, illustrated in Table 4.5, but the automotive industry is the primary market for over a quarter of firms. The automotive industry has and continues to dominate the manufacturing sector in the West Midlands (Tully and Berkeley, 2004). Despite this, IMP firms have tried to avoid dependency on the industry by diversifying into other sectors, such as aerospace, power generation and marine (Interview data, 2009-10). This is in part due to the IMP industries transition away from higher volume products. There is a strong tradition of jobbing foundries. These firms undertake customised, one-off or small batch production for multiple markets and avoid specialisation for any particular market. Although both mid-high volume and jobbing firms remain in the

IMP industry, there has been an overall reduction in the volume capacity of the industry in-line with market demand. The industry is now primarily geared towards batch production of mid-low volumes on repeat orders with a relatively stable customer base.

Table 4.5 IMP Principal Market Industries

Market	Number of firms with primary market (%)
Automotive	12 (26.7)
Marine	4 (8.8)
Construction	4 (8.8)
Aerospace	4 (8.8)
Fabrication	3 (6.7)
Power generation	3 (6.7)
Off highway	3 (6.7)
Jobbing/specials	3 (6.7)
Pump & valve/structural	2 (4.4)
Mining	2 (4.4)
Decorative work	2 (4.4)
Telecommunications	1 (2.2)
Petrochemical	1 (2.2)
Art	1 (2.2)

Source: Interview data (2009-10)

Overall, export levels are relatively low with the average firm exporting 26.6% directly (Interview data, 2009-10; FAME data, 2010). IMP firms tend to supply UK manufacturing sites, most of which then export to international markets. Three firms have export levels above 50% (*Forge Large 2 - Fabricator - Subsidiary 1, Foundry Large 1, Foundry SME 10 (PLC group subsidiary)*). These firms are very large (PLCs), continue to manufacture mid-high volume and tend to supply multiple customer sites. Although firms overall supply the UK market, they continue to compete with domestic and international suppliers, particularly western Europe and the USA, but also low cost manufacturers in eastern Europe and Asia for more standardised products.

IMP firms manufacture to customer designs and specification. Customisation of products is a common service with 71% (32/45 firms) providing the service. This traditionally would not involve any formal recognition of the design services undertaken by the IMP firm but there has been an increasing transition in the industry to develop product ownership, either through independent product ranges or formal collaboration with customers. Product ranges, such as bells, locks and security gates, have been developed by eight SMEs. In addition to this, firms have undertaken vertical diversification into fabrication (7 firms) and machining activities (6 firms). Fabrication, the assembly of a metal structure rather than only manufacturing a component of it, has been undertaken by both foundry and forging businesses, although primarily by small firms. The service provides scope for design involvement and a price premium by manufacturing an entire sub-unit but requires little cash investment. In contrast, the incorporation of machining activities includes a price premium (for a finished component) but requires considerable investment in equipment and space.

The IMP industry has traditionally consisted of firms specialising in either discrete orders of small volume or continuous orders of high volume. With the decline of high volume demand firms have developed a greater mix of order types, which has resulted in a more varied order structure. There are three primary types of product order;

- *discrete* – independent orders for a fixed quantity at a set price in a single transaction over short time periods;
- *batch* – independent orders for a specific quantity over an extended, yet still short, time period, and;
- *schedule* – long term agreements, which can be over a designated time period, such as three to five years, or open-ended, with a stable monthly volume. Quantities and timescales are generally not fixed initially, although prices are.

The order structure is a reflection of market and product types, where schedule orders remain for complex components of products still mass produced elsewhere and discrete and batch orders reflect the more bespoke element of component manufacture. Those firms with a specific market dependency, such as the automotive industry, may have a greater proportion of a specific order type, such as schedule.

4.3.1 Competitive Strategies

IMP firms have a series of competitive advantages which differentiate them from local and national competitors. These are outlined in Table 4.6 below. Quality (measured against international standards) and flexibility to customer demands (short lead times and bespoke manufacture) are key elements of differentiation to all competitors. Upgrading the firm's image to prospective corporate clients was a common strategy. Seven cases were identified where firms were attempting to attract more prestigious clients by investing in the image of the firm, either through website development, building improvements, changing location or sourcing practices. This approach was related to proactive firms attempting to move upwards in the value chain by working more closely with lead firms.

Table 4.6 Forms of Competitiveness in the IMP Industry

Competitive Strategy	Definition	Processes	Location of Competitors	Number of Firms
Price				
Price	Cost competitiveness	Mechanisation Technological investment	Overseas & local	12
Service Provision				
Logistics	Services provided in addition to manufacturing	Stock control Emergency production	Overseas	4 1
Factoring products	Purchasing mass produced products from low cost locations	Joint ventures Agents	Overseas	6
Flexibility to customer	Bespoke manufacture Diversified capabilities	'Specials' Process/product/material versatility	All	2 3
Capabilities				
Technical ability	Complex product manufacture Innovation	R&D investment/design input Technical knowledge input	Overseas	17 12
Quality	Fit for purpose products	International standards Process investments	All	11
Further processing	Additional manufacturing processes to increase value added	Prototype Machining/finishing	All	4 9
Other				
Image (capability/'green')	Capability of providing higher value added Green products	Marketing Site improvements International standards	All	7

Note: Strategies are not mutual exclusive and IMP firms most commonly undertake multiple strategies.
Source: Interview data (2009-10)

In addition to these strategies, IMP firms have generated competitive advantages targeted specifically against low cost overseas competitors based on additional services for their customers. By providing a ‘package’ of production and service capabilities IMP firms are able to differentiate themselves against lower labour cost suppliers. This approach has been identified in other metal industries and the wider manufacturing sector as a common method to compete against lower cost manufacturers (Bryson, 2009; Bryson and Taylor, 2010). Technological advancement of material, product development and design and production capacity have explicitly been utilised by 12 firms within the sample. One firm in particular uses its technical capability as its only competitive strategy and invests heavily in material advancement through European R&D consortiums (*Foundry SME 10 -PLC group subsidiary*). Product factoring services (the sourcing, purchase and stock handling of components from lower cost producers) is a common strategy for firms which cannot be price competitive from their own manufacture. In these cases the firms develop competitiveness from the services it provides in addition to the production of the product, such as quality inspections and stock management. Services and capabilities are the most extensive combined competitive strategies found in the sample, with 31 firms explicitly developing a service base to accompany production activities. Vertical diversification into added value activities in further manufacture or development are a key part of the ‘package’ offered.

Despite the prominence of non-price based competitive strategies, the majority of firms continue to engage in price based competition (only four firms are not price competitive). The sector is characterised by relatively low and medium technology levels, which Heidenreich (2009) and Hansen (2010) suggest influences firm competitive strategies as firms are less able to engage in product innovations to add value and differentiation from competitors. Instead, firms in lower technical ability industries are more able to make process innovations to reduce costs and increase efficiencies. Therefore, it is suggested that these firms are less engaged with differentiation and are more likely to continue to compete on price through process innovations. Those firms which do not have specific niches, either from technological advancement and investment (1 firm), very low volumes of old parts (2 firms) or extensive relationship building with their customers (1 firm), are likely to continue to rely on cost competitiveness. The firms that engage in some form of price based competitiveness do so as a partial competitive strategy, which is often more significant with new products or customers before financial and relational investments are made. Price is particularly significant for those firms who still engage in relatively high volumes of production for the automotive industry. In these cases, firms have developed cost efficiencies from technological investments in production automation, have exceptional international quality standards and provide additional services to their customers in an attempt to enhance their price competitiveness.

4.3.2 *Competitive Protection*

The strategies used to generate competitive advantage identified from the empirical evidence do not significantly engage with the location of the enterprise. However, a series of protectionist strategies were identified in the sample that explicitly engages with the geographical location of the firm, as outlined in Table 4.7. The approaches have been separated from the competitive strategies of IMP firms as they are more accurately concerned with protecting the competitive position of IMP firms by developing a competitive niche.

Table 4.7 Protection Strategies in IMP Industry

Competitive Protection Strategy	Definition	Processes	Location of Competitors	Number of Firms
Low profitability products	Small quantities Products with low mark-up	Accept small batches with high labour rate and low mark-up	Local	9
Sunk costs	Transaction specific investments	Transaction specific investments in tooling/equipment/training by customer	Any	8
Ownership	Design ownership	IPR	Any	6
Brand	'Made in the UK'	Building on brand of advanced technical and quality expertise in UK for manufacture of critical products	overseas	9
Proximity to customer	Response time Face-face contact	Additional sites close to customer Build relationship with customer	overseas	8
Reputation	Reliability	Build relationship with customer	Local	8
Niche	Distinctive set of capabilities	Technical/versatile	All	6
Trust	Security of production process	Traceability/standards Relationship building	All	2 12

Source: Interview data (2009-10)

Most interesting is the capitalisation of the 'made in the UK' brand that firms producing technically complex products for markets such as automotive, aerospace and power generation capitalise on. These markets require high levels of reliability demanded by regulations and consumers. The British manufacturing brand, seen as a highly skilled and reliable sector with governance structures and a proven track record, has provided firms with a strong competitive edge in certain markets, which has strengthened the competitive position of firms (Tokatli, 2012). This is particularly important because of the product area firms in the UK have moved into, that of complex, added value, high technical ability products. As a result, the reliability and technical criteria of these products is extremely significant and something customers will need to ensure, compared to products where reliability and accuracy are less important. Firms which are capitalising on this brand are those which are developing strong relationships with the original equipment manufacturers and advancing product development where these skills are most valued.

Proximity to customers generates competitive advantage from short lead times and face-to-face contact for products which require relatively more knowledge and dialogue with customers i.e. development stage and bespoke manufacture. Being located in close geographical proximity to customers or having strong transportation infrastructures can make firms more competitive when responding to customer needs by providing fast response time (Bowen and Leinbach, 2006), particularly for low batch volume products and for prototyping. The requirement to be close to suppliers and for certain products to only be manufactured in places of certain reputations is particularly significant for the competitive protection of IMP firms. Sunk costs have also been highlighted as a means of protecting firms in high cost locations from overseas competition. Historical transaction specific investments made by the customer and established knowledge repertoires generate an element of locational ‘stickiness’ depending on the extent of investment and relative gains to be made from sourcing elsewhere.

In addition to these specific place-based forms of protection, several firms are generating ownerships rights to products (6 firms) and are developing niches from an assortment of capabilities (6 firms). The most interesting strategy found in the sample is perhaps the passive approach to competitive protection from engaging in manufacture of low profitability products, which “…nobody else wants” (*Foundry SME 13*). This form of protection has been found at enterprises less engaged with active customer or market enhancement and experiencing periodic reductions in turnover and profitability.

Competitiveness in the West Midlands IMP industry incorporates both price and non-price advantages. Although price is only cited as a specific advantage for 12 firms (26.7%), it remains a factor of competitiveness in conjunction with service provisions for all but one firm. The significance of price despite integration into higher-value added products and services is noted by other studies of the US manufacturing sector (Berger, 2005; Herrigel, 2010). Building a relationship with customers is a key element in the competitive protection strategies in IMP firms, as identified in wider competitiveness studies in economic geography (Murphy and Schindler, 2011; Uzzi, 1997). However, customer relationships in the IMP industry are characterised by fairly intricate commitment structures, sunk costs and ownership rights. Casting and forging firms manufacture products to specific customer designs with tooling that is tailored, stored and maintained at the IMP firm, whilst legally owned by the customer.

This, together with a product base tailored to responsive, technically advanced and low volumes, generates an intricate supplier-customer relationship where mutual dependence is a key factor. Despite the transition to higher value added products, the IMP industry continues to have a relatively low profitability. Relationships with customers are shown to have a significant effect on competitiveness and access to higher-value markets. The following section will examine the role of inputs in shaping the profitability of IMP firms

4.4 Input Structure

The IMP industries are characterised by four primary inputs: labour, metal, energy and finance. The composition of these factors in the individual firm differs according to the products, processes and materials used. Each of these inputs is explored in turn.

4.4.1 Labour: Automation and Skills

Labour is the largest component of the cost base in the IMP industry overall (43% of selling price). Labour rates in West Midlands IMP firms are on average 25-30% higher than lower cost competitors in China, eastern Europe and India (*Foundry SME 21, Foundry SME 24, Forge SME 14*). Relatively high labour costs have created a competitive disadvantage in both high- and low-volume firms. Higher volume manufacturers, such as larger firms orientated to the automotive or off highway industries, have utilised technology through automation and mechanisation of the production process. This has been a direct attempt to reduce the labour content in the production process. One interviewee of a mid-volume forge that manufactured high value automotive components has drastically reduced its labour content and sees this as a key selling point to their customers:

> *When you walk people round the forge, you see what we do, the whole place is buzzing, and they can see no labour. All of a sudden they, they know that is the right way to go (Interviewee 1, Forge SME 10).*

In this example, firms have been able to stabilise labour costs in the business by increasing mechanisation. In conjunction with this, productivity improvements increase the value of the remaining labour force. Continuous improvement programs, increased monitoring of production flows and automated systems have been used to increase productivity to offset higher wage rates, as one interviewee of a large automotive component forge explains:

> *I believe it's the best thing for this business, that while the workforce are 20% higher in terms of their pay, our productivity, measured by the rate divided by y'know what they do, it's 40%. So they pay for themselves in essence. But if we don't keep that productivity up and other people catch us up then we've got a problem because our rates of pay are high (Interviewee 1, Forge Large 1).*

In contrast, smaller firms that undertake lower production volumes cannot introduce such high levels of automation due to the diversity of products, customers and markets that require a range and dynamic set of production techniques. Instead, these firms have managed the high labour cost by reducing the lead time and increasing the complexity of product design. This has been facilitated in part through the uptake of computer aided design and process technology. Increased technology has adjusted the required skills for the industry, particularly for a greater range of design based skills in smaller firms.

There is a current skills gap in the industry, which has been identified in other metal based industries in the West Midlands (Bryson *et al.*, 2008). There is limited employment of younger workers in the industry due in part from a negative industry image (as a result of past employment declines) and limited formal training schemes. The aging workforce creates succession and growth problems. The industry is characterised by a stable and long standing workforce that has developed a high level of tacit knowledge. The high skill level requires continued transfer of tacit knowledge through the workforce and extensive training to generate the range and quality of skills to manufacture bespoke and complex products. This is particularly a problem for smaller firms specialising in customised production. To manage the shortage of skills, IMP firms have attempted to deskill the production process (primarily larger firms that are able to efficiently employ automation), undertaking in-house training schemes (18 firms), employed foreign labour (primarily Polish workers) (6 SMEs) and utilised temporary workers for short term capacity filling. The shortage of skills has started to drive up local wage rates (short term reductions in rates was undertaken during the recession, however, rates remained relatively stable because of the skill demand and firms were reluctant to lose employees during the period). As the industry is essentially ‘selling labour’ (*Foundry SME 14*), the local wage rate is a key characteristic of its global competitiveness (Christopherson, 2009a, 2011; Christopherson and Clark, 2007). The incorporation of technology and widening of skill sets (to incorporate more advanced design and process capabilities) has been a fundamental mechanism in managing this disadvantage.

4.4.2 Raw Materials: Metal as a Strategic Input

The proportional significance of metal input costs can vary depending on the material type and nature of the product but the average cost is 42.8% of the selling price (Interview data, 2009-10). IMP firms tend to specialise in either ferrous of non-ferrous based metals as they have distinct properties and therefore markets (see Table 4.8 for the most common metals used in the industry). In addition, many IMP firms have developed capabilities to manufacture components with increasingly complex metal alloys. Metal alloys have been used for a considerable period, particularly in the casting industry, however, there has been a transition towards more complex alloys such as titanium and zinc based alloys in the aerospace and structural engineering markets. Steel and aluminium alloys remain the most common materials used in IMP firms (11 firms using each material).

Table 4.8 Main Metals used in IMP Industry

Ferrous	Non-ferrous	Alloy
Iron	Copper	Steel
	Aluminium	Aluminium alloy
	Lead	Carbon steel
	Zinc	Nickel alloy
	Bronze	Titanium

Source: Interview data (2009-10)

The materials are purchased through vastly different markets, which are outlined in Table 4.9. Non-ferrous, steel and aluminium alloys are traded on global commodity markets, which set a global benchmark for all contract prices (Cockerill, 2003). In comparison, ferrous metals tend to be purchased against a more local price (Cockerill, 2003), influenced by the local scrap market, manufacturing capacity and demand. Imports are increasingly common for the UK (ISSB, 2011), however the price continues to be influenced by local demand characteristics. The trading of metal through global commodity markets generates a more 'ubiquitous' factor of production which reduces the competitive (dis)advantage which can be generated from it (Maskell and Malmberg, 1999). However, localised pressures on material demand, availability and security can influence the international cost and generate escalating costs, which further threaten the competitiveness of manufacturing entities under different cost structures (Kalafsky, 2007).

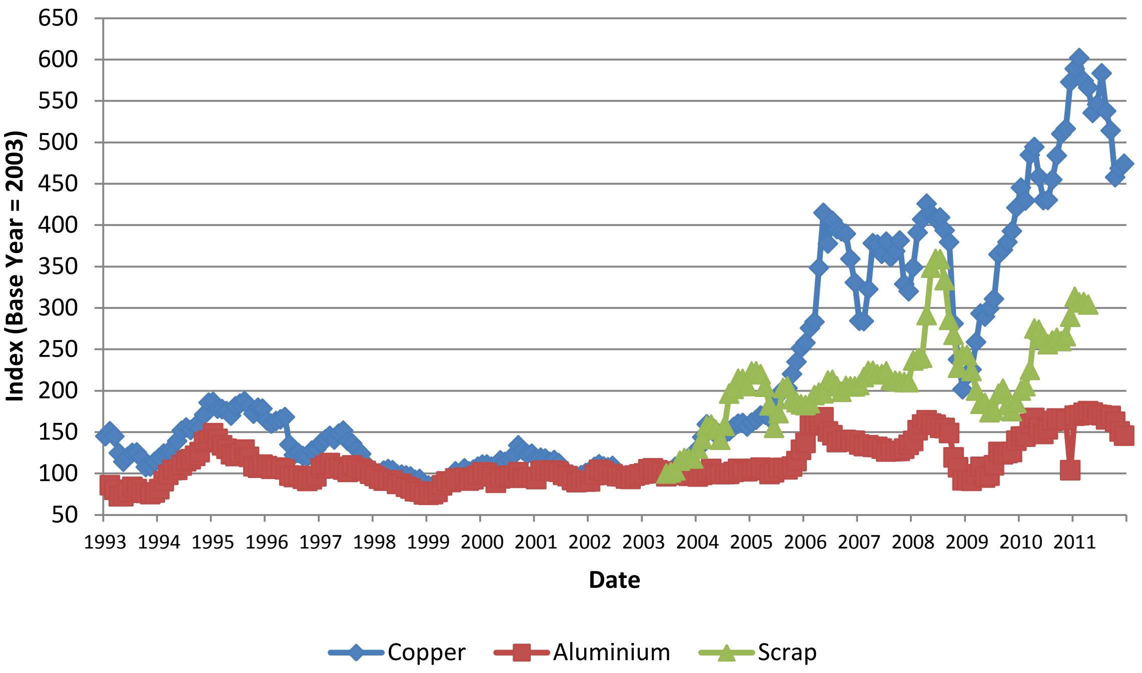
Table 4.9 Metal Purchasing Methods

Method	**Product**	**General ownership structure**	**Implications**		
			Price	***Availability***	***Service***
Mill	Standard products	TNC	Annual fixed-price contracts	Large purchases	Specified quality standards for large buyers
Stockholder	Undifferentiated products	Independent	Spot price Premium for low volume	Low volume	Storage, breaking of bulk
Service Centre	Customised/ further processed	Outlet of mill	Spot prices	Wide product range	Further processing to tailor product to customer needs
Merchant	Recycled (scrap)	Independent	Influenced by local market prices	Dependent on local markets and monopoly buyers	Quality and metal grade varies
Distributer	Imported metal	TNC or outlet of mill	International market prices	Large purchases	Access to mill products through spot prices

Source: adapted from Cockerill (2003), Ahlbrandt et al. *(1996), ISSB (2011), Interview data (2009-10)*

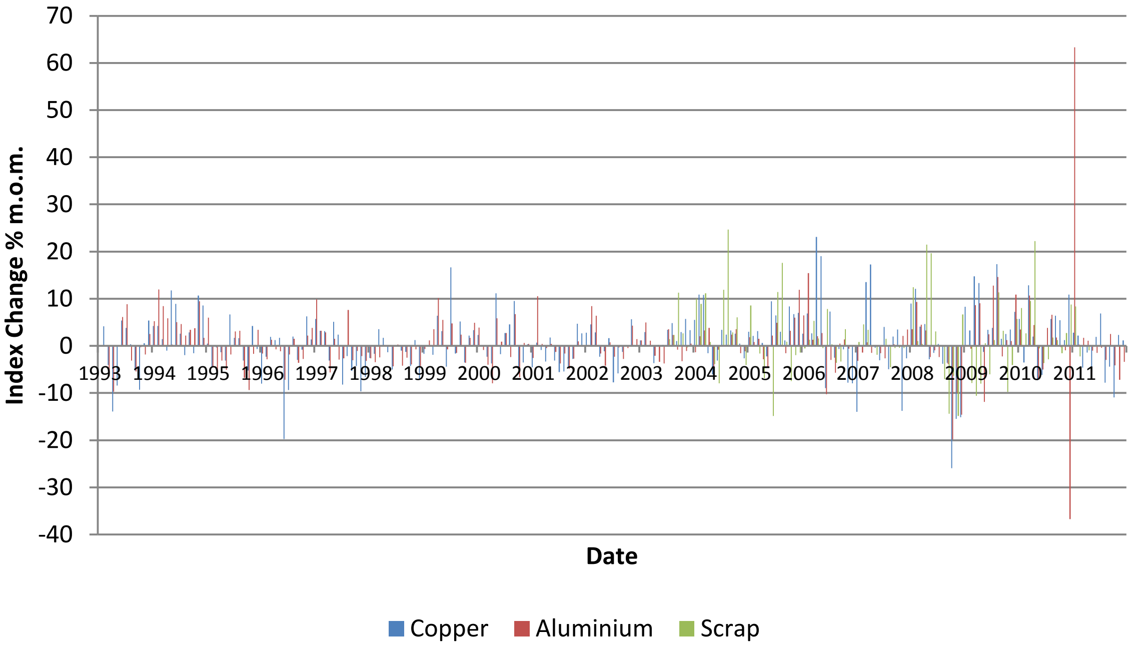
Metal prices are volatile. There was a considerable increase in the rate of price change in the early 1990s, as shown in Figure 4.6 and Figure 4.7, which resulted in the introduction of metal surcharges. Metal surcharges are supplementary payments which reflect the change in price from one period to another. A base price is set between supplier and customer based on the current market price. Any movement above or below this price during a specified period is then later adjusted for through a separate payment at a series of intervals during the production agreement. The system has developed into an industry convention to protect individual firms from the potential cost of rapid input price changes (both for the supplier and customer). IMP firms have also adjusted their purchasing methods to reflect both the increased volatility in metal price and reduction in volume (due to overall fall in demand and transition towards lower volumes). Firms will typically purchase ‘as and when’ they need the materials for production to limit material stock. Two firms have actually outsourced their material purchasing to generate economies of scale in pricing through combined purchase with other firms registered to the system.

Figure 4.6 Metal Price Index, UK



Data source: CAEF (2011), LME (2010a; 2010b)

Figure 4.7 Magnitude of Metal Price Change (Month-On-Month)



Data source: CAEF (2011), LME (2010a; 2010b)

The adjustments by IMP firms towards lower volumes of more specialised material products and reluctance to hold material stock has prompted significant changes in the structure of the metal supply industry, particularly in ferrous metals (Cockerill, 2003; Table 4.9). IMP firms increasingly purchase from service centres, stockholders or distributers rather than directly from the mill. Mills require large schedule orders or standard products, which many IMP firms either no longer need (demand is more focussed on lower batches of specialised alloys) or are reluctant to undertake because of the volatility in prices during the length of the agreement. In the case of steel, demand from stockholders has been the biggest growth area (25%) compared to limited growth in sales direct to the consumer (such as the IMP industry) (9%) (2009-10) (ISSB). Stockholders and service centres allow IMP firms to buy ad-hoc from them for relatively low volumes and portfolios of metal products at a price premium. This allows firms to move into more specialised material products by providing low volume 'packages' of materials. The ability to purchase 'packages' of metals allows firms to engage in increasingly specialised product markets and reduces their vulnerability to price fluctuations as they do not need to buy bulk supplies.

This supply structure does have two further implications for IMP firms. Firstly, the price premium associated with 'package' supply means that firms may be competitively disadvantaged against other manufacturers who are able to purchase the materials at discounted prices through bulk purchases and under relatively more stable prices. Secondly, service centres undertake further processing/treatment of material as well as providing packages, therefore reducing the capacity for IMP firms to add value within their processing activities. This is particularly the case for IMP firms who have relatively low value-added product bases.

4.4.3 Energy: A Complex Commodity

The IMP industry is energy intensive (Hammond and Norman, 2010), meaning they are large users of energy. The principal forms of energy used in the IMP industries are gas and electricity, which combined represent 74.3% of basic metal production (including casting) and 93.8% of fabricated metal production (including forging) use (Table 4.10). Total energy usage in the IMP sector has reduced considerably since 1990 (-63.55% in the casting industry and -37.4% in the forging industry) and demonstrated a reduction in energy use far greater than the manufacturing sector as a whole (based on data from ONS, 2010a). Energy efficiency improvements in the sector have been made continually to reduce the overall cost base (Bassi *et al.*, 2009), reduce the energy content in product design and in an ongoing drive to meet regulations for carbon emission reductions (Carbon Trust, 2006). Despite this overall reduction in energy use, energy costs now represent a larger proportion of the cost base (8.6% 2009-10 from 2.5% during the early 2000s) (Interview data, 2009-10).

Table 4.10 Composition of Energy Use in IMP Industries, UK

	Industry (SIC 03)	Natural Gas	Electricity	Total
Current composition (2009) (thousand tonnes of oil equivalent) (% of total)	27	646 (31.9%)	858 (42.4%)	2022
	28	346 (44.7%)	380 (49.1%)	774
Change from 1990 level (%)	27.5	-69.77	-54.70	-63.54
	28.4	-54.06	-9.07	-37.39

Note: Lowest resolution of fuel use and volumes available. Most recent data available
Data source: ONS (2010a)

The UK has benefited from some of the lowest energy prices in Europe over recent years (HC, 2011), particularly for gas. However, prices are rising and forecast to continue to do so, particularly for industrial large consumers (DECC, 2011); in turn, small enterprises will be negatively affected by price increases because of the present contract purchasing methods in the UK market structure (HC, 2011). Industrial high energy consumers have been targeted for additional energy taxes (specifically the Climate Change Levy[7]). Although the Climate Change Levy (CCL) adds only 3.5% and 3.6% on electricity and gas respectively to industrial energy bills (according to Q32010 prices) (ONS, 2010b), it remains an additional cost to UK based firms through energy purchasing contracts (Bassi *et al.*, 2009; HC, 2011).

Gas and electricity prices have become increasingly volatile (based on data from DECC, 2010). Energy prices have always been volatile due to the influence of local

[7] The Climate Change Levy is a tax imposed on energy use at the time of supply for specific groups of industrial and commercial users operating in the UK, based on quantity of fuel supplied. It was introduced in 2001 as part of the UK's strategy to meet carbon emission reduction agreements of the Kyoto agreement (Pocklington, 2001).

and global political and economic changes on the availability and price of energy resources, particularly global oil price (Jones, C., 2010; Rutledge, 2007). UK energy is managed through a network of interconnections with other countries, where demand and supply between countries is managed through price signals (DECC, 2011). The UK's reliance on non-domestic sources of supply is threatening the security of supply and consequently increased the UK's exposure to global price vulnerability. This level of price volatility has the potential to destroy IMP firms working with relatively low profit margins. At the time of fieldwork (2009-10) there were no established industry conventions to manage price volatility, such as the surcharge mechanism for metal. This poses a significant challenge to the IMP industry as price volatility can erode a firm's profit margin if sales prices do not accurately reflect input costs.

4.4.4 Money: Capitalisation, Cash flow and Investment

The structure of capital in the IMP industry varies between firms, although there are common finance mechanisms used to fund day-to-day working capital[8] and longer term investment decisions. The value of working capital for the majority of firms is less than 50% of their turnover (22 firms, 84.62% of known values: average use is 10.5%), with seven firms (16.7%) having negative working capital levels (current liabilities exceed assets). This indicates a very precarious trading position, dependent on continuity of trade to finance operating costs. The main routes of working capital are identified in Box 4.1.

[8] Working capital is defined as the difference between current assets and liabilities. Cash flow refers to short term liquidity in the business.

Box 4.1: Working Capital Mechanisms

1. Existing cash reserves from operating surplus
The availability of cash reserves in the sample firms was mixed. Overall, 31 firms (68.9%) used cash reserves to at least partially fund working capital. However, 12 firms had no reserves, including three cases of recent administration (2005 onwards).

2. Trade credit system
Trade credit is a vital facilitator of exchange in the production system, with all firms using the mechanism. The system is based on credit exchanged between individual producers and consumers within the production system, with no formal institutional provision of the service (Berger and Udell, 2006). Following dispatch of goods, invoices are sent to the debtor usually under industry standard terms and conditions (30-60 days payment for UK based transactions and up to 90 days for international sales). As credit is not secured through formal institutions there are limited mechanisms to recovery unpaid debts, which regularly occur. In response to this, a credit insurance industry has evolved which provides insurance for suppliers against unpaid invoices. A credit limit is provided based on the purchaser's credit history, which determines the financial amount that will be covered by insurance. This service is used in the industry (eight firms use insurance), however many of the smaller firms (eight firms) self-evaluate the credit worthiness of their customers or use online credit checks (such as Dunn and Bradshaw) (three firms), which they have subscribed to in order to avoid additional costs of insurance policies.

3. Use of bank overdraft facilities
Overdraft facilities provide short-term lending with a relatively high interest rate. This is the second most popular cash flow method, with 16 firms using overdraft facilities. This method is principally for short term cover for reductions in working capital.

4. Confidential invoice discounting (CID)
This mechanism generates immediate cash against a sales invoice, where the receivable is used as collateral for the lending. The proportion of sales value immediately released depends primarily on the credit worthiness of the purchaser but commonly 80% of the value is available. The remaining 20% is released once the purchaser has paid the debt. The service has an associated charge (up to 1% of the sales value (Cashflow UK, n.d.). Under this facility, the firm retains ownership of the debtor book[1], therefore, customers are unaware of the use of the facility against their debt (i.e. confidential) and management of debts remains the responsibility of the firm. The value of finance raised against the debt can also be influenced by the credit worthiness of the supplier firm as part of a portfolio of assets (such as buildings and equipment as well as the debt). This allows firms in a relatively stable financial position to increase the value of immediate cash available.

The use of lending facilities for cash flow is common in the sample (22 firms use either overdraft or CID, 6 firms use both). The high usage rate of overdraft facilities could be a result of the timing of the study (recession). However, the propensity of

CID is a clear indication of a long term finance structure in the industry. The facility is particularly useful for firms with limited cash reserves as it offers immediate working capital (5/12 firms that had no cash reserves used this method) or unproven financial stability (3/4 firms under new ownership from administration or management buy-outs). All the firms with CID illustrated relatively low cash reserves (< 6%, based on known turnover and bank deposits levels), which is less than the average level of bank deposits (9.9%). However, financial data is limited and therefore this only provides an indication.

Long term investments have been funded through a mixture of sources identified in Table 4.11. External credit has been used through bank loans and hire purchase (lease) schemes. There is a clear divergence between firm size in the use of credit facilities, with firms that are part of a larger group tending to access finance through group bank loans (4 firms) and single plant organisations using lease schemes (8/9 firms). This restriction of bank loans to sites within larger organisational groups reflects the cost and risk of external finance, as these sites will benefit from a preferential interest rate and security of group resources. In contrast, hire-purchase is a transaction based finance tool (Berger and Udell, 2006) and therefore credit is provided based on the projected value of the asset rather than the financial state of the firm itself. There is strong correlation between firms which use CID and hire-purchase schemes (6/9 firms), reflecting the accessibility of transaction-based credit mechanisms. Interestingly, the most common credit source was a grant (15/45 firms). The firms which utilised these were primarily SMEs (grants are usually targeted at SMEs to fill finance gaps), with those larger firms having used grants in the past when they were smaller businesses.

Table 4.11 Investment Sources

Source	Cash Reserves	Bank loan	Grant	Hire Purchase
Number of firms using source/number of firms with known activity	3/9	4/18	15/45	9/18

Source: Interview Data (2009-10)

Transaction-based lending is the primary mechanism from which IMP firms have accessed external credit. It is accessible to these firms because it is based primarily on the credit worthiness of either the purchasers (i.e. in CID) or asset (i.e. hire-purchase), rather than using financial information on the IMP firm (Berger and Udell, 2006). This is particularly relevant for SMEs with little available financial evidence or poor financial stability, which would make traditional methods of lending far more difficult to obtain (Beck and Demirguc-Kunt, 2006). Trade credit however, is based on a combination of transaction and relationship information between individual firms (Berger and Udell, 2002). The ability of firms to gauge their own risk through ongoing relationships and reputations has provided a fundamental component of working capital for small firms (Berger and Udell, 2006). Regional banks have traditionally been a source of credit for small businesses (Tickell, 2000) through relationship-based lending and the use of 'soft' information on owner-managers as opposed to 'hard' data on financial spreadsheets. The reduction of small regional banks has reduced the ability of relationship-based lending, particularly detrimental to SMEs (Berger and Udell, 2002).

Analysis of the financial stability of the sample, shown in Table 4.12, illustrates that one third of firms are financially unstable with a liquidity ratio below one, indicating their inability to pay back liabilities under their current asset base. In addition, the sample indicates that the majority of firms provide a higher level of credit to their customers than they receive from suppliers (85% of firms). This also causes concern for their stability, particularly during economically turbulent times and credit restrictions, as they become increasingly vulnerable to delayed payments and require high levels of cash flow.

Table 4.12 Financial Stability Ratios

	Liquidity	**Trade credit** (measured by ratio of trade debtors to creditors)	**Capitalisation** (measured by ratio of bank deposits to credit)
Sample average	1.74	1.69	3.15
Number of firms with ratio > 1	28 (67%)	17 (85%)	6 (30%)
Number of firms with ratio <1	11 (33%)	3 (15%)	14 (70%)

Source: Interview Data (2009-10)

The capitalisation in the industry is low, with 70% of firms having low available cash reserves compared to their existing credit use. Capital is sunk into existing equipment and buildings, which are very expensive. The role of credit availability for investment has been identified as a key constraint for growth in SMEs particularly (Becchetti and Trovato, 2002; Beck and Demirguc-Kunt, 2006); however, the study here identifies the fundamental role of credit for working capital also. Lawrence (1987) has also identified the influence of credit availability in the functioning and organisation of the Australian agriculture industry. The low profitability over recent decades has increased the reliance on transaction-based credit mechanisms for day-to-day running.

4.4.5 A Changing Cost Base

Input structures of firms have received considerable attention in economic geography for their impact on competitiveness from their use, such as investment practices of firms and restructuring to reduce labour costs (Angel and Engstrom, 1995; Clark and Wrigley, 1997a; Massey, 1995). The availability of inputs has been highlight to be a particular issue for IMP firms, both in terms of shortages and supply market structures. This has received comparably less attention, with the notable exception of Christopherson and Clark's (2007) discussion of regional labour markets. The availability of input factors are a particular challenge for the IMP industry in regard to skill shortages, credit restrictions and the complexity (and cost) of commodity inputs of metal and energy.

The cost base of IMP firms has changed. Non-labour costs now form a more significant part of the cost base than they did previously (Interview data, 2009-10). This is a reflection of both increased automation in the production process and the rising costs of other inputs, particularly metal and energy. This has important ramifications for the industry and individual firm. Labour costs are largely structured at the regional scale (Christopherson and Clark, 2007) and provide relatively stable costs. Labour costs are influenced by mechanisation, skill shortages and unionisation (Bluestone and Harrison, 1982). However, these changes are over a long temporal period. In contrast, the non-labour costs considered here, metal and energy, are structured through more complex procurement practices and have a far greater rate of change in factor prices. This price volatility can alter the structure of the cost base in very short periods of time. Energy is an interesting and increasingly significant case. Whereas industry conventions have been developed to manage price volatility in metal markets, energy is a relatively new challenge (with volatility in prices since 2005) and IMP firms are experiencing significant difficulties in managing the cost. Energy is perceived to be a production input managed through production efficiency and therefore the domain of the IMP firm. In reality, energy is an emerging commodity, with a complex market structure that can have immediate and significant impacts of the cash flow and viability of the business.

4.5 The Current Macro-Economic Environment

The IMP industry suffered considerable demand reductions during the economic downturn (October 2008 onwards). Demand reductions occurred across the majority of market segments to varying degrees and timescales. The automotive, construction and general engineering industries suffered the largest and quickest loss of demand, with aerospace suffering to a lesser extent, and a delayed onset in the marine industry due to long term contract structures. The demand loss at the individual firm ranged between 30-75% in automotive and general engineering-based businesses and only 10-17% in aerospace, marine and power generation-based businesses.

The IMP firms have several vulnerabilities to such a demand reduction. Firstly, prior to the downturn there was peak demand in the industry, with all time high output levels (Benedettini *et al.*, 2010). This caused many firms to invest in additional capacity, either through space, labour or both, and built up a large stock of materials, work-in-progress and finished products both in the supplier firm and throughout the supply chain to meet the continuing customer orders. Secondly, the speed of onset left very little time to adjust to changing order levels. Demand reduced literally overnight in some industries, particularly the automotive industry, with staggered reductions over a few weeks most common. As a result, firms were left with high levels of over-capacity. Thirdly, the demand loss occurred across all markets. Although some markets suffered considerably more, there was not enough buoyancy in any market to stabilise order levels across the firm.

4.5.1 Finance

The ‘credit crunch’ was an associated element of the economic downturn. The term refers to the withdrawal of available credit for business and increased interest rates, which effectively reduces the availability of affordable credit. This was a particular issue for IMP firms for three reasons:

1. *The financial structure of the firm*

The proficiency of credit, and particularly CID, for working capital left IMP firms extremely vulnerable to downturns in demand and the additional cost of using these facilities. As the credit stream is related to the sales value, the decline in orders dramatically reduced working capital. In conjunction with the speed of the onset, the firm was left with existing material supplies and orders for a previously high demand, but a reduced working capital to pay for such items and, therefore, a reliance on agreed lending for immediate cash flow (BBA, 2010).

The firms which had undertaken considerable investment prior to the downturn to modernise and increase the capacity of the business during the demand boom were also vulnerable in some cases. The relatively high debt levels were seen as a risk, resulting in reductions in existing credit streams (overdrafts, CID) and further exacerbating cash flow difficulties in the business.

2. *Tightening and withdrawal of credit insurance*[9] *led to an increased reliance on trade credit and limited protection*

Due to the propensity of trade credit, credit insurance is a vital element of the system as products are manufactured and dispatched prior to customers being invoiced. Not all firms will use credit insurance because of the associated additional cost (particularly older, smaller businesses with long standing relationships with customers may not require insurance). However, it remains a common facility across the industry (only one firm did not use insurance originally) and, particularly, for new customers. With the onset of the recession, insurance became increasingly difficult to attain at an affordable cost or to cover the total value of orders (Cosh *et al.*, 2009). The IMP firms were affected by this reduction in cover in two ways. Firstly, the firms were unable to cover all of their customer's order values, leading to individual firms having to supply goods with no protection. Secondly, the suppliers of IMP firms were unable to get cover on the IMP firms' themselves, leading to a 'pay on delivery' culture. Effectively, the large scale removal of trade credit insurance ground the supply chain to a halt.

3. *Limited availability of investment credit*

Credit restrictions constrained growth in the industry, despite firms gaining new orders, particularly in firms orientated towards the automotive market. Credit restrictions had a similar effect outside the industry (BBA, 2010; ERA, 2011).

[9] Credit insurance is an external product purchased to protect the firm from loss of payment from customers. Firms are credit scored and provided with a financial limit for which they are insured against. A premium is paid for the insurance cover.

Although growth opportunities were missed in some cases (2 firms), overall there was a reluctance to invest during the period.

4.5.2 Adjustments to the Economic Downturn

Adjustments to the economic downturn followed four main areas outlined in Box 4.2; cost cutting, relationships with existing customers, new customers and markets, and development/training. The principal approach was to minimise costs through reductions in labour costs (either redundancies or short-time working). The practice of short time working was a direct result of the labour structure of the industry. Firms were reluctant to lose skilled workers as they would be difficult to replace once the upturn came. The older workforce meant that many of those who could potentially be made redundant would be unlikely to return work should they have the opportunity. As a result, firms worked shorter hours to maintain the employment of their staff during the period. Short-term working reached its peak in the autumn 2008 – spring 2009 when in some cases firms were working one day/week (*Foundry SME 4*).

Box 4.2 Recession Adaptations

<u>Cost cutting exercise</u>
By far the most common approach was to consolidate the business and reduce costs. All firms engaged with some form of cost reduction and in many cases this was the only adjustment practice. Cost reduction activities centred on reducing the workforce through redundancies and short time working practices. Redundancies were used in 29/45 firms, with between 6-60% of the workforce being affected. The largest redundancies were seen in firms orientated towards the automotive industry. In addition, firms were practicing more frugal purchasing, entered into financial holidays (such as rent and VAT) and restricted all investment to maintenance of buildings and equipment. Pay freezes were commonly enforced.

<u>Relationships with existing customers</u>
Very few firms lost any customers to competitors during the period and customers were only lost if they closed. Existing customers became very important to the overall viability of IMP firms while they waited for the upturn. The dependence on the customer base meant customers were able to increase their requests on the supplier, which often resulted in increased risk being placed with the supplier. Price cutting was commonly undertaken, although this changed during the recession period. The majority initially engaged in price cutting to retain their customers, however, many of the small firms resisted reductions because it would reduce the viability of the business. These firms typically had a wide customer portfolio which allowed them to be less dependent on a particular customer.

<u>New customers and markets</u>
IMP firms were less active in initiating new markets and customers. Only two firms engaged in explicit marketing drives. Investment in new equipment to expand their market base was only undertaken in one firm and was a pre-existing plan, although execution was prompted by the downturn (*Foundry SME 23 - large group subsidiary*). However, there was limited movement of existing customers between firms in the industry. Customers tended to remain with their supplier because of the threat of working with a supplier with unknown trade and financial history. Three of the older firms utilised their extensive land resources by renting it to small firms who had to downsize during the recession. This provided a short term income injection to support the primary revenue streams.
The exchange rate benefit was utilised by some firms, although with mixed results. Two firms explicitly invested in export growth through employment of overseas agents and promotion through export trade fairs. However the firms that benefitted the most were those who already had a strong export base. Those firms became exceptionally cost competitive and already had the facilities and experience to utilise immediate exchange rate advantages. There was a small element of customers who had previously off-shored their business to low-cost locations returning to IMP suppliers. This occurred in five firms. The relocation was triggered by the reduction in cost savings between the UK and low-cost producers but critically, there was existing long term unhappiness with the specific low-cost producers on issues of quality and service. Although the IMP firms benefitted from relocation of customers, this was a long term strategic move prompted by the recession.

<u>Development</u>
There was limited development of staff or technical capacity during the period. There were three exceptions were IMP firms utilised funding schemes to train non-active staff in industry relevant qualifications (such as NVQs). There were no examples of benefitting from equipment advancement through cheap sell offs.

During the period customers became increasingly demanding of the capacity and role of suppliers by requiring shorter lead times and increased stock contingency. In addition, existing contractual commitments from the customer were withdrawn and new order structures put in place to reflect changing demand, leaving many IMP firms with existing material and stock costs. The increased risk transfer from customers to IMP suppliers was based on increased dependency in the immediate term to utilise existing stock and work in progress (particularly because products are customised). As the downturn continued, some IMP firms became more reluctant to engage in price cutting, particularly because their customers were increasingly dependent on IMP firms when demand was slowly returning and there was minimal stock in the supply chain, making response time critical.

The recession has played a significant part in the restructuring of the current order configuration of IMP firms, increasing the dependency in customer-supplier relationships. Schedule orders declined, and in many cases stopped altogether, as volumes reduced. Instead, customers who traditionally depended on schedule orders began to order smaller batches or discrete low volumes to match reduced and infrequent product demand from their own customers. In turn, this increased their reliance on British IMP firms as components were required quickly and intermittently, thereby, reducing the customer's ability to purchase from high volume suppliers located in low cost locations.

4.5.3 Survival: Cash Flow and Maintaining Relationships

The response to the downturn highlighted some key features of the IMP industry. Firstly, cash rather than profit became critical. The prior reliance on credit mechanisms (overdraft and CID) as well as trade credit, combined with low capitalisation, resulted in the industry being particularly susceptible to credit reductions. Secondly, the focus was on adjusting existing relationships rather than seeking new customers or markets. Although some firms did engage in market expansion (two firms), this was a minority response. Greater attention was given to supporting the demand requirements of existing customers and strengthening relationships through sharing financial information (*Foundry SME 19*), greater communication and inspection of IMP firm facilities for demand rises (*Foundry SME 4*) and absorbing additional production functions (*Foundry SME 21*). This involved careful management of contracts and commitments with customers.

4.6 Summary

The industry analysis has provided an overview of the current state of the IMP industry and identified the key challenges facing the industry. Profitability is a fundamental difficulty and constraint. Low capitalisation from an extended period of restructuring has caused a structural weakness in the industry; profits have been used to subsidise rising inputs costs and the value of outputs has not increased enough to support this. The problem is composed of several interlinked issues related to the industry's ability to adjust to increased global competition based on the nature of its relationships with other firms.

There are two key findings emerging from this research. They indicate immense challenges facing the IMP industry at present, as follows:

The transition to higher value added manufacturing has not generated a rise in profitability in the industry.

The competitive position of the IMP industry is underpinned by the strengthening of customer relationships through the absorption of additional tasks to increase the portfolio of capabilities and services provided by suppliers. Despite this, profitability in the IMP industry remains low, and in some cases has declined over recent years (separately to the recessionary impact). This indicates that the relationship between IMP firms and their customers is a key aspect of long term stability in the industry and involves a complex negotiation of value within the relationship.

Energy is an increasingly significant input due to rising and increasingly volatile prices.

Energy price rises and volatility pose significant risk to IMP firms, if there are not passed through the supply chain, as escalating costs will quickly make firms uncompetitive in an international market place. The IMP industry is beginning to adjust to the changing cost base, although it has faced considerable difficulty. The volatility of energy prices has generated a significant immediate risk to IMP firms, absorbing profitability and cash flow, and potentially a longer term problem from limited investment.

The analysis has illustrated that the industry faces complex and technical issues related to its long term survival and competitiveness. Relationships with customers and rising energy prices are key elements to this. As a result, the following empirical chapters are focussed on exploring both of these issues and the subsequent impact of inter-firm agreements on the adjustment capacity of IMP firms. The experiences of the IMP industry in relation to these challenges are a key aspect of their potential to survive in an advanced economy.

5 CLIENT-SUPPLIER INTERACTIONS: RELATIONSHIP STRUCTURES IN GLOBAL SUPPLY CHAINS

5.1 Introduction

IMP manufacturers have undergone considerable change over the last few decades in response to increased competition from manufacturers located in lower labour cost areas. The restructuring of the market place has driven firms to make adjustments to remain competitive and ultimately influenced the structure, nature and stability of production networks and the vertical inter-firm relationships that comprise it. The previous chapter identified customer relationships to be a key element of competitiveness. IMP firms are found to be competing against low cost competitors by providing a ‘package’ of product and service capabilities for their customers. This is an attempt to move away from standard market transactions and encourage a ‘closer’ relationship with their customer base. Interestingly, some IMP firms were found to be attempting to protect themselves competitively through a series of commitment structures (sunk costs, product ownerships, trust and reputation) based on strengthening the client-supplier relationship. Despite a transition to value-added manufacture and strengthening of client-supplier relationships, profit levels remain relatively low with an industry average of 2.5% (Interview and FAME data – 2010).

Relationships between buyers and suppliers have become an increasing area of focus within economic geography over recent years (Bathelt and Gluckler, 2011; Dicken *et al.*, 2001; Yeung, 2005). The interconnected nature of production systems has generated expansion of supplier capabilities to incorporate core (and usually high value-added) elements of the production process, such as product design and prototype development (Herrigel, 2010). The collaborative nature of production has generated an increased level of interdependency between buyers and suppliers (Gereffi *et al.*, 2005), which has prompted a focus on relationships in the production chain. Particular attention has been on the ability of lead firms to influence suppliers through various forms of tacit governance, such as trust (Sako, 1992), relational proximity (Murphy, 2011) or shared competencies (Gereffi *et al.*, 2005). However, the conceptualisation of these relationships is based on the strategic action of lead firms in shaping the nature of the relationship and their flexibility to move between suppliers. The role of smaller suppliers in shaping global supply chain relationships and the flows of value within them has received far less attention (Dorry, 2008).

The following analysis focuses on the output structure of IMP firms and the transition towards higher value-added products and services to remain competitive. It brings together current thinking on client-supplier relationships and empirical results to address the limitations in understanding around the role of suppliers, and particularly small firms, and their capacity to influence relationship structures through complex power asymmetries. The attainment of value from product and process upgrading in the industry is examined in further detail. Client-supplier interactions are deconstructed to identify areas of relative power between transaction partners. These structures are used to build an understanding on the types of relationships found within the industry and the implications for the stability of IMP firms. Finally, the process of value attainment in each relationship type is highlighted. Profit generation is found to differ considerably between relationship types based on the structure of customer purchasing contracts, generating distinct temporal patterns of value creation.

5.2 Deconstructing Client-Supplier Relationships

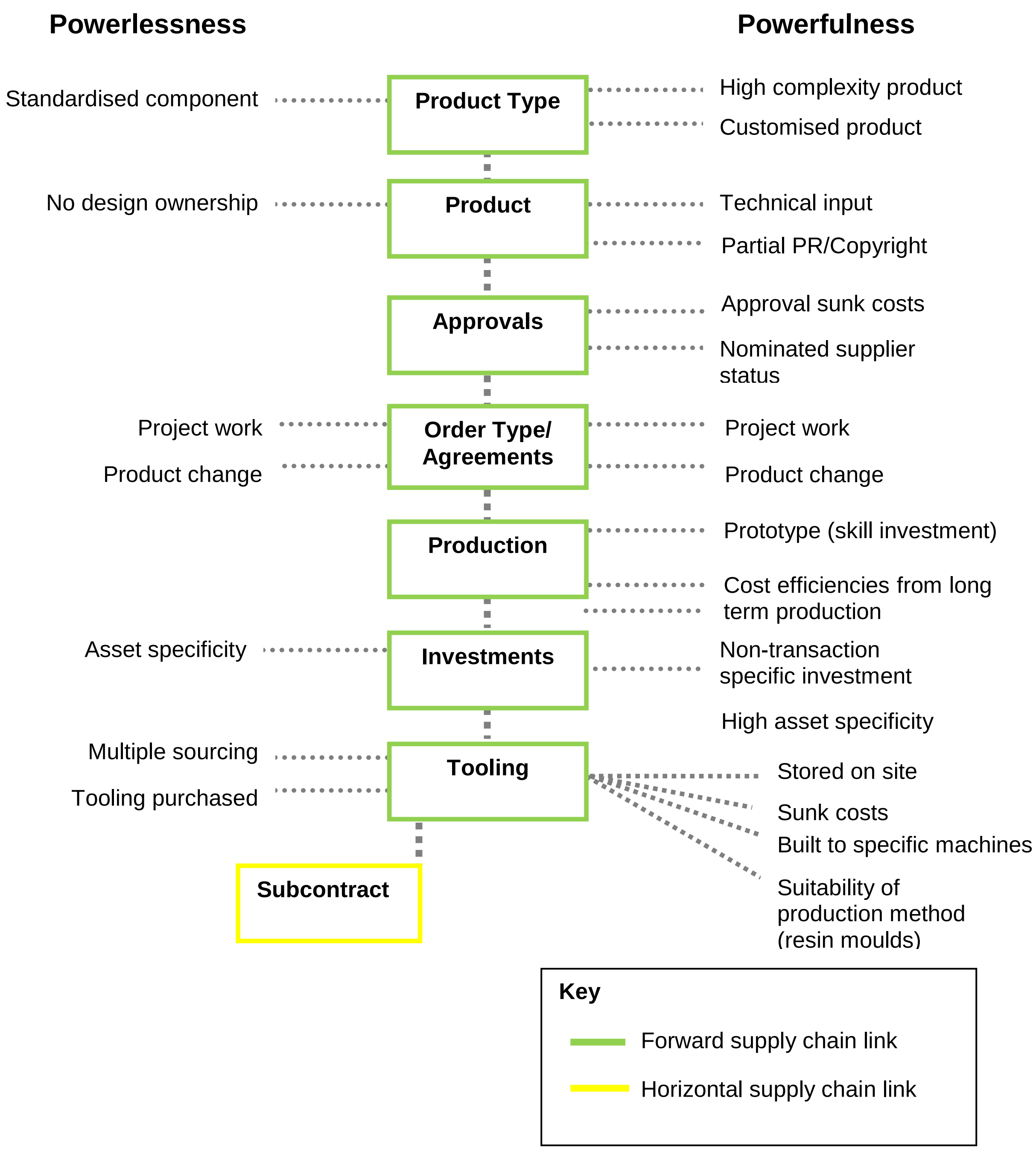
Interdependency between transaction partners has received considerable attention in both the network and chain literatures. Under both approaches dependency between transaction partners, based on unequal resource levels or access, is a central element of governance. Asset specificity encourages dependency through investments targeted only at particular relationships and therefore the investment is only valuable within specific transaction context (Williamson, 1979). Increasing product complexity and collaboration across production tasks within the production systems has been suggested to generate increasing interdependency between transaction partners (Herrigel, 2010).

Forms of dependency have focussed attention on the explicit power of lead-firms to structure the nature of relationships through their investment behaviour and their consequential distribution of risk and cost to suppliers (Fields, 2006; Sturgeon and Lee, 2001; Sturgeon, 2002). However, it has been suggested that these dominant forms of power may be influenced, at least temporarily, by more complex power asymmetries in vertical inter-firm relationships (Dorry, 2008; Rutherford and Holmes, 2008) that are influenced by strategic decision making of firms (Gibbon and Ponte, 2008). IMP firms have demonstrated complex and varied relationships with their clients, with multifaceted power dynamics. The following empirical analysis will explore the structure and nature of the client-supplier relationships found in the IMP industry.

5.2.1 Power in the Production Process

The study has identified a series of areas in the production process which can generate specific elements of relative power between buyer and supplier, as depicted in Figure 5.1. The elements are based on the deconstruction of the production process into stages of decision making between the supplier and customer: product type, ownership, level of approvals needed, order structure, method of production, level and nature of investment required, and specific tooling requirements. These stages represent instances where one transaction partner can generate a position of *relative* power over the other. The approach is based on a conceptualisation of power in the organisation as causal power (Clegg, 1989). That is, power asymmetries develop based on control of resources. The following analysis builds on this by viewing power as a dynamic and transitory capacity (Taylor, 1996; Taylor *et al.*, 1995), where control of resources is influenced by strategic decision points in the production process. As such, it looks at the *relative* power fluctuations between supplier and purchaser, defined as 'powerfulness' or 'powerlessness' of the supplier (Taylor, 2006). This follows an assumption that power is based on interaction between two parties that determines dominance through recognition (Bathelt and Gluckler, 2005). Critically, power is conceptualised as a *potential* ability to influence based on the structural frameworks of the transaction. Although this conceptualisation is limited to the inter-firm relationship, it does identify the complexity of power dynamics between transaction partners, which has yet to be fully incorporated into current understandings. A discussion of each stage will be provided in detail below following the layout in Figure 5.1.

Figure 5.1 Decision Points in Inter-Firm Production Relations: Implications for Power Inequalities between Exchange Partners



Source: Author (2012)

Product type

The type of product manufactured is a fundamental component of the relationship dynamic. To generate complex and customised products requires a more varied skill base at the supplier firm compared to more standardised components. A standardised component generally requires more asset specific investments by customers and therefore reduces the relative powerfulness of the supplier firm by restricting their market (Gereffi *et al.*, 2005; Sturgeon, 2002). Complex and customised products tend to be of higher value than more standardised components. Transaction partners are more likely to invest in developing an ongoing relationship where spend is of considerable value. *Foundry SME 10 -PLC* group subsidiary, a large foundry, has focussed on a key set of high –value customers in an attempt to strengthen their relationship, as they explain:

> *Instead of having lots of little customers with lots of little orders we've concentrated on a big customer who can give us a big amount of the work and then we can love them up …if somebody wants to buy a £5,000 casting or somebody wants to give you a £2 million order, who are you going to look after? (Interviewee 1, Foundry SME 10- PLC group subsidiary).*

The strengthening of the relationship builds a sense of trust and shared competencies between supplier and customer (Herrigel, 2010; Murphy, 2011) but also increases dependency and potential risk as a single customer represents a large proportion of turnover. The product becomes more critical to the relationship when it is of strategic importance to the customer. This creates increased dependency on the behalf of the customer as the supplier becomes vital to the continuation of the wider production chain. An example of this is *Forge SME 10*, a mid-high volume forge that specialises in automotive components. The product they manufacture is critical to the continuation of the entire production chain for their OEM customer because it is an integral part of the functioning of the car. In this instance, the strategic importance of the particular component allows the supplier to enact on its position of relative power because the customer is dependent on the suppliers capability at a specific point in time.

Product ownership

Product ownership is a critical point which can determine the role of the supplier. If the supplier has no rights to the product, then they have little influence over sourcing and profit options. However, if the firm is partially involved in the design process then the firm can influence where the product is manufactured either through intellectual property rights or the existence of design intelligence specific to the firm, which may discourage or prevent sourcing elsewhere.

However, the enactment of this protection is not always successful, despite clear and formalised legal rights. In several cases, IMP firms have lost production orders despite complete or partial ownership with customers. *Foundry SME 1 - Fabricator*, a SME foundry that also diversified into fabricated products, had developed intellectual property on a particular product for a customer. Rather than securing the customer's demand, the customer transferred production to another company and the IPR was unable to prevent this. In this instance, the relative power gained from partial ownership was ineffective because of the far greater influence of the customer's size and resources to pressurise the supplier into accepting their use of the supplier's product. In contrast, *Foundry SME 20 - Fabricator*, another small fabricating business, utilised partial product ownership to recover unpaid debts from a customer, another small manufacturer. In this case, the customer was unable to sell the product without *Foundry SME 20 – Fabricator's* involvement. As such, *Foundry SME 20 - Fabricator* negotiated the sale of their IPR to recover part of the unpaid debt. This was a difficult and lengthy process, but due to the customer's low level of resources and financial instability the IMP firm was able to enact their relative power through ownership rights to secure the recovery of funds. In both cases the enactment of ownership power was dependent on the IMP firm's relative resource power to challenge their customer's.

Approvals

Product and supplier approvals are certifications of appropriate standards of capabilities in supplier firms to manufacture products to the required quality and specification. Approvals generate increased levels of power for the supplier because they require investments in time and finance by customers. By undertaking this, the customer becomes interested in maintaining the relationship because "…production part approval processes … can be very expensive. For example, I am told that if a product has to go through the whole process of approval then it can cost around £10,000" (*Interviewee 1, Foundry SME 26*). This is particularly the case for the aerospace industry because of product specifications and, increasingly, to differentiate suppliers in the automotive industry based on quality capabilities.

These additional costs are only undertaken if the customer trusts the supplier to invest so heavily in developing these approvals. In addition, particular industries, such as aerospace, and products, such as critical engine parts, require production approvals from the OEM, not necessarily their direct customer. As a result, the process can be very time consuming and limit the ability of a firm to transfer production to new suppliers. It does not prevent resourcing completely, and redistribution of sourcing between existing suppliers is common, but it generates a time lag that the IMP firm can utilise to find other sales avenues.

Order type and agreement

The nature of the product order and agreement can influence the level of dependency from the customer. Under long term product agreements, the customer is likely to invest in the supplier and therefore become more committed and less able to shift production elsewhere. In contrast, contract order type is also associated with a discrete product life cycle and, as a result, the continual change of product makes alternative sourcing options more applicable, as new costs will still have to be laid down. Continual product change does not build this sort of dependency and, therefore, the supplier remains less powerful against the customer. However, in these situations the supplier has less invested in the customer and is not as dependent on maintaining that particular relationship.

Production method

The production method is associated with the product value, volume and stage of development. Prototype work has the potential to lock-in customers to further work: sunk costs have already been established at the supplier firm through tooling and design adjustments. Long term contract and schedule work can generate cost efficiencies at the supplier firm through continual improvements in production processes. These characteristics make it more costly, both financially and temporally, to source somewhere else and therefore puts the supplier firm in a relatively more powerful position with the customer.

Investments

The specificity of investment to meet the requirement of particular customers by suppliers can both increase and reduce their relative powerfulness. Asset specific investments can strengthen a buyer-supplier relationship by illustrating commitment by suppliers. On the other hand, it increases the suppliers' dependency on customers. Non-transaction specific investment has the benefit of strengthening suppliers' capabilities without enhancing dependency on any particular customer (Sturgeon and Lee, 2001; Sturgeon, 2002).

Tooling

The tooling characteristics, such as customisation to firm machines, sunk costs, partial ownership and storage patterns can also provide some relative power for supplier firms. Customers retain the ability to source components at other manufacturing facilities, ultimately reducing the powerfulness of suppliers in relation to customers because of this open sourcing ability. In addition, customers usually retain ownership of designs and purchase the tooling, making it impossible for suppliers to utilise the tooling and ultimately its value to suppliers is minimal without the associated customer order.

These sunk costs do allow IMP firms to capitalise on the customer's dependency and increase their relative power in certain circumstances, such as unpaid debts. Several firms were able to threaten their customers into paying their debts in order to recover the tooling, which despite not being owned by the supplier was in their possession. Thus, one supplier had an unpaid debt due to their customer entering administration:

> *. . . we were owed a lot of money and we had all of their dyes and tools. They had to trade the business because it provided forgings to people like [OEM 1].*

> *[OEM 2] was the biggest problem for them and you take those forgings away and all these cars are not going to be built. So the administrator was in a position where they had to trade the business 'cause if they fall out with [OEM 1] then they're in trouble with the next one in administration, and the next one and the next one. So they had to trade the business. They came to trade the business and they've got no dyes and tools to make any parts. So they knocked on the door. They offered us double the price for every dye and tool we'd got here to have the dyes and tools back, which came to a small figure compared to the overall bill. We said no, we're going to keep them, we're not interested…It got to the point where they paid every single penny (Interviewee 1, Forge SME 10).*

Due to the time delay and cost of generating new tooling the supplier was in a position of relative power to demand payment. However, this powerfulness is unlikely to continue as customers tend to multisource products where it is cost effective, for example on higher volume products.

Sunk costs and dependency

These decision points represent instances of resistance, as well as coercion (Clegg, 1989). The production decisions stabilise the power asymmetries between the organisations during a period of time where the control of resources and investments generate value. Investment is a key determining factor in each stage, generating distinct and differentiated forms of sunk costs (Clark and Wrigley, 1995). Sunk costs imply a preference to continue a production relation while prior investments in equipment or knowledge retain value by maintaining the current production context. This analysis has illustrated the continued relevance of sunk costs as framework for understanding production relations but highlights the complexity of their influence. Multiple areas of sunk costs generate a complex system of investment structures between transaction partners and may entail conflicts between different sets of investment. These layers can generate distinct areas of relative power for transaction partners and specifically instances of relative power for suppliers. Although sunk costs are not the only dependency element in production relations [for instance access to resources see Pfeffer and Salancik (1978)], they form distinct inter-firm asymmetries.

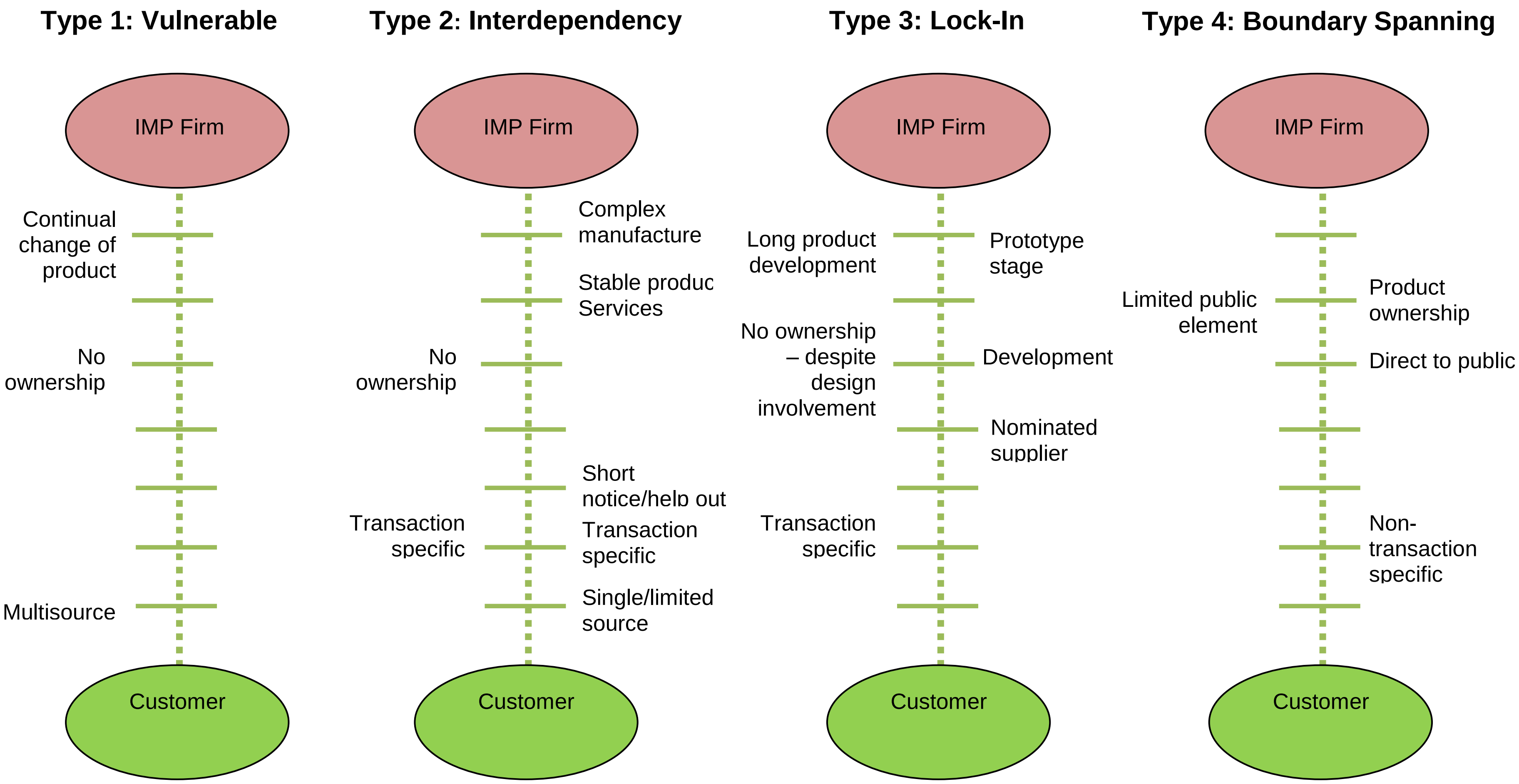
It should be noted that these production decisions are rooted in the overriding financing framework. Trade credit is a prominent funding system for the IMP industry. As IMP firms are generally givers of trade credit (Chapter Four, section 4.4.4), much of their financial capacity is continually tied up in raw materials, work in progress and finished stock. In this situation, their relative position of power is reduced against the customer because they are highly dependent on the sale of goods to unlock cash. During the 2008 recession, IMP firms were in a further state of limited power as credit levels and insurance were reduced and their trade with customers was unsecured. To generate any income, they needed to continue to trade and free already tied up money in the production line. The importance of trade credit to the IMP industry enhances the dependency of firms on their customers. Financing structures represent the disposition and facilitative aspects of Clegg's (1989) Frameworks of Power model. Clegg's model identified interlinked circuits of power and resistance, generated from three key aspects of power: agency, termed causal power; rules of practice, termed dispositional power; and resource dependencies, termed facilitative power (Taylor, 1996). The interaction of these circuits generates a dynamic system, where power is held in tension, based on the feedback loops of agency, working practices and innovations. Critically, for this study, the feedback of the socio-economic environment influenced the power inequalities in IMP-client relationships. The reliance on trade credit, a working practice, and the reduction in credit insurance, a destabilising force, created a distinct, or ‘episodic’ change in the nature of the power inequalities (Taylor, 1996). These additional ‘circuits of power’ work in conjunction with the sunk costs framework identified above. The circuits influence power structures between IMP firms and clients, generating distinct periods of relative powerfulness within the inter-firm relationships.

5.3 Relationship Structures in the Value Chain

The complexity of the power dynamic between buyer and supplier has generated variations in inter-firm relationship. The empirical results have shown four distinct types of customer-supplier relationship within the IMP industry. These relationships illustrate the negotiation of power and dependency between transaction partners at key areas of the production process. These are outlined in Figure 5.2 and Table 5.1 below. Each relationship type is detailed below to identify the characteristics and impacts of the relationships. The nature of interdependency found in the study will be discussed, followed by an examination of the role of IMP supplier firms in developing the relationships.

The types of relationship are based around the negotiation points identified in the previous section and the strategic action of IMP firms. They are differentiated based on the basic orientation of the IMP firm towards shaping the relationship they have with the customer. The types are not mutually exclusive and firms may have engaged in different relationships across their customer portfolio; however, the groups include those firms where a dominant strategic direction could be identified. The relationship dynamics are in continual flux and illustrate heterogeneity within the classification from the different resources and historical development of individual firms. They are based on the distribution of relative power between buyer and supplier during the production process and the resultant dependencies this creates.

Figure 5.2 Client-Supplier Relationship Types in the IMP Industry



Note: Spine points reflect the decision making stages as indicated in Figure 5.1
Source: Author (2012)

Table 5.1 Client-Supplier Relationship Characteristics

	Type 1: Vulnerable	Type 2: Interdependency	Type 3: Lock-In	Type 4: Boundary Spanning
Number of firms	4	4	10	2
Firm characteristics	Limited investment potential Subcontract position in supply chain	High investment levels High profile/image Large customers High volume production or support for high volume production elsewhere	Joint product development Early pre-production and prototyping.	High cash resources
Advantages for IMP firm	Low dependency on individual customers	Increased customer dependency from time lag in re-sourcing	Additional value added production tasks Learning/knowledge build up Strengthening of relationship with customer Increase dependency of customer	Less dependency on current customers Networking outside industry Knowledge build up
Disadvantages for IMP firm	Limited collateral in relationship Dependent on customer preferences for skills No ownership	Dependency on customer Additional risks and costs High investment requirements	Dependency on customer No ownership protection Additional services require investment from IMP firm in skills	High investment requirements Commercialisation capacity required

Source: Interview data (2009-10)

5.3.1 Relationship Types

Vulnerable

The first relationship typology identified is *Vulnerable*. In these instances the customer is a relatively more powerful relationship partner as there are limited sourcing ties to the specific supplier. In particular, there are three key areas of the relationship which can leave the supplier firm unprotected from loss of demand. Continual changes of customer product do not require additional sunk costs when moving and are not usually long enough for the supplier to generate cost efficiencies. As a result, the supplier is susceptible to loss of customers as they have no sunk costs or benefits to encourage them to remain with that particular supplier for future products. Lack of ownership of product design by the supplier ultimately leaves the firm unprotected from sourcing decisions by the customer. The supplier may have a high skill base but they are generic IMP skills and non-transaction specific, consequently there is little protection from customers resourcing. This group is less vulnerable to multiple sourcing of components because they generally engage in small order volumes.

This relationship type is characterised by small jobbing IMP firms (both foundries and forges), relatively low investment capacity and low levels of dependency on primary customers (illustrated by proportion of turnover primary customer represents), with a modal dependency between 10-23%. The limited investment capacity could be a result of seven of the ten firms being relatively old and have suffered extensively from loss of demand to overseas competitors in the past, which has led to a low capitalisation from profits supported through cash reserves. Two of the three relatively newer firms have suffered financial difficulties in recent years and changed ownership through administration.

These firms have a varied and large customer base, with ongoing 'relationships' of up to 150 different customers (*Foundry SME 16*) that typically purchase small batches every few years. Although the firms are not reliant on any particular customer (as each represents such a small proportion of turnover), they are have limited competitive advantages or potential to generate transaction-specific sunk costs and therefore customers remain highly mobile. As such, they are reliant on price premiums from customisation and repeat orders. A large majority of these orders are repeat batches (up to 85% (*Foundry SME 13*)) and as such, tooling outlays can generate sunk costs that discourage production being allocated to other firms. Here, the IMP firm is able to generate some power in the relationship, although the tooling is relatively cheap and therefore does not constitute such a significant sunk cost. To retain this commitment from customers it is common for these IMP firms to retain tooling independently. Although the tooling is technically owned by the customer as its cost is either directly or indirectly charged to the customer, the customer is rarely interested in keeping it, particularly because it is relatively cheap. IMP firms retain it, under their own cost, as a means of attracting the customer back for subsequent runs. This is a weak form of lock-in because of the low level of sunk cost: the IMP firm remains vulnerable to resourcing for subsequent runs and the finite nature of the product runs.

Instances of Interdependence

The firms engaged in *Interdependent* relationships are involved in mid-high volume manufacture, either directly or as a capacity filler and logistics supplier. The level of interdependency is dynamic, influenced by stability in the production chain (e.g. disruptions from natural hazards or strikes), customer sourcing practices (three firms in this category were sole suppliers of certain products) and level of asset specific investment made by both transaction partners. In this approach the relative powerfulness between buyer and supplier changes during the course of the trading relationship. However, both transaction partners rely on each other at specific points in time.

IMP firms within the West Midlands often act as capacity fillers and short run producers to supplement high volume component manufacture undertaken in lower cost locations. In these instances, the supplier can gain opportunities to build relationships with customer when they provide capacity at crisis points with short notice. This notion of 'helping them out' has featured heavily in the study as a way of stabilising the customers sourcing concerns and building trust and respect in the supplier-customer relationship. As a result of this, the supplier often finds their relative powerfulness increases when they help customers at difficult times and can generate additional, more permanent work from these instances. Here, the notion of benevolence features strongly. Sako (1992) suggests that benevolence is a key element within buyer-supplier relationships as those individuals engaged in the relationship feel a strong duty to repay the debt now or in the future. Although the study finds many instances of repaid debts, they are all dependent on the customer being in a continued position of dependency and the IMP firm able to enforce this debt repayment through their relative powerfulness. An example of this is an event which occurred at a relatively large SME (*Forge SME 10*) that provided critical components for an OEM. The forge had previously provided capacity filling for their

OEM customer that prevented stoppages on the OEM production line (saving the customer considerable expense). Sometime later the forge was asked to produce additional components, something the OEM packaged as a ‘benefit’ to the forge in response to repaying their ‘debt’. The forge was aware, however, of the precarious position the OEM was actually in and, in accepting the additional component work, demanded additional benefits, such as faster payment. In this situation, although the OEM was seen to be benevolent, in reality the OEM was experiencing difficulty and trying to capitalise on the existing relationship between the firms.

It is common for these IMP firms to be a sole supplier of a strategic component, generating an area of relative supplier powerfulness. IMP suppliers often manufacture a range of components for a particular customer within their specialisation. These are usually critical parts to the final product and importantly, in one or two cases they are the only producer. This is often not a result of ownership of property rights or specific capabilities but rather of the closure of other suppliers or the consolidation of the customers supply base. This generates customer dependency on the IMP supplier because the part is critical and any delays in its production would significantly impact on the supply chain. However, the sourcing practices are determined by the customer, so while this may create a dependency and powerfulness of the supplier in these instances, this is not necessarily a continued area of power. The supplier has little influence in maintaining this dependency, provided they do not disrupt the relationship.

The significant cost of tooling for mid-high volume production of generally more complex (in terms of materials and design), although standardised, components reinforces the above dependency and generates a level of sunk costs for the entire product portfolio of the customer with the IMP supplier. As IMP firms hold patterns and tooling equipment on site, they can use this to their advantage in times of a relationship breakdown, despite the tooling in theory being owned by the customer. In several cases of unpaid trade credit, suppliers have retained the tooling equipment until a payment or agreement has been reached on the outstanding amount. Customers often want to transfer manufacture quickly somewhere else and reduce costs; as the IMP firm retains the tools, they are unable to do this without sinking in further investment somewhere else until the IMP firm releases the tooling. This provides the supplier with a more powerful position to reclaim owed money and potentially retain sourcing, if the customer is financially viable to continue. In instances of a breakdown of the relationship for other reasons, the sunk costs in the tooling for firm specific machines can allow the suppliers to have a more powerful position and increase the resourcing time, while disputes are settled or the customer initiates secondary tooling. This adjustment time can prove vital to the supplier form sourcing new orders. High levels of investment are made by IMP firms to generate production efficiencies and automation to reduce the cost base and maintain, or improve, cost competitiveness. Customers in these relationships are characteristically OEMs which drive annual price improvements and threaten to relocate production (Bair, 2008; Rutherford and Holmes, 2007). As such, IMP firms need continual investment in process efficiency to reduce their cost base (Hansen, 2010; Heidenreich, 2009). The problem here is not that the investments are necessarily specific to that customer but that they are product and market specific. These firms have survived by becoming specialist producers of certain products with reputations as consistent quality suppliers (often with world leading quality measures). As such, their market is very much reduced and with increased consolidation, particularly in automotive, there are a limited number of customers. As a result, despite their generic capabilities in these fields, IMP firms find themselves increasingly reliant on certain groups of customers rather than reducing their dependence as suggested in the modular value chain model (Sturgeon and Lee, 2001; Sturgeon, 2002).

This classification is characterised by a low number of foundry IMP firms. This is to be expected as the forging processes lends itself more to production of standardised products on a larger scale, where equipment investments and higher levels of automation are not only more cost effective but rewarded by the market. However, it is interesting to note which foundries have engaged in this type of relationship. Two of the three firms generate interdependency from cost efficiencies in production process due to the relatively large volumes (mid-high). Both of these firms manufacture for the automotive industry and have extremely large (OEM) direct customers. Although *Foundry Large 1* has a range of customers and markets, *Foundry SME 4* is highly dependent on a small set of automotive customers, which were actively reduced from five to three during the recession. The third firm has a slightly different relationship in that it has a range of customers but two principal customers that are also large multinationals. The demands from one customer in particular has generated increased dependence on both transaction partners. The size of customers cannot solely account for the formation of this relationship type. However, the requirements to engage with these customers (i.e. cost efficiencies and capacity) have encouraged the development of dependency from the IMP firm. The IMP firm's capacity, or willingness, to invest in this manner (i.e. transaction-specific) has put into practice this dependency. Therefore, the scale of the customer (and its consequent purchasing power), together with the IMP firms strategic direction and financial capacity has generated this form of relationship.

Lock-In

The *Lock-In* relationship specifically attempts to generate a form of dependency from the customer to the IMP firm by developing strong relationships through product development or status as a nominated supplier. IMP firms have extended their formal product range and services to include prototype and pre-production manufacture, thereby reducing their vulnerability to the loss of higher volume and more standardised manufacture to lower-cost producers. The prototype and pre-production stages involve increased collaboration between buyer and supplier in order to generate a product with performance qualities that can be manufactured in the most economical way. Product development requires substantial investment in generating specific customer and product knowledge. This investment acts as a sunk cost, providing the basis for continued commitment between transaction partners as the products are for set quantities/length of time (as once demand reaches a critical mass production will be transferred to a supplier who can mass produce at a lower cost). As such, the development collaboration is in effect a project, but forms part of a series of projects with the same customer. Customers are likely to continue to use the IMP firm for additional projects because there are sunk costs in customer knowledge and working practices (Grabher, 2002; Grabher and Ibert, 2006). For both the continued relationship and the sensitive nature of the work involved (i.e. confidential prototype development), trust in the IMP supplier is critical. Investment in equipment is less significant as tooling is generally far less expensive than that for mass production (due to the material used). The knowledge base and personal relationships established encourages future product development by the customer to be done at that particular IMP firm (Eccles, 1981).

Collaborative working between buyer and supplier has always been part of the manufacturing process in these firms, with IMP firms providing guidance on production techniques and product alterations to generate the most economical manufacture. However, the IMP firms which are developing a lock-in relationship are formalising this service, thereby generating a new, and sometimes independent, revenue stream:

> *That's actually, you may think that's wasted, you're not making a component that goes out the door and is sold, but what you're doing is building up a bank of knowledge to be able to sell that component and have an ongoing funding stream for future sales from it. Y'know, each new project is developing a funding stream for the future and then you do another one and another one and all these funds, hopefully they will last for several years and make money in the future (Interviewee 1, Foundry SME 3).*

Those firms, which do undertake this form of development work but are not engaged in lock-in relationships, do not charge for the service they provide and instead view their capability as a means to generate competitive advantage rather than an additional revenue stream (*Foundry SME 1 – Fabricator, Foundry SME 14*). By undertaking formal development work and marketing it as a service to customers, IMP firms are attempting to 'lock' customers in to undertaking the next production stage (pre-production) with them as they already have sunk costs with them. The investments in knowledge and equipment (tooling is tailored to the firms specific machines) allows a smooth, and quick, transition to the next manufacturing stage. In addition, by continuing the relationship the customer is more likely to site its next prototype project with the IMP firm because of a common understanding and an established trust between transaction partners. As a result, a subsequent stream of further work is generated.

Another form of lock-in is by increasing status with the customer through nominations as key suppliers, but critically for new products as the New Product Route (NPR). Trust again becomes significant through the application of customer approvals on IMP firm supplier status. By developing status the supplier firm increases the level of trust between the transactional partners. As a nominated supplier the customer is reflecting a level of trust engaged with the supplier and deepening the relationship by investing in audits, continuous improvement programs and providing additional benefits to the supplier. In return, the supplier also invests in the relationship by capacity and service commitments, adherence to specifications and audits. Although it does not protect the firm from sourcing changes, it does build increased commitment in the relationship and, therefore, more ties between the firms. Again, this forms a lock-in to the pre-production manufacturing stage.

There are disadvantages for the IMP firm in this type of relationship. A particular characteristic is the lack of product ownership, with no formal patents or development rights for the IMP firm. In this situation the formal ownership could disrupt the trust building between customer-supplier as the IMP firm is viewed as being less dependent on their customers (Sako, 1992; Vlaar *et al.*, 2007). In addition, the capacity to generate IPR can be low as many of the product or process developments are generic and the skills for identifying and undertaking such formalisation processes may not be available in the firm. To provide the development facilities also requires significant investment in skills by the IMP firm, often new employees and training. Ultimately the IMP firm can become more dependent on their existing customer base as a greater proportion of revenue is generated from them. In some cases it has broadened to a new customer segment, as discussed above, but this is less common.

The group is comprised solely of foundries, which could relate to the tendency for foundries to produce higher complexity products and therefore a propensity towards product development and design. These firms are also mainly small (only one large firm) and promote a strong ‘professional’ image to their customers. Image was particularly important with this group as a means of attracting high-value work from corporate customers. Although the movement into prototype design has been targeted at existing customers (i.e. with a prior relationship), the transition towards more sensitive knowledge and higher-value production required the IMP firms to promote themselves differently (Raj-Reichert, 2011; Tokatli and Kizilgün, 2004). The low number of large firms utilising this strategy is not surprising as they have the production capacity to generate value from economies of scale. The large firm in this group, however, was also keen on developing its own reputation for particular shapes of casting and has become a market leader in this particular area of more complex castings. Although other large firms are also market leaders, particularly *Foundry Large 1*, this is based on price, capacity and skill combined. In the case of *Foundry Large 2*, they are more focussed on ‘locking-in’ their customers based on their ability to manufacture particular shapes through market dominance. In this situation the IMP firm has attempted to promote its design and production capacity to the market, although it does not hold any formal design ownerships.

Boundary Spanning

The *Boundary Spanning* relationship type is quite different to the other types. The firms are involved in the design of products but importantly, they are developing formal property rights to reinforce this design involvement. Firms are doing this through either investment in R&D consortiums, generating joint and independent IPR, and through joint ventures with customers. The large firms have done this through investment consortiums for generic and firm-specific product development (*Forge Large 3, Foundry SME 10 - PLC group subsidiary*). The purpose of this is to share the cost and risk of large scale production and material developments with other supply chain partners (one firm was engaged in a MNE investment centre, the other in a European consortium for advancements in material properties). This strategy allows them to be at the forefront of material and production technology, thereby, building a reputation and links with other supply chain partners involved in these collaborations for future work. In addition, by participating in this investment the firm acts as a prototype production facility. This learning process builds sunk costs in equipment and knowledge should the prototype be successful, which encourages the consortium, or any potential users of the product, to site production at the experienced producer. Participation in these groups requires significant investment (£1m was the minimum investment for a place in both schemes). As such, innovation of this nature is limited to firms with significant capital.

The second aspect is to generate a series of new products, either through joint ventures or in-house development, that generate product ownership (IPR) (*Foundry SME 1 – Fabricator, Forge SME 1 – Fabricator, Forge SME 8 – Fabricator, Foundry SME 26*). This requires less investment than above, but does still require significant capital and risk to the firm. In two of the cases, the IPR was a chance opportunity to expand an existing product or a chance encounter with a product developer. This highlights the significance of an entrepreneurial, or strategic, attitude in developing opportunities when they arise.

Although IPR protects the firm from loss of production and increased control over value distribution (Hudson, 2004; 2005), the use of the product is still dependent on the customer. Joint ownership of either the product or split ownership of component parts within it mean that both parties are dependent on the other to actually sell the product. The formal ownership rights should protect the IMP firms from loss because the associated costs of ignoring the legal rights discourage such action. However, in some cases this has not prevented larger customer firms opportunistically ending relations with the IMP supplier, as one interviewee explains, they had

> *…. been manufacturing these castings … for about ten years. It was a really good part of the business and then again they [large MNE customer] found somebody who could do it slightly cheaper. We designed the product and the bloke just said 'well we're a lot bigger than you are'. He said 'we owe your site 50 grand, I won't pay that and we'll be fighting for years so you might as well have your money, there you go' (Interviewee 1, Foundry SME 1 – Fabricator).*

The IMP firms are limited in selling the product without the customer because of the inhibiting costs, legal restrictions from IPR and also their access to the market. The IMP industry is characterised by a lack of direct market access and as such, IMP firms have little experience in selling directly to the end user or the marketing and distribution skills necessary. Through joint product development and IPR the IMP firm is provided with routes to market and both parties technically are dependent on each other to take the product to market.

In instances where investment does not generate joint IPR (and therefore is not transaction-specific) the IMP firm is able to expand its customer base and become a relatively more powerful transaction partner because they own the product. However, due to the limited routes to market, the IMP firms is restricted in its ability to enforce this relative powerfulness as it requires the market access through its traditional further manufacturing customers:

> *Yes we've done, on the lock project we're doing for this security gating, he came to us with a concept he'd got that he was buying from a French company that wasn't 100% satisfactory. So we took it and said look, if you don't mind we'll play with it for a couple of months, see if we can make it a lot simpler, more economical, and if it looks ok we'll quote some prices and take it forward. And that's what we've done. We've spent about nine months total now developing this lock. And it's the only lock in the UK now for security grills and that sort of thing to withstand a category two criminal test now. That's the only one in the UK. Which is why our customer, which we've gone into a joint venture on this now, is very keen to start this project going (Interviewee 1, Forge SME 8 – Fabricator).*

Firms in this group are characterised by high levels of investment in product development and a stable financial position. This is reflective of the high costs of independent product development, which cannot be borne by the majority of firms within the sample. It also illustrates a relatively high risk strategy for the firms. *Foundry SME 2 -PLC group subsidiary* is undertaking this in collaboration with other companies in the value chain in order to look for product/parts of products which it can generate IPR on for its existing customer base. Thereby, the relative risk of failing to achieve returns on their investment is reduced. *Forge SME 8 – Fabricator* on the other hand is generating product developments without a specific market strategy or customer demand. This is illustrated in the development of a plastering tool which they have been unable to sell through a distributor (as the distributor demanded ownership) and, therefore, has left the company forced to sell directly to the public, a more high risk and, as of yet, less profitable option.

The *Boundary Spanning* group has a relatively low number of the foundry businesses (two foundries, four forges) to what would be expected from the ratio of foundry:forge in the sample. This pattern is also seen in the diversification into fabrication processes in the sample overall, with significantly more forges than foundries making the transition towards fabrication. In fact, three of the four SMEs in this relationship type have also made the diversification into fabrication processes. This could be a result of the production process and product type made in foundries (generally more complex products) where value-added is more easily achieved through customisation and low order volumes, therefore less need to search for value added through diversification. In both the fabrication and boundary spanning group, access to market is the primary motivation. Through both routes the IMP firm deals directly with the end user, either for a new product or for a complete product, or with customers further up the supply chain, such as in the investment consortiums.

5.3.2 Complexity in Relationships

Relationships between buyers and suppliers are complex, varied and dynamic. They include multiple decision points that create variety in the inter-firm relationship, both between customers and over time. The previous analysis of sunk costs and forms of relative power identified *layers* of production decisions that shape relationships. These elements come together in a multitude of ways, creating time- and space-specific relationship structures. A focus on non-lead firms has highlighted varied forms of power and influences on relationship structures. Non-lead firms undertake a variety of tasks in various value chains across their customer portfolio. This creates different forms of relationships, influenced by the configuration of tasks in the particular exchange, generating complexity in particular relationship structures and across the customer portfolio. Prior work on inter-firm relationships has highlighted this variability in relationships (Cox, 1996; Gereffi *et al.*, 2005; Herrigel, 2010), although with only limited awareness of the affect of a *combination* of relationships *within* a firm.

The relationship types identify two aspects of relationship development which are underdeveloped in current conceptions of vertical inter-firm linkages; interdependency as a dynamic process and the active role of suppliers' strategic action. These elements offer a more nuanced approach to understanding the varied forms of buyer-supplier relationships and will be discussed in turn below.

Interdependency comparison

Three of the above relationship types illustrate instances of interdependency between buyer and supplier: *Interdependent*, *Lock-In* and *Boundary Spanning*. A careful distinction is made here to identify *instances*, rather than continual levels, of interdependency between buyer and IMP supplier. The relationship is dynamic and adjusted in response to specific environmental or firm contexts that generate temporary interdependency in certain customer groups and over specific periods of time.

The distinction between the three forms is important because they differ in approach to interdependency, forms of security and customer segment. The *Interdependent* approach uses investment in equipment, knowledge and, often, sole manufacturing capability of strategic parts to retain production. This approach is used with all major customers as these IMP firms have a small set of customers which together represent around 85-90% of turnover. The dependency is formalised through continued production agreements, not necessarily formal contracts. The use of agreements in this approach is important because profit is generated towards the end of the product life-cycle; therefore, the supplier needs to retain the whole production life in order to generate profit. The customer is also keen to maintain the relationship to prevent additional tooling and set-up costs with other suppliers during the life of the product. Here the interdependency is generated through the *contract* life as both parties can generate cost efficiencies through maintaining the supply relationship. The *Lock-In* approach specifically attempts to create dependency through investment in knowledge but without any formal security to lock-in customers to continue production. Instead IMP firms 'package' the development work as a service that will hopefully encourage customers to keep the next stage of production with them. Critically, this approach attempts to generate interdependency with a specific group of existing *customers*. Here both the customer and the supplier are invested in the relationship for ongoing work through multiple development projects. Although the agreement covers only one product, the sunk costs encourage ongoing collaboration between the transaction partners on multiple projects (Grabher, 2002; Grabher and Ibert, 2006). In the *Boundary Spanning* approach the ownership of design rights act as a formalised and permanent securitisation of the supplier's involvement in design and production. The customer is tied to the supplier because of these rights and as such the interdependency is created for a specific *product*. Here the switching costs are related to a particular product and increases in the supplier’s skill set through investment to generate generic, not transactional-specific, knowledge bases.

Interdependency has been identified here to be more complex than shown in current typologies in the literature. In all forms of interdependency, switching costs are key elements of dependency on respective transaction partners: learnt knowledge and capabilities in the *Lock-In* approach, equipment and efficiencies in the *Interdependent* approach, and formal IPR restrictions in the *Boundary Spanning* group. This reflects Gereffi *et al.*’s (2005) notion of interdependency, under the relational governance type, from the lead firms relative cost to move suppliers (based on the level of standardisation, investment and abilities in the supply base). However, the study illustrates how the nature of the buyer-supplier relationship, and specifically the areas the supplier is able to generate instances of relative power, affects how switching costs generate interdependency. *Interdependency is generated for particular customers, contracts or products.* The IMP firms in the *Lock-In*, *Interdependent* and *Boundary Spanning* approaches have also illustrated instances of strategic action to capitalise on the position of the lead, or customer, firm that are outside these cost efficiency based forms. Learnt practices and ways of working from repeated transactions, defined as relational proximity by Murphy (2011), have influenced both the *Lock-In* and *Interdependent* forms of interdependency. In the *Lock-In* approach trust between customer and supplier has been a significant determinant of the supplier’s ability to engage the customer. In the *Interdependent* approach the sense of benevolence (Sako, 1992), or repaying a favour, has been used repeated by suppliers to generate a form of dependency. In both these cases, the closeness, or specific forms of relational sunk costs, has been used by the customer to their own advantage, where they can also benefit from the situation. In this sense, both transaction partners have been active in shaping the relationship dynamic and the negotiation of power at specific instances for specific groups or customer.

Importantly, the costs of switching alone have not sustained a level of interdependence from the customer on the IMP firm. The interdependency has adjusted as the supplier capitalises on situations to increase their independence and the customer to limit it. The relational governance type identified by Gereffi *et al.* (2005) is seen to generate mutual dependency between transaction partners through high supplier skill base and complex products with little ability to codify the transactions. This level of mutual dependency was not observed in the study. Although instances of increased dependency from one partner were found, these were for specific periods, and in all instances one partner remained more powerful than the other. In this sense the IMP firm moves between positions of 'dependent with influence' and 'independent with influence' (Ruigrok and van Tulder, 1995), depending on the environmental and firm specific circumstances of the relationship. A position of interdependence is not found to be achieved as the relationship is in continual flux and varies between customers. Critically, the IMP firms are capitalising on instances of implicit power, rather than the explicit forms of power discussed in Gereffi *et al.*'s (2005) typology of governance types.

Active supplier involvement

The different types of interdependency have formed as a result of supplier strategic action in shaping relationships and utilising situations, such as emergency production requests, to generate temporary positions of dependency and ongoing collaboration.

The division of relationship types is influenced by the type of product and production process characteristics, as illustrated by the general distribution of IMP sub-industries between the groups. Foundries lend themselves to developing lock-in relationships due to the generally higher level of complexity in their products. On the other hand, forges tend to benefit from more standard products, where efficiencies can be generated. These factors influence how IMP firms fit in the buyer-supplier relationship and the areas of relative power they can generate. The vulnerable group has a fairly representative split of foundry and forges, illustrating a lack of strategic intent from IMP firms to develop areas of power. However, there are instances where these classifications don't fit, particularly in the boundary spanning group. Here the strategic direction and financial capability of individual firms is important and illustrates the important role IMP firms, or suppliers more generally, play in determining the nature of a buyer-supplier relationship.

The negotiation of power has differed in each relationship type. In the *Interdependent* approach the customer is the driving force behind the relationship type by encouraging investments by the supplier to drive cost reductions and can determine sourcing decisions. Although there is a level of interdependency from this, it is not directed by the supplier. The IMP firm only becomes active in shaping in the power dynamics in the relationship in instances of 'helping out', whereby the supplier generates an increased dependency for a limited period of time and after being asked by the customer. However, these firms do generate instances of interdependency from switching costs (specifically they are often sole suppliers of a strategic part) but also from generating a tit-for-tat relationship by 'helping out' their customers in periods of crisis. In all these situations the supplier is active in capitalising on these situations and generating a form of dependency from the customer and a resultant *period* of relative powerfulness. The usefulness of the debt, however, is determined by the customers own sense of benevolence and the suppliers strategic use. As such, suppliers activeness in asserting relative powerfulness is guarded by the customers own strategic purpose.

In contrast, the *Lock-In* and *Boundary Spanning* approaches illustrate the active role of the supplier in shaping the relationship which is not driven by customer governance. In the *Lock-In* approach, the instigation of a product development service was by the IMP firm looking to generate additional revenue streams and was met with resistance from the customer base in some instances:

> *With customers I think there's always, probably a nervousness…that it somewhat limits them later for going into the market place to achieve the best price. Where we've got excellent relationships with customers…they have started to use the facility now. Because they know that we're not doing it to lock them in we're doing it as an added service to customers. There is always scepticism as to why are they doing this, are we locked in at an early stage then they've got us. And y'know, you have to work on getting a history with people so that they understand and believe when you say yes we can do this and also believe that when you get to the final part you're still going to be competitive and you what you haven't done is lock them into you and taken advantage on price (Interviewee 1, Foundry SME 19).*

In this case the customers were reluctant to increase their dependence on the IMP firm and resulted in the IMP firm having to build relationships and persuade the customer to utilise the service.

In the *Boundary Spanning* approach, the investment in product development was most often undertaken in combination with existing customers or to encourage new customers. The product is either jointly owned or only valuable to a specific customer for their product. As such, the IMP firm is still dependent on the customer. In these cases it is the supplier who is active in securing property rights, as the following three examples illustrate:

> *We were naïve for a long time and not set up proper contracts to sign up people. So we've now …said as soon as we get into negotiating with people, if we don't have the intellectual property right into it, we're going to design it, they've got to sign some form of agreement (Interviewee 1, Foundry SME 1 – Fabricator)*
>
> *…every couple of years we develop a new product if we can…We've got a couple of patents that are still live and umm, that's what we try to get ownership of a product at some point (Interviewee 1, Forge SME 8 – Fabricator)*
>
> *[A strategic partnership in an industry research centre has generated]…IP that's developed from the core projects [which] is shared between all the members or you can do your own individually funded project and basically any IP that's developed belongs to you because you funded it. …We'll be participating with our peers on generic projects and then we'll have some other projects that we'll fund specifically which hopefully exploit the market place (Interviewee 1, Forge Large 3).*

The ability of suppliers to do this has been influenced by their ability to invest and the determination of the IMP firms to adjust working practices to capture some level of ownership. Customer firms have also been actively involved in this relationship formation, often through joint ventures or encouragement to be involved in R&D consortia with them. In this sense both customer and supplier have been active in developing the relationship.

The IMP firms have been able to instigate relationship dynamics more in the *Lock-In* and *Boundary Spanning* group, where they are involved in product design. Herrigel (2010) suggests the division of production tasks, specifically the division of design and production, as being critical in influencing the level of dependency between partners as collaboration is always required. The division of design and production tasks alone does not determine levels of dependency in IMP firms. This is specifically illustrated through the *Lock-In* and *Boundary Spanning* firms both involving shared design capacity with the IMP firm. The distinction between them is not their design involvement per se, but their strategic intent to formalise it: the co-ownership of design rights in the *Boundary Spanning* group generates relatively low levels of dependency from either transaction partner, whereas the sole ownership rights of the customer in the *Lock-In* approach generates increased dependency from the supplier. Both these approaches are, however, differentiated by how the supplier chooses to capitalise on this profitable, and powerful, area of the production process. The *Boundary Spanning* firms are attempting to generate property rights, whereas the *Lock-In* firms are attempting to generate informal ties for further production.

The active involvement of the supplier in capitalising on opportunities to increase their power and generate instances of interdependency has formed a critical element of these relationship forms. In Sturgeon & Lee's (2001) modular value chain approach, the suppliers are increasingly becoming independent from specific customers through the generation of generic skill bases and departure from asset specificity. This has not been identified in the IMP firms. In fact, these firms are actively increasing their dependency on customers through investment in *specific* customers, products and contracts. This increased collaboration, particularly in design, found in this study has also been observed by Herrigel (2010). The sustained competitive collaboration (SCC) approach illustrates how the collaboration is central to buyer-supplier relationships, particularly in high-production cost locations, such as the West Midlands. However, Herrigel suggests that the relationship will inevitably depart from this interdependency, as transaction partners learn additional skills and search for new work. In contrast, this study has found an increasing level of interdependence in the three approaches, culminating in shared property rights in *Boundary Spanning* firms. In this sense, the IMP firms are actively formalising their collaboration and increased dependency rather than moving away from it. Despite this general transition, there remains a considerable level of heterogeneity in relationship types and the IMP sector does not seem to be evolving into any particular relational type. Overall the customer remains powerful in the relationship but the suppliers do actively negotiate relative powerfulness from periods of increased customer dependency. This is achieved through the division of tasks in the relationship and product type but also the strategic intent and investment capacity of the individual supplier firm. Each relationship, however, is different and characterised by past interactions and industry norms, their own customer and product base compositions and their customers sourcing activities.

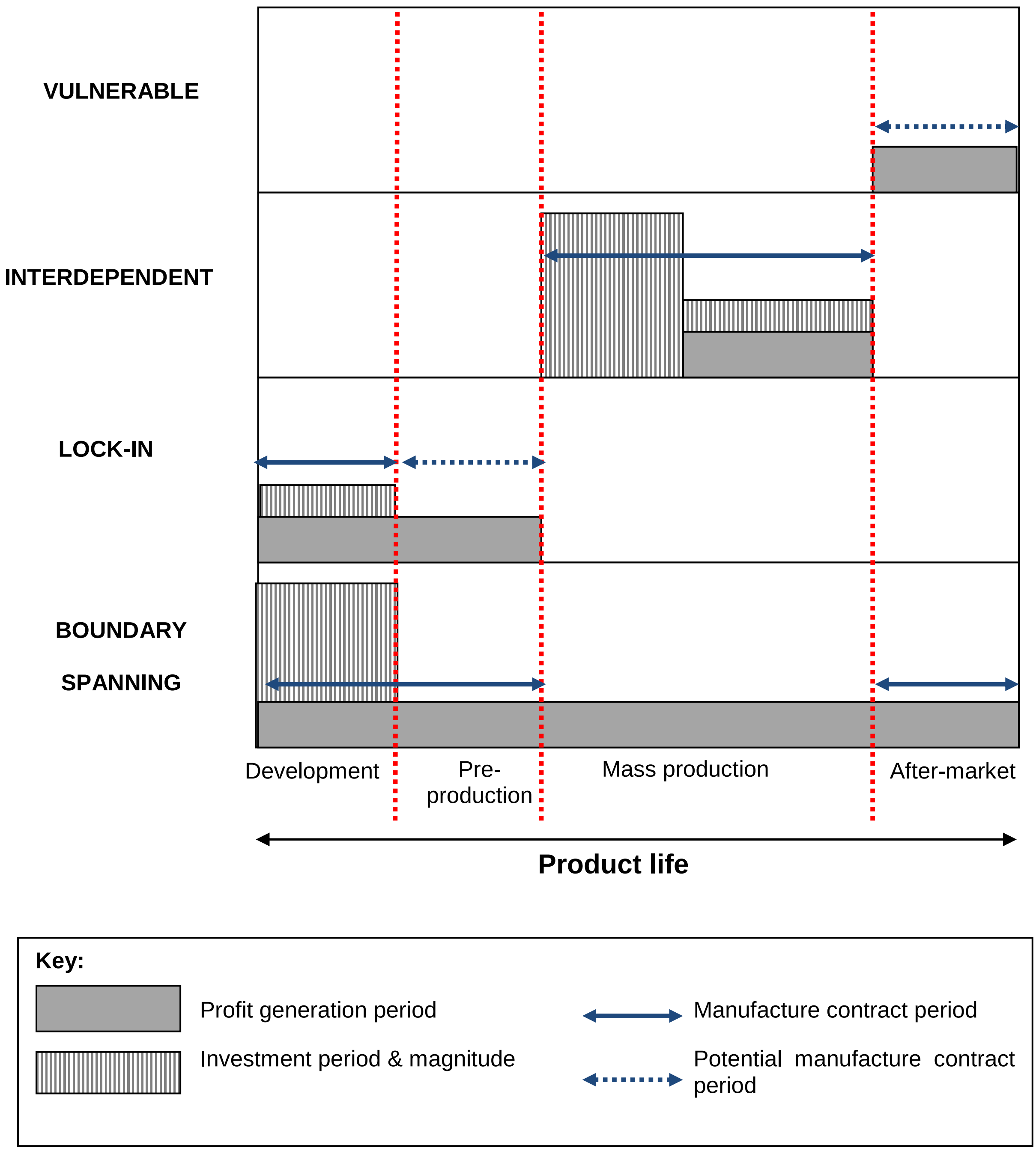
5.4 Generation of Value

The focus on high value-added manufacturing as a defence against low cost competition has received considerable attention (Bryson *et al.*, 2008; GHK *et al.*, 2009). Competitiveness has been shown to be generated from multiple aspects of the manufacturing process, not just production (Chapter Four, section 4.3.1) (Bryson and Rusten, 2011; Bryson and Taylor, 2010; Livesey, 2006). There are key stages in which value is created within the supply chain (Livesey, 2006) and this shapes the nature of the inter-firm relationship. The nature of profit and the ability to capture value will be examined below. This analysis identifies the main areas of profit generation from premiums that can be achieved in each relationship type but it should be noted that profit is not exclusive to these mechanisms.

5.4.1 Profit Timescales

The areas of profit generation differ between the relationship types based on diversification in the supply chain, customer governance and contract timescales, as illustrated in Figure 5.3. In *Vulnerable* relationships the IMP firm generates its profits from price premiums on low production volumes and outsourcing of finishing activities. Spare parts are commonly produced through jobbing manufacturers because of the low and infrequent nature of demand. These have a relatively high price premium, because they are required quickly, in low volumes (sometimes single orders) and, critically, the customer does not possess the tooling. The tooling is often retained by the original manufacturer (who undertook production prior to its transfer to a more cost efficient mass manufacturer) and stored, at the IMP firm’s own cost, for future spares work. In addition, it is common for the customer to ‘forget’ their responsibility to retain tooling for spare parts after the components life cycle (*Foundry SME 13*). As jobbers, these firms often provide additional finishing services to provide a complete product to the customer. Due to the small volumes and high capital expenditure required to invest in such facilities, the IMP firm outsources these activities. They then charge a price premium to cover the logistical expense and low number, again generating a significant profit stream for some firms. Overall the profit levels are variable, associated with fluctuating demand, and very low. The recession was a particularly difficult period as demand volumes dropped and there was less uptake of additional finishing options on the products, as customers attempted to reduce production costs. As such, profit levels were disproportionately affected in these firms.

Figure 5.3 Value in Contract Structures



Source: Author (2012)

The profitability of the *Interdependent* group varies over time. Due to the nature of the product, IMP firms usually manufacture the component for the entire product life (up to 7 years) because of expensive tooling equipment. During this period the level of profitability varies. Initially the IMP firm will make a loss due to production difficulties, which are funded by the supplier under fixed sales prices form the customer. The drive by the customer for continual cost reductions encourages investment by the IMP firm in process efficiency. Once these difficulties have been managed the IMP firm can start to generate profit from the contract (which could have been unprofitable prior to this). This profitability supplements the losses made early on in the production contract, making the IMP firm highly dependent on maintaining the relationship throughout the contract period to generate profit. Over this period the tooling and equipment become increasingly tailored to the production site as the IMP firm make modifications. As a result, future work can be generated at a relatively lower price than if a new supplier was initiated*.* *Forge Large 1*, a high-volume automotive pressworks, was able to utilise sunk costs under an existing contract when their customer was introducing a new, replacement, model because "…if they're using the same platform [base part on which components fit into] and same parts then, they've almost got to continue using us haven't they…. Because so many of those parts are specifically designed around our presses that we've got here" (*Interviewee 2, Forge Large 1*).

The *Lock-In* approach has attempted to extract *additional* revenue, and particularly higher profit margins, from their *existing* customers. This type of work carries a higher market value than more cost-conscious standard production. The development work generates the highest areas of profit, albeit for a short period of time as projects are finite and, once production reaches a critical level, it will be transferred to a high volume supplier who can provide cost efficiencies to the customer. Due to the limited temporal period to capture profit, these IMP firms attempt to extract all the production work prior to this move. An example of this is *Foundry SME 19* who have recently introduced a ‘rapid prototype’ facility as its production site. This has enabled the firm to develop an additional and separate revenue stream at a particular stage of production, as the interviewee explains:

> *…we’ve picked up an amount of work with rapid prototyping where we will never be the long term supplier because the part possibly isn’t suitable for our, our manufacturing, it may be in a material we don’t produce but by advertising we’ve got this facility then you open the doors for anybody who might want to use it (Interviewee 1, Foundry SME 19).*

Although the approach was targeted at existing customers, the facility has attracted a new set of independent customers, some of which have subsequently continued production at the IMP firm despite having no prior experience of working with them. Consequently, it has generated an additional revenue stream of the most profitable areas of production they can engage in.

The *Boundary Spanning* firms generate profitability from property rights for design involvement. Where this is through a joint venture, the IMP firm is better able to stabilise their profit levels and generate profit for the entire product life as production must be undertaken by the IMP firm. In instances where the IMP firms have their own products, despite entitled to all of the profits, routes to market are difficult and therefore this generates a relatively small revenue stream (around 5% of turnover).

Following Herrigel’s (2010) identification of supplier strategies in collaborative partnerships (his SCC approach) in high cost locations, the IMP sector has illustrated transitions towards specialisation and diversification, both within and across supply chains. All relationship approaches have diversified within the supply chain. The *Lock-In* and *Boundary Spanning* groups have made a transition towards design involvement to add value, a common strategy in high cost manufacture (Bryson and Rusten, 2011; Bryson and Taylor, 2010; Bryson *et al.*, 2008). In the case of *Lock-In*, additional profit is generated from moving into an additional production stage – prototype and development. These firms perceive their vulnerability to losing the customer to lower cost manufacturers during the mass production stage. As such, the option to add value through finishing is lost when the firm is only utilised for pre-production activities. The *Boundary Spanning* group increase their value added by investing in design ownership and generating a continuous and secure profit stream from the component. Both these approaches have similar profit margins (averages of 1.5-1.6% - note based on limited data) and dependency levels (32-33% dependence on primary customer). In these groups, the IMP strategies have been to engage in the more profitable areas of production by diversifying down the supply chain.

The movement into design as opposed to finishing to add value is also influenced by investment capacity. To engage in finishing activities requires considerably more capital for equipment and space than design based added value, which is generally already undertaken in many IMP firms, although not formalised. Investments tend to be limited to personnel and small scale equipment. As such, those firms which have engaged in machining activities are predominately in the interdependent group, where their competitive advantage relies on cost efficiencies from a high level of automation. In addition, large firms in other groups have developed machining facilities. These firms have made substantial investments in equipment. Smaller and vulnerable firms are not undertaking machining directly and out-sourcing these activities to continue to provide the service and generate a price premium. To recoup large investments in machinery IMP firms need relatively high volumes of product, which is why the transition up the supply chain is restricted to large and interdependent firms.

The only group to exhibit diversification across supply chains is the *Boundary Spanning* group, and, particularly, those firms that have moved into fabrication. In these situations, the firms have actively looked for avenues to increase their profitability and direct market access. The diversification across supply chains/products is fundamentally used to gain more direct access to markets. Without market access IMP firms are reliant on further manufacturers to promote and sell their developed product, which has proved inconsistent in the past. These firms are undertaking diversification through both joint ventures and own product development. Although it has generated additional profit, it requires substantial investment in product development. Three other firms have entered new market areas that capitalise on existing skill bases, but also provide direct access to end users. The development of these areas is sporadic and niche, such as customised bells and balconies, and represents only a very small revenue stream. In these cases, the diversification has not proved successful in generating anything other than a small revenue stream and is often quoted as an ‘interest’ rather than a strategic direction (*Foundry SME 5*).

Specialisation has been developed in the *Interdependent* IMP firms who have significantly invested in generating product/market specific skills. This approach has led to a very confined customer base of particularly OEMs, most of which are based in the automotive sector. The continual cost pressures have driven down margins and the small market limits the IMP firms' capacity to generate additional custom or profit. These firms have capitalised on the cost efficiencies generated from collaborative relationships, without necessarily diversifying in or across supply chains, to generate profitability. Two of these firms have diversified within the supply chain to increase their profitability, and, in fact, are by far the two most profitable firms in the study (16.2 and 17% profit margins). *Foundry Large 1* has invested in large scale machining operations to provide finished components to their customers. *Foundry SME 21* has, on the other hand, moved into providing development work for its biggest customer who has recently begun the transition towards resourcing manufacturing in China. In both these instances, their diversification has supported the specialisms they have developed in the market by bringing more profit to the business.

The variability in profitability within the temporal extent of the contract is a key aspect of firm adjustment to higher value added manufacture. It has been illustrated that the different aspects of 'higher value added' production carries with it discrete zones of profitability. This concept builds upon the industry life cycle approach to profitability in production cycles. Markusen's (1985) work on the profitability of industries characterises profit cycles primarily on investment, output and employment at distinct points in the industry's life cycle. Here, however, the profitability of the *product* lifecycle is influenced by the distribution of profit also between buyer and supplier. The ability of IMP firms to capture this value will be considered next.

5.4.2 Capturing Value

The capture of value differs between relationship types from two primary influences. The first is the formalisation of IMP firms' involvement in product design. By formalising production activities, the IMP firms are better able to justify the additional value they bring to the manufacturing process and are more likely to capture this value through price increases. Both the *Lock-In* and *Boundary Spanning* group have formalised their capacity and involvement in product development, though in different ways. In the *Lock-In* approach, the involvement does not generate any product design rights and, as a result, profit has to be negotiated between buyer and supplier. This formalisation has in some cases generated an additional revenue stream as a design service. However, the profit is not secured and generated only during their involvement with manufacturing. In these situations, relative power in negotiating the distribution of value is reduced as the IMP firm has no ownership rights to the product to secure its manufacture. In contrast, the *Boundary Spanning* group have enhanced the formalisation of design involvement by insisting on intellectual property. This has ensured the production of the product is not undertaken without their involvement, thereby securing a revenue stream from part ownership. In instances where the IMP firm does not hold any direct product IPR, which may be the case in investment consortia, the IMP firm is again unable to secure involvement in production. The firm is in a position similar to that of *Lock-In* firms, who have to negotiate profit based on sunk cost dependencies.

The second factor is the IMP firms' access to potential markets. As an intermediate supplier they are characterised by supplying further manufacturers and, as such, they have limited, if any, direct routes to market. Consequently, the demand and price for their production process is resultant on the marketing and distribution practices of their customers, or even customers' customers. The creation, or enhancement, of added value by the suppliers only generates profit if prices are supported by the customer: customers are required to pay an additional amount for the activities of the IMP firm within the price. Increases in production costs and price pressures from customers can slowly erode the value added achieved by the IMP firm. This is particularly an issue for ongoing buyer-supplier relationships where production price changes are not necessarily reflected in sales prices. The interdependent group are particularly susceptible to this because of their long term production agreements. The enhanced value created during the contract can be absorbed through production cost increases and price pressures from customers. The lack of product ownership or direct end-user sales leaves these IMP firms unable to avoid this erosion of value over time. Although profitability increases during the contract, this is a result from increased efficiencies by the supplier. Their ability to capture a secure level of added value dissipates during the production agreement. Product ownership in the *Boundary Spanning* group, however, where access to market is secured through joint ownership, can allow a steady profit level to be achieved as customers are tied to that particular manufacturer. There has been ongoing consideration of the movement of value through firm ownership structures (Lawrence, 1987) but the increased fragmentation of the production process has made product ownership a key determinant in capturing value (Angel and Engstrom, 1995; Dedrick *et al.*).

Despite IMP firms increasing their value added activities, the industry continues to sustain only a very low profit margin because additional value added is not always captured by the firm and profits in one area of production are often used to support other less profitable, and sometimes loss-making, activities. This supports Ruigrok and van Tulder's (1995) suggestion that involvement in design tasks does not necessarily capture value for the supplier. Although all firms are engaged with value added activities (both design and finishing based), only the firms with some IPR are actually able to capture a continued and secure level of profit on their production activities. In the other relationships, the distribution of value varies over the course of the production agreement (Figure 5.3) and the suppliers' capacity to negotiate profit margins (Dedrick *et al.*, 2010; Murphy and Schindler, 2011; Rutherford and Holmes, 2008; Starosta, 2010). The *Boundary Spanning* group are characterised by their strategic direction towards product ownership to secure revenue streams and negotiation power within the buyer-supplier relationship. The *Lock-In* firms instead use complementary assets (Teece, 1986) such as specialised design and production skills to capture value because they are unable to generate formal ownership structures or enforce them. The majority of IMP firms are engaged in high value-added activities; however, the distribution of value from this is complex and varies between firms and between relationships within firms according to strategic intent, investment capacity and inter-firm power dynamics.

5.5 Summary: Sunk Costs, Value and Contracts

The intricacy of relations has been illustrated through the many levels of sunk costs within the buyer-supplier relationships and production agreement. These areas of sunk costs have different temporalities of influence and value properties, which is illustrated through the different forms of relationship evident in the IMP industry. Asset specificity, from transaction specific sunk costs, is a key characteristic of strengthening client-supplier relationships in all relationship types (even the *Vulnerable* firms rely on prior investments in tooling to recoup after-market work). However, an important amendment is made. Asset specificity is related to the value of the investment in the current market rather than the fact there has been an investment related to a specific customer/relationship (Cox, 1996). Following this, particular sunk costs will strengthen relationships only during periods where both parties can recover their investment in the market. This has two implications. Firstly, sunk costs have a temporality in which they are effective in shaping operation decisions. Formal contracts reflect the temporality of value in sunk costs and provide IMP firms with a means of capturing some of the value at discrete periods of time within the contracts. Secondly, ownership is a key aspect. It is assumed that as collaboration increases between clients and suppliers, and the associated asset specificity that is built between them, that forms of ownership are likely to emerge to increase efficiency in the transaction (Cox, 1996; Grossman and Hart, 1986). IMP firms have used ownership only as a partial strategy to strengthening relationships. The *Boundary Spanning* group pursued ownership of supplementary products or partial design rights (for which enforcement is difficult). The *Lock-In* group in contrast relied more heavily on dependency through sunk costs in early stages of production rather than formalised property rights. Sunk costs have more influence in this industry because it is more prohibitive for customers to move away from than ownership rights (due to limited market access and enforcement difficulties).

Prior work in relational contracting has stressed the importance of asset specificity as an alternative form of governance to formal market transactions or hierarchies (Gereffi *et al.*, 2005; Williamson, 1979). High levels of asset specificity encourage stability in the relationship because prior investments in equipment, knowledge or the relationship itself increase the efficiency of the transaction and reduce the need for other governance structures as there is a mutual dependence (Sturgeon *et al.*, 2008). Relations between buyers and suppliers in the IMP industry are complex, with various forms of interdependency between transaction partners. Customers continue to remain significant and usually dominate the overall relationship but IMP firms have been shown to play an active role in influencing and, in some cases, driving relationship dynamics. Suppliers are able to influence the relationship at specific decision points in the production process and have incorporated a range of methods to attain value based on these interactions. The complexity of relationship formation, through a multitude of decision points, provides opportunities for suppliers to influence the power asymmetries (Gibbon and Ponte, 2008). Critically, this incorporates dynamism into the client-supplier relationships as power asymmetries can be adjusted over time. Prior work on upgrading has focussed on the transition of suppliers into higher-value added roles in the supply chain, which has illustrated the long term transitionary nature of relationships in these chains (Özatağan, 2011; Patel-Campillo, 2011; Pavlinek and Zenka, 2011). The evidence from the IMP industry, however, identifies a far more dynamic relationship development over shorter temporal periods. Bargaining and power struggles occur within a production contract and are heavily associated with the value of existing investments in the relationship. As the value of these investments changes, the relative power relationships between transaction partners are adjusted. The above analysis has highlighted the range of relationship types evident from the mix of products, investments and strategic action of transaction partners. The dynamism in the value of prior investments adds to the range and complexity of relationship types. Interdependency has a distinct temporality based on the combination of various forms of asset specificity, contract structures and their value. Relational governance conceptualisations do not incorporate this short term dynamism or complexity of multiple levels of sunk costs throughout the production process.

This has an important ramification when thinking about the transition of firms in high cost locations towards value-added manufacture. Value upgrading is not solely about the type of manufacture (product or process) but is also linked to the nature of the exchange relationship. Agreements, and specifically contracts, form distinct dependencies based on sunk costs and product ownerships. These have direct implications of *how much and for what periods of time* suppliers can capture value. The conceptualisation of high cost locations only able to undertake high value-added manufacture is also questioned. As Herrigel (2010) suggests, the division between high- and low-cost location manufacture is indistinct. Low value manufacture continues to form a considerable part of the activities in the industry. These tend to be supplemented by other areas in the production chain, such as the packaging of design activities as an additional service, which have traditionally been undertaken informally. In addition, the 'higher value' activities in which IMP firms are undertaking can be difficult to capture the additional value and rely on investments in production contracts, as well as ongoing relationships.

The following chapter will continue to explore relationship structures in the IMP industry but with a focus on adjustment to rising input costs, specifically energy, and the ability to IMP firms to manipulate their customer relationships to retain profitability.

6 ENERGY, RISK AND GOVERNANCE: ADJUSTMENT AS A NEGOTIATED PROCESS

6.1 Introduction

Energy (gas and electricity) costs are an increasingly significant challenge for manufacturing firms. Despite reduction in production volumes, the cost of energy inputs has increased, as can be seen in Chapter Four. Rising prices have increased the relative importance of energy in production environments (Bassi *et al.*, 2009; Goldsmith, 2008; Guidi, 2009; Hammond and Norman, 2010; Leonard, 2003) and distribution costs, where the continuing focus of climate change abatement on industrial activity and rising oil prices have the potential to drive the re-localisation of production (North, 2010). The enhanced volatility of energy input prices has generated specific competitive risks (Leonard, 2003). Energy has a complex price structure, influenced by international political and economic stability and intra-national regulation, legislation and market structure (Jones, C., 2010; Rutledge, 2007). This potential competitive disadvantage is compounded by the challenges already facing manufacturers in high cost locations like the UK, as Jones describes:

> *…given the wider global context within which … developed countries must compete, energy-cost-related structural change may pose more threat than opportunity. Much of this threat may arise from changes in the competitive landscape as a result of increased energy costs, as facilities in Europe compete (often within multinational companies) with those based elsewhere (2010a: 3010).*

This complex, multi-scalar, geographical structure differentiates firms located in different places (Maskell and Malmberg, 1999). Firms are being forced to adapt to an increasingly volatile cost base; labour costs are a predictable cost compared to many other inputs including energy. Manufacturing firms must make complex short-term adjustments in their cost base that are also intertwined with longer term changes (Gertler, 1984). As such, the ability to cope with input price volatility plays an increasingly important role in the viability of enterprises.

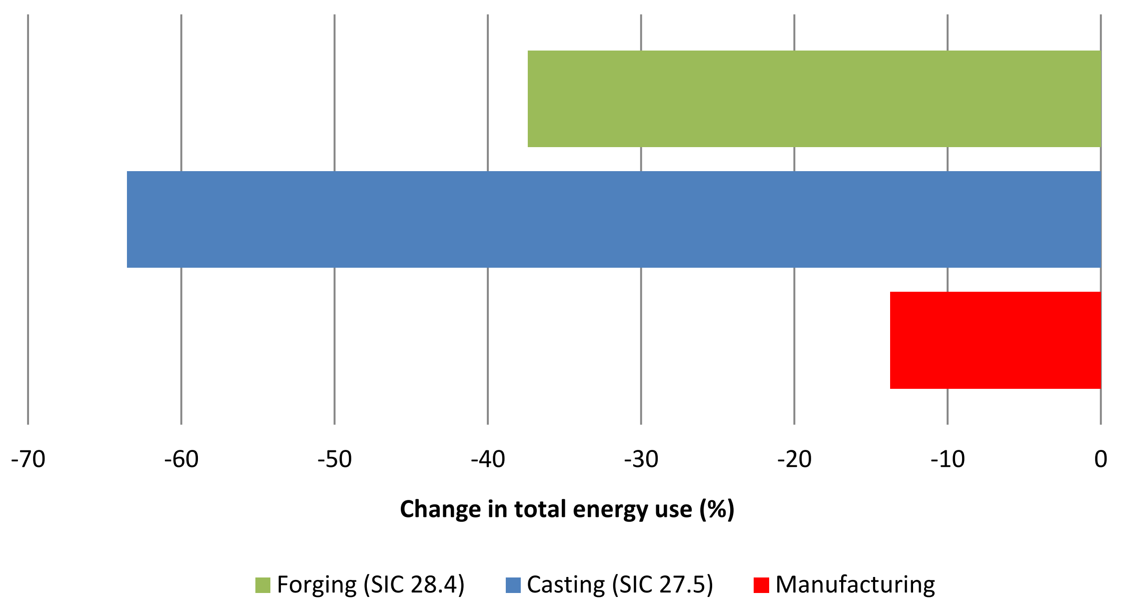
This chapter[10] explores the process of adjustment through an examination of the industry's response to changing energy costs. It has two aims. Firstly, it explores the role of energy in the IMP industry, drivers for efficiency and the influence of energy costs on the competitiveness of IMP firms. Secondly, it provides an investigation of the industry's adaptation to rising and volatile energy prices. Four distinct approaches to managing the risk from energy prices are identified. Governance influences from agreement structures and embedded understandings within the supply chain are shown to be constraining factors on the ability of IMP firms to manage this risk. In response IMP firms and their customers are engaging in a negotiated process of adjustment, through power asymmetries between transaction partners, to determine the distribution of risk in the supply chain.

[10] Parts of the arguments of this chapter have been included in a journal publication which is included at the end of the thesis.

6.2 Energy Use and Transformation

Energy use in the IMP industry has reduced by 63.5% (casting) and 37.4% (forging) since 1990 as shown in Figure 6.1. This is a far greater reduction than seen in the manufacturing sector as a whole (13.7%). The reduction has been erratic, with increased use from 1999-2001, followed by a drop in use from 2002-7. This pattern is apparent in both casting and forging sub-sectors and closely follows the 'boom and bust' nature of demand in the industry. The overall level of energy use differs considerably between the IMP sub-sectors. The castings industry has seen a far greater reduction in energy use: at almost double that of the forging sector. In addition, the forging sector has seen a transition towards electricity use, indicated by a smaller reduction in electricity use (-9.07%) compared to natural gas (-54.06%) (DECC, 2010) (Chapter 4, Table 4.10).

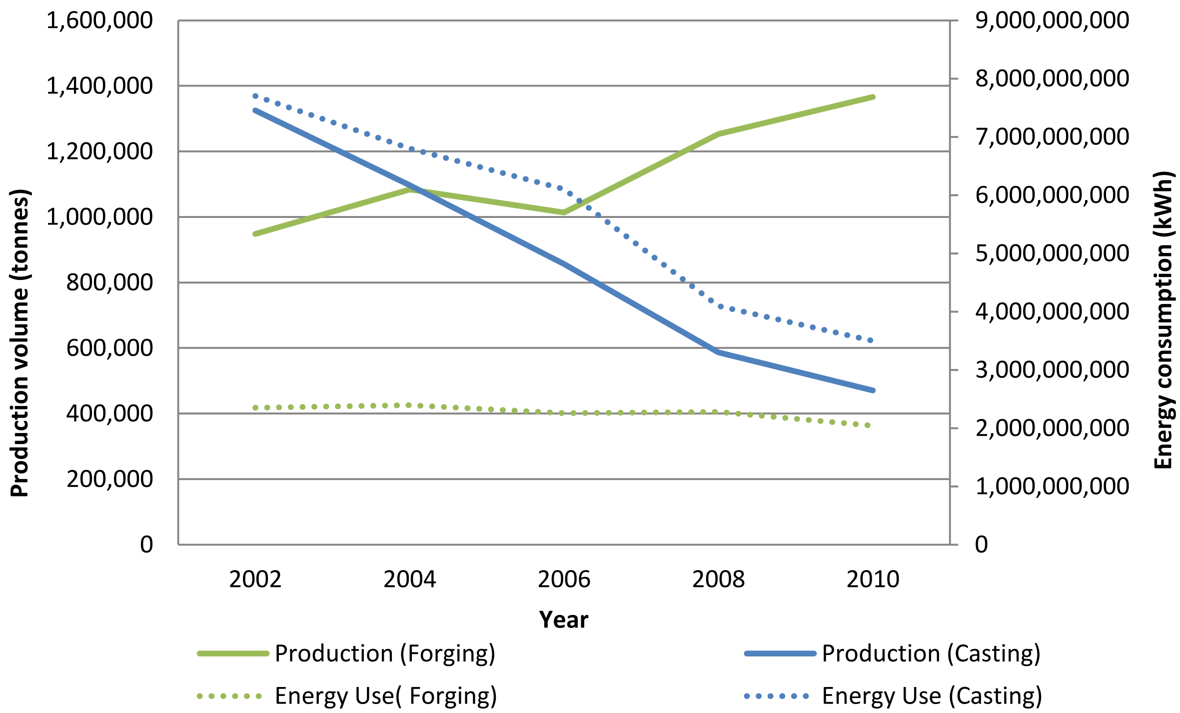
Figure 6.1 Change in Total Energy Use by Industrial Sector (UK), 1990-2008



Source: ONS Industrial Energy Consumption (2010a)

Both industries illustrate a non-linear relationship between production and energy volume; a drop in production volume does not necessarily result in an equivalent reduction in energy use. This is illustrated in Figure 6.2. The forging industry has seen a rise in production volume since 2002 but a drop in energy use of 13.1% (CBM, 2010). Although the casting industry has illustrated a reduction in both production and energy volumes, energy use peaked above production volume during 2006. The relationship is influenced by two factors: energy efficiency of the production process and product characteristics.

Figure 6.2 Comparative Analyses of Production and Energy Use Levels in IMP Sub-Industries, UK



Source: CBM (2010), CTI (2010)

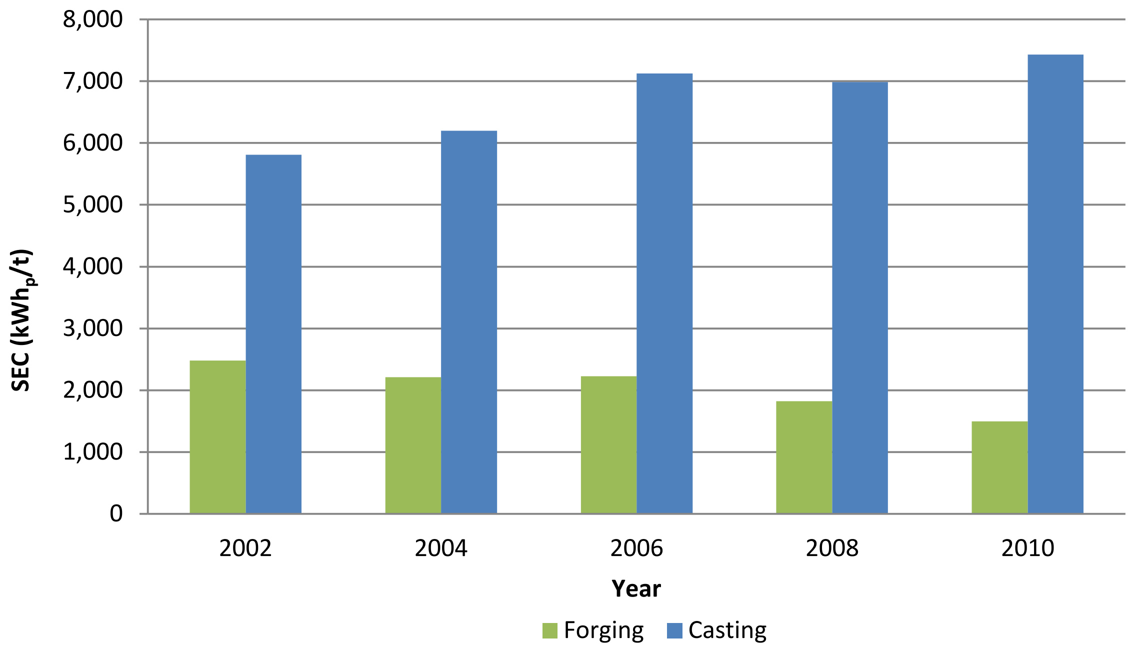
6.2.1 Efficiency

Energy efficiency (measured by the volume of energy used per ton of production) varies between the IMP sub-industries, as illustrated in Figure 6.3. The forging industry has consecutively increased its efficiency since 2002 (CBM, 2010). In contrast, the casting industry has become effectively less energy efficient during this period with a higher use of energy per ton of product produced. Investment levels differ considerably between the industries. The forging industry has seen a relatively stable level of investment in machinery and equipment since 1996, with an overall increase of 10.2% since 1996 (Table 6.1). The casting industry, however, has seen a substantial decline in investment since 1996 (85.9%), which could be related to both the overall decline in number of enterprises but also investment capacity and product development in the industry. Any investment options tend to be large scale in both industries because many of the smaller scale, lower implementation cost initiatives (e.g. in-house layout efficiencies) have already been made (Bassi *et al.*, 2009). Low profit margins mean that firms have to rely on accessing credit or grants for capital investments. At the time of study the UK was experiencing a recession (2009-10). The considerable reduction in credit availability during this period, particularly to manufacturing firms, constrained investment by IMP firms. The availability of a government interest free loan from the Carbon Trust[11] encouraged investments in efficiency technology (10 firms in the sample utilised this scheme). However, firms

[11] The scheme was introduced in relation to the Climate Change Levy. Funds collected from the levy are recycled, through a reduction in National Insurance contributions and the formation of a funding scheme intended to increase efficiency in energy use in SMEs (Pocklington, 2001). The Carbon Trust was established to run this scheme by providing advice, audits and funding for research and development into energy efficiency. The scheme provides an interest free loan for investments from approved technology providers that meet government guidelines for energy efficiency.

were reluctant to invest in new technology because of sunk costs in existing production methods and investment was only made when equipment needed replacing.

Figure 6.3 Specific Energy Consumption (SEC) by IMP Sub-Industry, UK



Source: CBM (2010), CTI (2010)

Table 6.1 Change in Gross Investment in Machinery and Equipment by Sub-Industry (UK), 2007

Industry	Investment Value (£m)	Percentage Change (1996:2007)
Manufacturing	16,140.5	-22.3
Casting (27.5)	32.2	-85.9
Forging (28.4)	99.6	10.2

Source: Eurostat (2012)

The production process in the forging industry lends itself to more standardised and less complex products (a result of more expensive tooling and a limited capacity for intricacy or materials), which drives a need to increase profitability by driving down production costs. As a result, more direct profit increases can be achieved from investment in the industry. The forging industry enhanced energy efficiency through wider process efficiency measures. Investment in process technology to reduce aggregate costs (labour and production time) has also generated efficiencies in the use of energy, as one interviewee explained:

> *[s]o we had a whole complete look at our business and decided we were either going to continue or decide not to continue . . . We put a massive amount of automation in there … So we halved our labour costs, 50% of our energy costs and it also freed up the rest of the buildings so making management a lot easier (Interviewee 1, Forge SME 10).*

The investment levels in the industry were targeted at larger transitions towards more efficient technologies, specifically the use of electric furnaces (which accounts for the reduction in gas use). The Carbon Trust finance stream was utilised by three forgings firms, all of which had introduced wider efficiency measures. The scheme has been a source of funding for ongoing development rather than stimulating changes independently. Investments in the casting industry have been smaller and used to directly address energy efficiency. This could be a result of limited capitalisation and credit availability for these firms, making the Carbon Trust loan the only available funding stream. However, these investments have been made in isolation, not as part of wider aggregate cost reductions. Of the six castings firms which utilised the scheme, only one used it as part of larger automation investments. More complex and differentiated products (by material or structural component) mean that efficiency from economies of scale is not as easily achieved in the casting industry.

6.2.2 Product Change

In both sub-industries, the types of metal component produced are changing. Products are increasingly complex, using advanced materials and bespoke shapes, and of smaller volumes. This limits the ability to combine customer orders within the production process and consequently reduces the relative efficiency of each product, as one interviewee of a heat treatment processing service plant identifies:

> *…what's tending to happen is that volumes are reducing . . . and the nature of our work is changing … we're not actually putting as much weight into the furnace. And when you actually look at the cost per ton, I mean its way, way up (Interviewee 1, SME Subcontractor).*

This is particularly the case in the castings industry, where there is greater scope for bespoke material compositions and larger products, both of which will reduce the economies of scale in use of energy that the forging industry can achieve. Higher specification materials often require more advanced treatment processes operating at higher temperatures, ultimately increasing the energy use per ton of product and reducing the relative efficiency of production.

The transition of the product portfolio of IMP firms, and specifically castings, suggests that efficiency levels are unlikely to improve dramatically, even with substantial investment. In the forging industry the relative gains in efficiency are related to volume increases and large scale investments. The remaining investment options could make incremental improvements, but these are likely to be offset with more 'energy demanding' products. As such, the role of energy as a cost in the industry is likely to become even more significant as energy use per ton of production will increase from the increasing mix of customers and orders (i.e. different products with different processing requirements). The relative cost of energy in the production process has increased in the casting industry; it is likely to follow suit in the forging industry as economies of scale become more difficult under lower volumes and increasingly bespoke orders. The IMP industry has always been a high energy user and energy has always been a significant cost, but its significance is increasing from *relative* energy demands.

Current conceptualisations of energy as a nominal factor input addressed through investment in efficiency (Thollander and Dotzauer, 2010; Thollander and Ottosson, 2010; Worrell *et al.*, 2009) do not take into account the complexity of the way energy is used in manufacture. Rapid price increases and price volatility of energy in the UK are adding to the relative importance of energy as a production cost (Jones, C., 2010; Leonard, 2003). This has created a new energy challenge for IMP manufacturers. The structural costs of production are increasing, both in terms of energy volume and value, and market sales prices need to reflect these changes (Leonard, 2003). Energy can no longer be addressed as part of wider aggregate cost reduction approaches; it warrants independent management. The following section explores the relationship between energy costs and competitiveness, both spatially and over time, by examining the changing nature of the UK energy market and the wider economic landscape as it relates to the competitiveness of the IMP industry.

6.3 Cost and Competitiveness

Energy has a relatively complex cost structure, influenced by multiple markets at multiple spatial scales, generating a non-global price (Stern, 2002). There are three key structural elements of energy prices: market price, legislation and purchasing method, and these will be examined in turn. The combined influence on competitive differentiation between firms, both domestically and internationally, will then be examined.

6.3.1 Price

The retail market price for industrial energy users in the UK has changed in two fundamental ways since the early 2000s: prices are rising and becoming increasingly volatile. The price of energy has increased significantly over the last decade (1998-2008), with the average industrial energy price paid by manufacturers increasing by 192% for gas and 60% for electricity (DECC, 2010). The rise has been particularly steep since 2003 with 113% gas and 110% electricity price increase (DECC, 2010). These increases have resulted in the growth of the relative cost of energy to the firms overall production costs. In other words, energy now represents a more significant proportion of the cost base, on average 8.6% (range 2.5-20%[12]) of the production costs (Interview data: during study period 2009-10). Historically, energy has been one of the three primary input costs but it represented a much lower proportion (2.5-3%) (interview data, 2009-10). The increase in the cost component becomes critical at a threshold point, identified from interview data to be when energy represents approximately 6% of the cost base. At this point, the influence on cash flow and

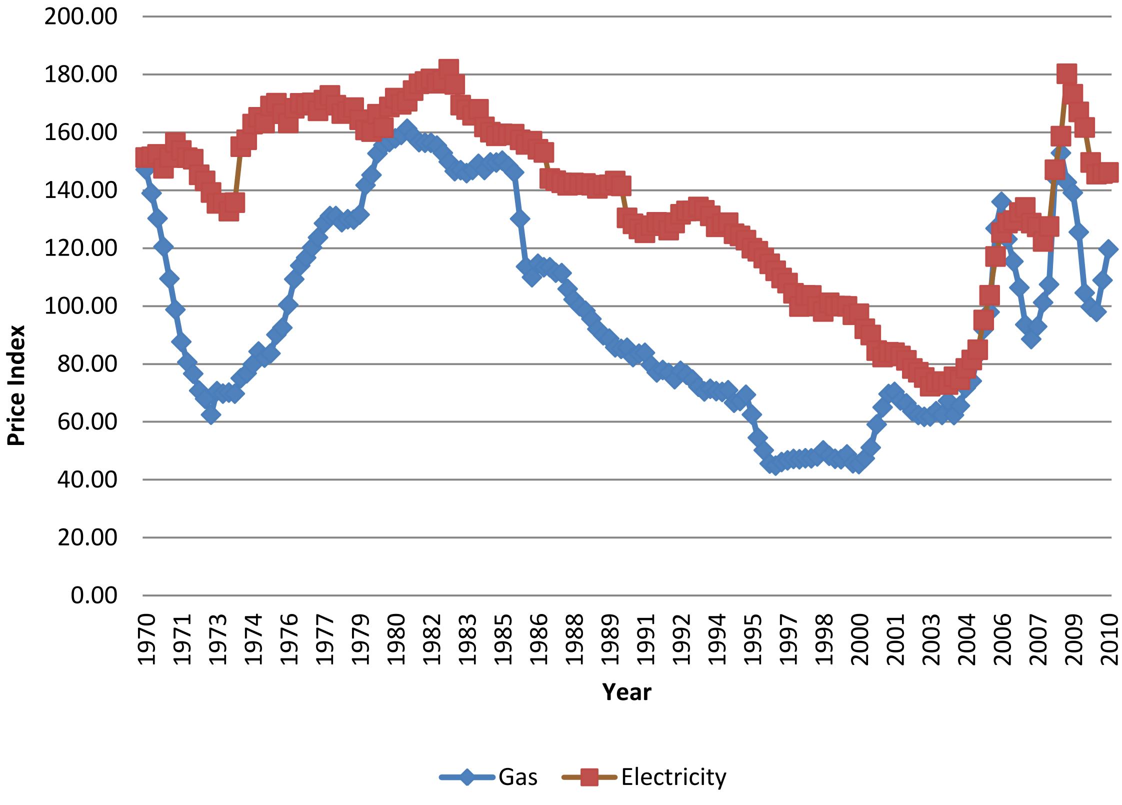
[12] The significance of energy cost is dependent on the product, production process and efficiency levels, all of which vary considerably between IMP firms.

profitability *directly from energy price increases* becomes critical to the survival of the firm and requires considerable independent management. Energy prices in the UK are forecast to continue to rise (DECC, 2011; HMT, 2011), particularly for large industrial users (DECC, 2011) and SMEs (HC, 2011). As such, the significance of energy as a cost component is likely to grow in IMP firms if additional efficiency measures are not installed.

The volatility of industrial energy prices is also increasing. The rate of change in price has increased both in magnitude and tempo since the early 2000s, as illustrated in

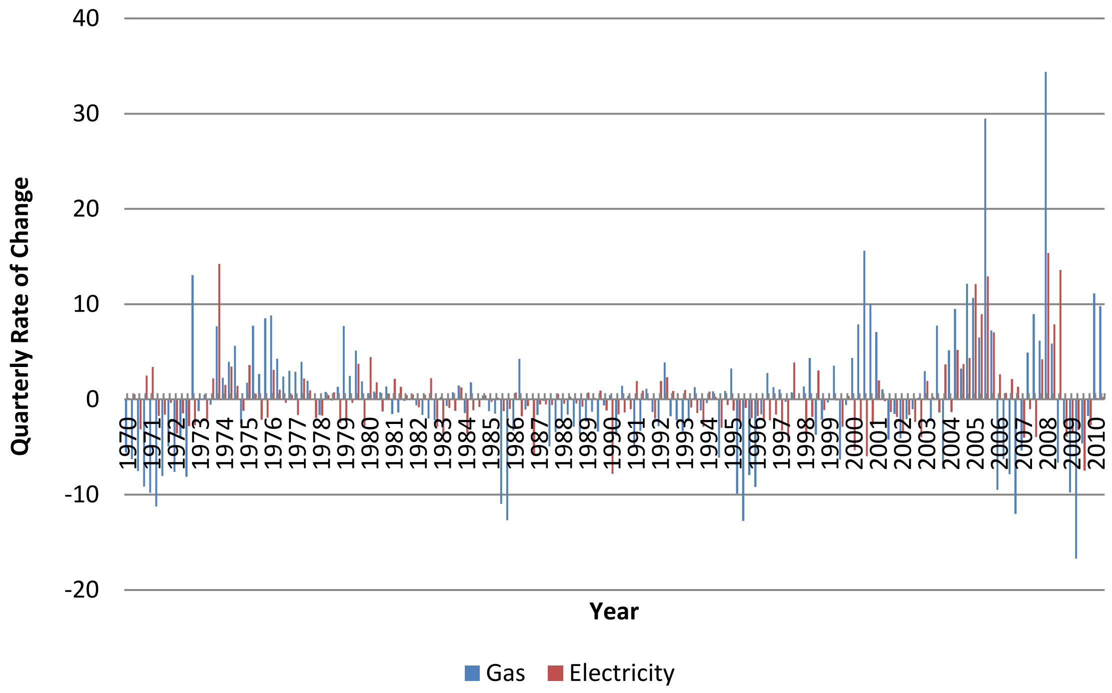
Figure 6.4 and Figure 6.5 below. Over this period (Q4 2003-current) volatility has become a consistent feature (Jones, C., 2010), with 62.8% of gas and 25.6% of electricity price quarters during this period having a rate of change greater than +/-5% from the previous quarter (DECC, 2010). This rate and consistency of price change is unheard of in modern UK energy prices (since 1970). In fact, the 1970s oil crisis saw a far more stable rate of price change, with only 17.9% of gas and 0% of electricity price quarters having the current magnitude of change between quarters (DECC, 2010). This volatility has caused substantial increases in energy costs in many IMP firms when supply contracts are renegotiated. An extreme example of this is *Foundry SME 24*, a small independent jobbing foundry, who faced a 105% increase when they renewed their contract. Due to the timing of the contract renewal, the foundry was purchasing energy at a relative high point (July/August 2008) which generated such a significant increase because the prior fixed price contract was taken out several years earlier at a considerably lower price point. Although this is an extreme example, IMP firms have been on average facing a significant increase due to the volatility of energy prices and contract timings. Of course, firms may also benefit from price volatility when energy is purchased at relative low points. This, however, occurred in only one case during the study period.

Figure 6.4 UK Quarterly Industrial Energy Prices (inc CCL). Seasonally adjusted. Fuel price index numbers relative to the GDP deflator.



Data source: DECC (2010)

Figure 6.5 Rate of change in price index by quarter. Fuel price index numbers relative to the GDP deflator.



Data source: DECC (2010)

6.3.2 Legislation

Large industrial energy users are susceptible to additional regulations aimed at reducing carbon emissions from energy used. There are three policy mechanisms used in the UK that apply to energy consumers: EU Emissions Trading Scheme (EU ETS), the Climate Change Levy (CCL) and Carbon Reduction Commitments (CRC) (DECC, 2011). In addition, suppliers are required to purchase a proportion of their electricity from renewable sources, which are more expensive. The primary mechanism that affects IMP firms directly is the CCL. Only two IMP firms are eligible to trade on the EU ETS (due to their volume of purchase) and as the industry is energy intensive (EII), their usage is beyond CRC.

The CCL is a tax paid through energy supply bills to encourage the decarbonisation of industry. This is a UK based tax targeted at large energy users (EIIs), which has added an average additional cost of 3.5% and 3.6% to electricity and gas bills (correct at Q3 2010) (ONS, 2010b). Several IMP firms have cited the additional environmental taxation in the UK as creating a price disadvantage against international competitors. To offset the potential international disadvantage of a UK-based levy, the funds generated from the tax are used to promote energy efficiency in EIIs through (1) a rebate of the tax (80% at present), if energy efficiency targets are met (Climate Change Agreements (CCA)) and (2) a funding source to aid investment in energy efficiency (either knowledge or equipment) (Carbon Trust). Both these schemes are utilised by IMP firms to make investments and have been effective. As a result, the competitive disadvantage from a national tax is less clear, particularly against rising energy prices. The CCA are based on a general sectoral reduction (negotiated through sector representatives), which is tailored to the firms historical energy usage (based on 1990 baseline levels). Due to the dramatic reductions in production volumes since this baseline (up to 60%), the targets are fairly ‘easy wins’ (*Foundry Large 2*) and all IMP firms are receiving their eligible rebate. This has reduced the actual price disadvantage from the CCL, however firms still need to fund input cost until the rebate is paid and therefore working capital is reduced. European and national taxation and subsidy policies can be applied to the market price, resulting in greater spatial difference between actual purchase prices paid by industrial users (EC, 2007; Haley and Haley, 2008; London Economics, 2007). However, the additional policies surrounding such taxes (such as the CCA and Carbon Trust scheme) reduce the actual cost impact. These policies are set to be reduced from 2013, which will increase the competitive disadvantage felt by UK EIIs (HMT, 2011).

6.3.3 Retail Supply Market Structure: Purchasing Methods

The purchasing methods used by IMP firms are a significant factor in determining the energy cost component. Denationalisation of UK energy markets has allowed increased competition in the market and as a result, greater variety of purchasing methods as illustrated in Table 6.2. The retail market has particularly responded to the increased volatility in prices by introducing greater variety of supply options to industrial users in order to capitalise on the buyers' desire to reduce this particular cost component. Fundamentally, there are three key purchase methods available to industrial users:

- *spot buying through the retail market* - one-off payments for discrete quantities at the point of use;
- *forward contracts through the retail market* – pre-agreed rates for a specified quantity over a specified period (these contracts usually have a cheaper unit price as they allow energy suppliers to plane for demand); and
- *wholesale purchase* – very large users are able to directly purchase from the wholesale market, eliminating the retailers margin.

In addition, energy brokers are increasingly utilised by buyers as a means of generating the most suitable and advantageous supply structure. Brokers act as intermediaries between energy suppliers and users, providing guidance on the most suitable form of purchase across the market.

Table 6.2 Energy Purchasing Methods

Traditional Purchasing Methods		**Current Purchasing Methods (2009-10)**	
Method	*Reasons for use*	*Method*	*Reasons for use*
Annual fixed price contract	Stable low prices	Multi-year fixed price contracts	Increased volatility in the market abated by fixing prices for longer periods Premium paid to supplier to transfer risk of price changes to the supplier Uniform volume usage within set minimum and maximum values
		Flexible contracts	Increased volatility in the market can be abated by purchasing blocks of energy, combining with spot price purchasing and purchasing staggered over time to hedge risk Customer manages risk of price fluctuations Set minimum and maximum volumes over contract period
		Spot buying (short dated buying e.g. day-ahead, month-ahead)	To avoid locking into a contract at a high point Prices usually significantly higher than contract prices*
		Direct from wholesaler	Available for large users to remove retailers overhead Increased financial and volume risk to customer from additional set up costs and volume requirements in market.
		Energy traders/agents	Able to advise and manage energy purchasing and trading on customers behalf to generate a more complex purchasing pattern than customers could independently manage Additional cost from traders margin

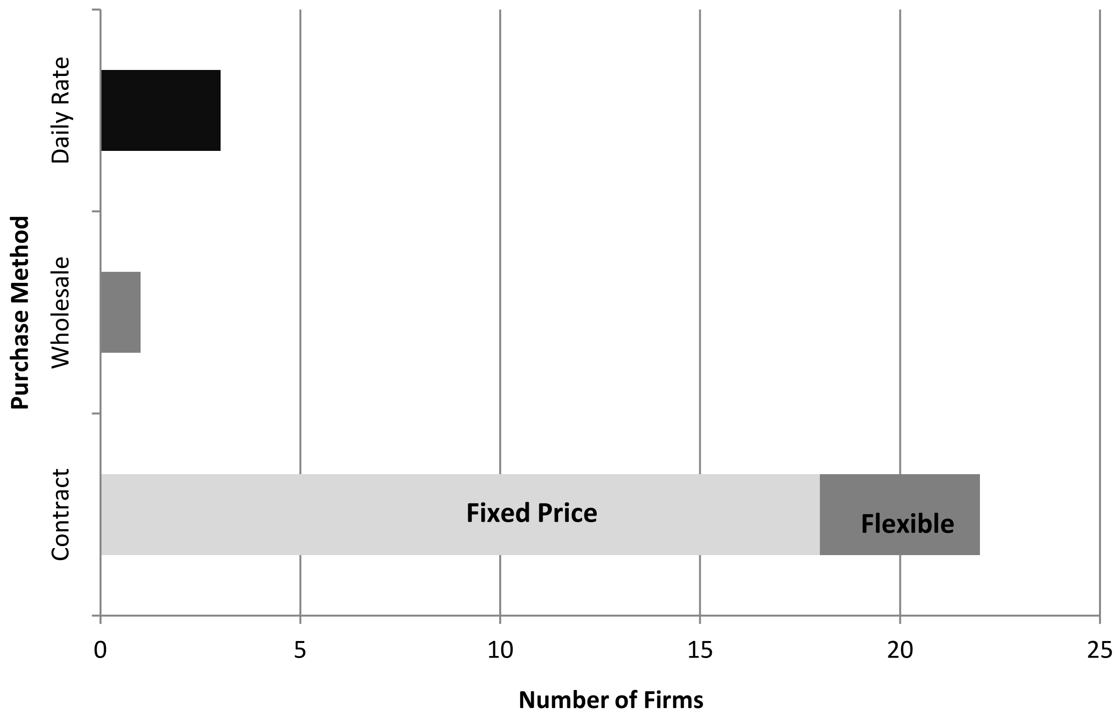
**Dependent on timing of contract and market fluctuations as spot-prices reflect point-in-time (half-hour blocks) prices rather than temporally independent prices in contracts*

Source: Utilities Exchange (2007), Manufacturer (2004; 2006, 2010; 2011), Interview data (2009-10)

The purchasing options available have altered in three fundamental ways. Firstly, the timing of contract purchases has changed. Traditionally, all large industrial users would generally purchase annual fixed price contracts at a set period during the year (around 1st October). With significant increase in price volatility, the timing of forward contract purchasing has become extremely important in determining competitive (dis)advantages: firms can potentially buy energy at a considerably higher or lower price than their domestic competitors based solely on the timing of purchase. As a result, forward contract purchasing now occurs throughout the year to (hopefully) optimise the timing of the lock-in price. The second change is related to the length of contracts. Again, traditionally, an annual fixed price contract would be purchased. However, due to volatility in prices the retail market now provides variable contract lengths. Extended contracts (up to five years) are increasingly available, which allows industrial users to forward plan their energy cost and mitigate their risk to unplanned price changes from market volatility. Though, the retail provider charges a price premium to cover any short term losses they may be susceptible to. The third alteration has been the transfer of the risk of price changes from the retail market supplier to the purchasing firm. The retail market now offers flexible contracts, which allow staggered purchasing of blocks of energy, spot buying, direct trading on the wholesale market or a combination of these, to allow purchasing firms to manage their own risk to commodity price changes.

IMP firms have responded to such supply market changes in several ways. The fixed price contract remains the most popular purchase method. However, contract length is now longer (usually two years but can be up to five years) (Figure 6.6). Spot buying (daily rate) has been utilised between fixed price contracts to optimise the timing of the contract purchase. Only four (4/27) firms currently have flexible contracts. Of these, three (all SME) used an energy broker to manage the purchasing within the contract and one (large) firm introduced an internal energy management role (as a supplement to a current employee's position). This is due to the additional knowledge and expertise required to manage commodity price risk under this contract type. Only one firm engaged in direct wholesale purchase. The limited use of this approach could be a result of the extremely large volume required to engage in wholesale purchase, which would usually be above and beyond the energy requirements of most IMP firms.

Figure 6.6 Energy Purchasing Methods in IMP Firms



Source: Interview data (2009-2010). Based on known purchasing methods from 27/47 firms.

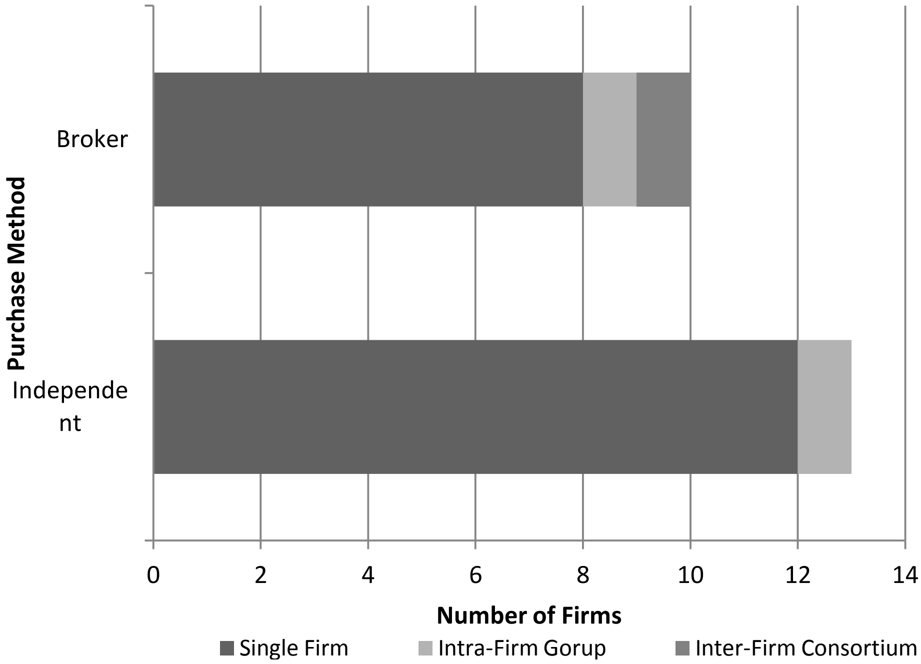
The new purchasing methods available have introduced additional risk to IMP firms by allowing firms to engage in differentiated supply methods and as such only a limited number of the firms have undertaken flexible contracts or direct wholesale trading. This approach is attractive as it has the potential to reduce energy costs through optimal purchase timing and without the retailer's price premium of a fixed-price contract. However, the risks are considerable. The large firm which engaged in wholesale energy suffered great financial loss under this purchasing strategy due to the difficulty of matching required energy and production volumes, as he explains:

> *We were buying blocks of energy on the open market [wholesale]. But we were buying them in advance to try and have enough bought, pre-bought for our production. Unfortunately that also perfectly timed with the downturn so we ended up having bought too much. And of course we bought it at the premium prices … we weren't using it and we were selling it back at a huge loss. That's why it cost us 2 million quid basically (Interviewee 1, Foundry Large 1).*

In this case, the IMP firm was free to manage its own energy requirements in relation to current production volumes, albeit by making a financial loss through trading. In forward contracts (both fixed-price and increasingly in flexible) usage volumes are predefined within a range (minimum usage clause). In fixed-price contracts the unit price is based on this volume tolerance and in flexible contracts the usage must be taken during the contract period. Forecasting production volumes therefore becomes critical to the cost of energy – usage outside the prediction creates penalties and a far more expensive unit price (the daily rate) for additional energy beyond the agreed volume. This did create problems for some IMP firms during the recession when production volumes reduced dramatically and very quickly. Those firms in the early or mid-stages of long term contracts were not susceptible to penalties because their usage could be spanned over the contract period (prior to the downturn production levels were very high and consequently, so was their energy usage). However, in some instances, such as at the end of the contract period or under more strict volume tolerances, the clauses restricted the flexibility of the cost base and actually, the relative unit cost of production increased because the relative unit cost of energy increased.

Firms have attempted to hedge their risk to energy price changes through spot buying between contract renewals and the use of external expertise (energy brokers/traders). To engage in commodity markets, such as the retail energy market, requires expert knowledge that is rarely available in-house to IMP firms. Large firms have developed specific energy management roles and integrating it with existing metal market management to generate the most competitive purchasing strategy. However, smaller firms often lack the capacity to do this. Instead, energy brokers are increasingly employed to advise on the most suitable purchasing methods. The usage of energy brokers in the IMP sample is illustrated in Figure 6.7 below. A smaller number of firms have engaged in ownership group purchases (2 firms) and inter-firm consortiums (1 firm) to increase their collaborative spend and hopefully generate more competitive pricing. The ability of firms to negotiate the best contractual terms is based on purchase volume or market knowledge.

Figure 6.7 Use of Energy Broker in IMP Firms



Source: Interview data (2009-10). Based on responses by 25/45 firms.

6.3.4 Competitiveness Effects

The influence of energy costs on firm competitiveness is multifaceted. Firstly, the actual market price varies between places as a result of multiple markets operating at multiple scales with different economic and political circumstances (Stern, 2002). Increasing industrial energy prices in the UK has been suggested to generate competitive disadvantage against overseas competitors by several IMP firms. This means that firms in the UK have to be extremely well managed and efficient as their cost base is higher than firms in many other locations who have cheaper labour and cheaper input prices. However, the UK has one of the lowest gas prices and an average electricity retail price for the European Union (EC, 2011; HC, 2011), suggesting that rising prices alone do not competitively disadvantage UK manufacturers against European competitors. In fact, UK IMP firms could be at an advantage because of their relatively cheap energy sources. Industrial energy prices of other competitor nations (chiefly the US, China and India) are more difficult to obtain, although anecdotal evidence suggests that energy prices are far lower in China (Haley and Haley, 2008) and the US (Goldsmith, 2008; Leonard, 2003). Although there is an additional UK tax (CCL) on energy use, this is a relatively small amount and could easily be absorbed by relatively lower energy prices and overshadowed by the much greater magnitude of general energy price increases. These geographical differences are shown here to be a relatively small influence on the energy cost competitiveness of IMP firms.

Secondly, the relative price differences between firms could generate competitive differences as a result of purchasing methods, and specifically forward contracting. As fixed price contracts remain the most popular purchase strategy, the timing of a purchase becomes the most critical factor in generating competitive (dis)advantage because of the volatility of energy prices. This competitive differentiation is not necessarily spatial and is influenced by the negotiating ability of the firm. Inter-firm differences in the ability to negotiate contract prices from the volume of energy purchased (i.e. ability to buy direct from the wholesaler or restricted to the retail market), utilise external expertise (i.e. through an energy broker), or the timing of price fixing and discrete purchases, can lead to significant differences in the relative cost of energy inputs between firms. The structure of the retail supply market therefore becomes a critical factor in the relative competitiveness of firms. This itself has a spatial element, in that supply markets are organised at a national, regional or sub-national [US (Hess, 2011)] scale, but critically, price differences do not have to be geographically determined and competitive (dis)advantages can be generated between firms operating under the same market structure.

Purchasing strategies reflect the additional significance of energy as a cost component from both the price increase (including additional environmental taxes) and price volatility changes that have occurred over the recent period. The supply methods utilised are increasingly complex, integrating a combination of methods to optimise the purchase of energy inputs. Price differences are related to competitive differences between retail providers and the firm's capacity to negotiate a good deal, therefore are not explicitly spatial. The complexity of supply structures can drive competitive differences between firms to a greater extent than geographical market or policy price differences. Energy is in effect a commodity, purchased through contracts that create rigidities in the production process. Contracts are formal, with limited influence from relationship characteristics, such as trust, between buyer and supplier. This highlights a distinct limitation of current conceptualisations of inter-firm relationships in economic geography based on fluidity and trust (Murphy, 2011; Uzzi, 1996; 1997). The rise in input costs can have specific short- and long-term impacts on the profitability, and therefore viability, of IMP firms because they are difficult to transfer to the sales market. This risk will be examined in more detail in the following section.

6.4 The Firm as a Nested Set of Contracts: Price Volatility, Contract Rigidity and Risk

The input and output structure of a firm generates specific risks. In order to generate an output, a product sale, the firm requires a series of inputs, each of which are purchased through specific agreements. The input purchases may not directly reflect the amount of input required for the particular product or order and are often instead ongoing purchases to satisfy the requirements of the total order book over time. In this sense, the firm is composed of a *nested* set of contracts, where an output order is composed of a series of input agreements to generate that particular product. This is critical for understanding the performance of firms and their related geography. The contracts are fixed within jurisdictions and operate over precisely defined time periods.

Inputs are purchased under different forms of agreement with varying temporal commitments; fixed purchase period, differential purchase period or long term contracts as illustrated in Figure 6.8. The IMP industry cost base is characterised by three distinct costs (Chapter Four); labour, raw material and energy. Each of these costs is purchased through either one or a combination of these temporal commitment periods. Labour costs are most often characterised by a steady rate with an annual wage rate adjustment for inflation (fixed input cost for the time period). Although temporary workers may be used, which ultimately increases the labour cost within this annual period, this is often for a fixed period of time (discrete purchase) and pre-empted by the firm, thereby the additional cost is predictable to a degree and easily changed (i.e. firms can dismiss workers quickly under temporary contracts). Metal tends to be purchased through short term orders for specific quantities, of discriminate purchase periods, to match order requirements. The timescale of the purchase agreement may vary but essentially the purchase order relates to a quantity for a specific, and known, product order. The final input purchase agreement is a long term contract. Energy is often purchased under such an agreement and the temporal commitment can stretch for up to five years. In these instances, the price of the factor input can be set for the entire contract period.

An output price is determined based on the cost base at a specific point in time, most often when the order is made. This cost base is composed of a set of nested input agreements (in the case of the IMP industry; labour, metal and energy factor contracts) and is determined for a *cost period*, a set period of time under which the firm calculates its cost base and fixes it costs from which it quotes sales orders. The cost period is recalculated at set points, traditionally annually after inflationary wage rises. When an order is quoted it is thus based on a set of input costs covering different temporal periods and therefore has the potential to include multiple contracts for the same input (frequent short term purchases). The risk arises from the interaction of output orders and the nested set of input purchase agreements.

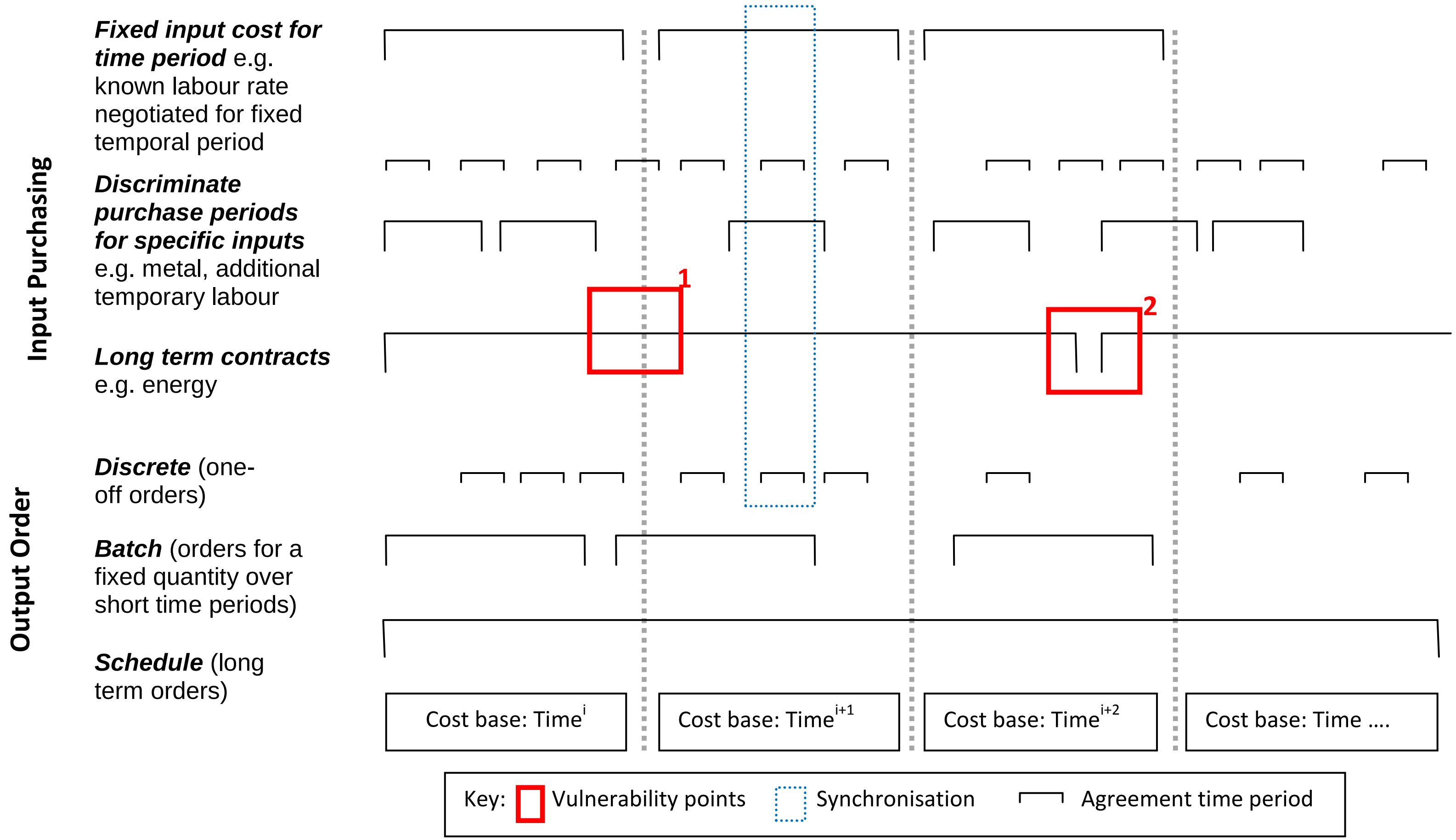
A risk can be generated when the sales price does not reflect the true factor costs. Discrete output orders are able to more accurately reflect the input costs because the cost calculation is done for a specific point in time, when the factor agreements can be sequenced as to provide known costs for the entirety of the order (a short temporal period) (Figure 6.8: Synchronisation). The largest variable in this instance is raw material costs, as labour and energy costs do not usually change during such a short time period[13]. As raw material is able to be purchased discriminately[14], the IMP firm is able to purchase directly for the order and therefore contracted costs accurately reflect the factor costs. Batch orders are similar in that they are also for relatively short time periods, in which case, even if factor prices alter the firm will only risk price changes for a short period.

The risk of mismatching input and output prices is greatest under long term orders (schedules) and existing long term trading relationships (where a price precedent is set, irrespective of the discrete nature of orders). Here factor costs are quoted based on the cost period, with a nested set of factor agreements, and as such, it becomes critical that the cost period accurately reflects the factor costs throughout the duration of the product order/arrangement. The composition of order and factor agreements changes over time *and* between firms. As such it has the potential to generate price differentials between competitors.

[13]Although labour and energy costs may change during the period they are usually based on fixed price agreements (worker contracts and energy supply contracts).

[14] The reduced demand for metal in manufacturing in the UK has resulted in a reduction of metal processing mills, which traditionally would supply large volumes, and instead stockholders and service centres are more common, which provided very low volume as and when required by the manufacturer (Ahlbrandt *et al.*, 1996; Cockerill, 2003).

Figure 6.8 Firm Cost and Order Structure



Source: Author (2012)

Confounding the risk from long term product agreements is volatility in input prices. Inputs are negotiated at a different *point in time* as well as for a different *length of time*. The point in time at which a factor is purchased is particularly important when the factor is purchased through long term contracts and the rate of change of the price is significant, such as with energy. There are two specific risks generated through such a cost composition (assuming the firms structure their sales price from their cost base, not solely to reflect market tendencies):

1. *Long term contract crosses multiple cost periods (*Figure 6.8*: Vulnerability Point 1)* In this situation the agreed energy price is set at the beginning of the first cost period (cost base: Time^{i}) but the price extends through to the second cost period (cost base: Time^{i+1}). The price may not reflect the market price for energy at the point in time when the second cost period is calculated. This could generate either a cost advantage (where the firms energy cost is less than the current market price) or a disadvantage (where the firms price is greater) between competitor firms. As energy is purchased under a contract, the firm is unable to renegotiate its energy purchase and can potentially be at risk of a sales price that does not reflect market price.

2. *Change of factor contract within a cost period (*Figure 6.8*: Vulnerability Point 2)* Here the risk is to the firm's cash flow. A change of long term factor contract mid-point during a cost period can again generate a competitive advantage if energy prices are currently low or a disadvantage if prices are high. As the firm has already set its cost base for the given period (reflecting the cost sequences at the start of the period) a change in a key input cost can result in inaccurate selling prices. These inaccuracies may not be able to be formally adjusted until the next cost period. As a result, the IMP firm needs to absorb such changes through its working capital.

It would be assumed that the best way to avoid such a risk is to synchronise input and output contracts (Figure 6.8: synchronisation). However, the risks generated from input price volatility remain. By purchasing inputs, such as energy, through long term contracts, although the cost base is stable and cash flow is not threatened under the specific order, there remains the potential to be asynchronous with the market price for such output, as one interviewee explains:

> *…we have energy escalators, so ultimately we pass the costs onto our customers. So we are covered for the increased cost, fine. The problem arises when we're out of step with everybody else. So if we are as a country expensive for electricity or for raw materials and I'm competing against a country that is cheaper, they are selling a cheaper product. So I might lose out on new orders or repeat orders or whatever. That's the risk (Interviewee 1, Foundry Large 1).*

The stabilising of input costs only removes the first risk, and does not prevent firms being at a competitive disadvantage from fixing input prices at rates which turn out to be higher than the present market price (a price at which, in theory, competitors could have purchased the input). Having said that, there is of course the counter of this proposition, where the firms fixed price is less than the current market price. In which case, they have a competitive advantage from an overall lower cost base (assuming all others costs are equal[15]).

6.4.1 The Energy Risk

The energy price risk is the loss of profitability in the IMP industry because of rises in structural costs (from energy demand and price increase) which are not recovered from market output prices. There are two related issues to this - actual and relative

[15] This is a simplified model to illustrate a theoretical competitive position.

price differences (Leonard, 2003, 2006). Actual price differences from increases in the cost base remove profitability and can potentially make profitable contracts unprofitable. The relative difference to competitors reduces the cost competitiveness of the product. Both have implications for profitability, which can immediately reduce working capital and cash flow in the business and long-term, reduce the investment capacity of the firm to improve efficiency and innovate. The risk is to the profit margin, not turnover, of the firm and ultimately to the short- and long-term viability of the business. The change in the cost base needs to be passed on to customers through alterations in sales prices to fully reflect price increases (Leonard, 2003). The temporal and spatial differences in factor markets create the risk. Products are sold in international markets with prices determined through supply and demand but inputs are purchased through more decentralised, local markets (Clark, 1985). The market sales price does not necessarily reflect the local, firm specific, production cost which ultimately creates a profitability risk that rests with the producing firm.

The price risk is from the increase in structural cost, a combination of both energy price increases and volatility. Price increases make energy a critical area of cost competitiveness, whereas volatility creates competitive risks from the unpredictability of the cost component. The significance of price differentials is influenced by the context of the individual firm: the level of capitalisation, dependence on energy inputs and the firm's strategic capacity in both purchasing and contract structuring. The already low profitability and capitalisation in the industry make it difficult for IMP firms to sustain these structural cost increases for even a short period. The interaction of energy price volatility and the input-output contract structure of the firm generate *temporal*, rather than *spatial* variability in pricing that creates the risk (Clark, 1985).

Time is especially important in contractual relationships. During the early years of a five year contract, profit margins may be acceptable, but may be eroded towards the end of the contract. In addition, the composition of order structure changes over time. The cost structure the sales price was quoted on can become unprofitable, either directly or within the mix of output agreements (i.e. the blend of profitable and unprofitable).

The sequence of factor and product agreements increases the rigidity of the firms cost structure, leaving firms less able to reflect input costs accurately in output prices. As such, the risk from short term price changes becomes internalised into the firm and the reduced flexibility to adjust to them makes short term changes more detrimental to the firm (Clark, 1985; Gertler, 2003; Monk, 2008). Existing adjustments to long-term environmental changes, specifically increased international competition, accentuate the risk from temporal variation in input price. Fixed-price energy contracts continue to dominate in the IMP industry. However, the important point is that these contracts typically extend over a longer time period (2-5 years as opposed to 1 year). This is a long-term adjustment to energy price volatility. The output agreements in the industry have also adjusted overall towards lower volume orders in order to compete in the current global market place. This was exaggerated during the recession when schedule orders were dramatically reduced, and often stopped altogether, and replaced by short-term discrete orders. The increased mix of product order types (particularly from bespoke and prototype product orders) has given IMP firms wider scope to manage the synchronization of agreements. However, these are predominately repeat orders with existing customers where a price precedent and long term agreement has been established. As such, these short-term orders actually behave as longer-term schedule orders in terms of costing. Importantly, it is the interaction of long term strategic adjustments and short term environmental changes which create the energy risk for firms. Energy has become a more significant and fixed cost, the product output structure more complex, and, ultimately, the firm's flexibility to respond to changing prices is reduced by this contractual, and hence cost, rigidity.

The significance of the energy risk has meant that IMP firms have been forced to address it specifically, and independently, from wider aggregate cost base adjustments. The direct transfer of the additional energy cost to the customer base through surcharges is not established. Surcharges are a common method of transferring commodity price movements, both upwards and downwards, in the industrial sector. However, these conventions have not been yet been established for energy and the IMP industry is forced to make other adaptations to the increasing cost. These adaptations will be explored in the following section.

6.5 Firm Adaptations to the Energy Risk

IMP firms are experiencing an energy crisis with two elements: price increase and price volatility. Although these components have different implications to the cost base -price increases raise the relative importance of energy costs in the wider cost structure of firms and price volatility renders firms more vulnerable to price differentials compared with competitors - both elements of the energy crisis have a significant combined impact on enterprise cash flow and profit margins. It is this outcome, generated from price increases *and* volatility, which impacts on firm survival and to which firm strategies are targeted. The following section explores four broad strategic approaches for managing energy price risk that IMP firms have developed, which are outlined in Table 6.3: *Ostrich, Protectionist, Re-assert Competitive Advantage* and *Opportunistic*. Although differences in energy use have been identified between sub-industries, the strategic directions of firms are not necessarily reflected in these groupings and they are only highlighted where appropriate in the wider adjustment approaches. This classification outlines the principal approaches and it should be noted that the categories are not mutually exclusive. Different approaches have been adopted using different timescales and in conjunction with one another.

Table 6.3 Approaches to Energy Price Changes within the IMP Industries

Firm Approach		**Ostrich**	**Protection**	**Re-assert Competitive Advantage**	**Opportunistic**
Strategic tools		(1) Absorb additional cost from profit margin, cash reserves or short term credit facilities	(1) Fix costs through contractual agreements (2) Transfer price increases forward in supply chain	(1) Investment in efficiency measures to regain profit margin (2) Restructuring to take advantage of cheaper tariffs (3) Buying consortium to generate economies of scale when purchasing	(1) Actively manage energy markets through wholesale or flexible purchasing strategies to eliminate retailer premium and benefit from low price points (2) Actively manage pricing structure of segments of the customer base to achieve additional profit during energy price low points
Number of firms using strategy independently		**3**	**3** (1) 0 (2) 3	**8** (1) 7 (2) 3 (3) 2	**0**
Firm characteristics	*Firm size*	Small	Multiple sites, group purchasing activity	Varied size	
	Product type	Some IPR ownership		Bespoke manufacturers, small volume	
	Order structure	Subcontract order	Prominence of schedule order	Prominence of discrete orders	
	Dependency	High number of markets, stock management for customers	Stock management for customers, additional risk taken on during recession	Market dependency	
	Investment			Government schemes	

Table 6.4 Continued

Firm Approach		**Ostrich**	**Protection**	**Re-assert competitive advantage**	**Opportunistic**
Number of firms using as partial strategy		**17**	**19** (1) 10 (2) 12	**11** (1) 6 (2) 8 (3) 2	**4** (1) 1 (2) 3
Firm characteristics	*Product type*	Bespoke manufacture	Bespoke manufacture	Bespoke manufacturers, high export level	Bespoke manufacturers, value added components
	Dependency	High market dependency	High market dependency, additional risk taken on during recession	Market dependency, lower drop of orders in recession, no additional risk during recession	Market dependence, additional risk during recession
	Order structure	Prominence of discrete orders (mix with schedule orders), high number of formal agreements with main customers	Schedule order books (mix with discrete orders)		Mix of order types, use of formal agreements
	Investment			Continual investment	Little investment
	Finance structure	Overdraft	Invoice discounting	High cash reserves or credit available: credit (7), cash reserves(6), grants (5)	Financial stability: no borrowings, cash reserves and high profit levels

Source: Author (2012)

6.5.1 Ostrich[16] Approach

Under this approach firms take on the responsibility of price increases internally by absorbing alterations in prices through reducing profit margins on a contract-by-contract basis. Price increases can be substantial enough to eliminate the profit margin, in which case the product is sold at a loss and is subsidised through cash reserves or short term lending facilities, such as bank overdrafts. This was the initial response by all firms at the beginning of the current period of energy price escalation (around 2004). This short term solution is limited by the profit margin the firm can achieve, which has been continually eroded through competition with lower cost producers, and the availability of cash reserves or short term credit facilities. As a result, the *Ostrich* approach most commonly forms an initial and partial solution to energy price increases and fluctuations, with only three firms using this strategy in isolation.

The three cases where this approach was used in isolation have a distinct type of relationship and order type with their customer base - subcontract. Although the IMP industry consists of subcontract manufacturers for semi-finished components, the firms using this approach in isolation have an order structure predominately based on transactions with subcontractors that do not undertake further manufacture of the product and have pre-agreed deadlines, costings and specifications from their end customers. This is unlike the more typical product agreements where orders are from other manufacturers without a pre-agreed fixed end price. This contractual agreement impacted on the cost base of firms as:

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[16] The approach is termed Ostrich to reflect the common phrase of ‘bury your head in the sand’. The approach does not confront the energy risk and instead attempts to continue existing working practices without adjustment.

[a] lot of people we deal with have got product catalogues. Catalogue price are settled at the beginning of the year, you can't change [them] … We go back to the catalogue price. We go back to things that we've made for 13, 14 years at that set price, that are sold at that set price (Interviewee 1, Foundry SME 20 - Fabricator).

By fixing a price further up the supply chain, quite often through catalogue pricing, the IMP firm is unable to negotiate a price increase after a quotation is made. As a result, the firm is forced to absorb the increase and at best share this absorption with subcontractors. These firms are also found to be small, acting in a range of markets without a strong relationship with a particular customer as order values are relatively low and infrequent (Table 6.3). This lack of interdependence between transaction partners reduces the relative power the IMP firm has within the supplier-customer relationship as asset specificalities for particular customers are not developed (Sturgeon and Lee, 2001).

As energy price changes have become more consistent many firms have developed other strategic approaches. The price rise absorption approach remains common as a partial strategy for many firms (17, 38%). This approach is used as a temporary measure for short term and low price fluctuations and as a last resort for customers who will not accept price increases or as a partial response to customers when price negotiations occur. The strategy is used most commonly for small price fluctuations, below approximately 5%, which are difficult and time consuming to pass on to customers. Relatively small price increases are far harder to deal with and are most commonly absorbed by IMP firms:

…5% price increases customers expect us to soak it up. When it's massive actually the whole world just passes it on. So actually if … prices are going to

go up, go up by a lot once is an easier thing to manage than it is to say every year (Interviewee 1, Forge Large 1 - Fabricator).

Over time, the absorption of relatively small price rises can have a significant detrimental effect on the financial stability of firms as it erodes cash reserves and profitability (Markusen and Teitz, 1985). Working capital is reduced, ultimately reducing the capacity to invest in product and process innovations. Firms which engage with this approach in combination with others predominately do so to address the discrete order segment of their product agreement structure. A sale price is set for current factor prices, which is stable for the duration of the order because it only covers a short time period. As such, any miscalculations of factor price adjustments during this period will hopefully be small and IMP firms are forced to absorb these adjustments. As a result, the use of overdraft facilities is common in this group of firms as a means of coping with price changes. Restrictions on credit availability undermine the ability of IMP firms to cope with energy volatility; the mainstream banks are reluctant to lend to cover cash flow or working capital problems as such loans are considered to be relatively high risk transactions.

6.5.2 Protectionist Approach

The *Protectionist* approach attempts to retain profit margins on sales by ensuring output prices reflect input costs. There are two principal methods used to achieve this: by stabilizing energy price fluctuations and price increases during a given period through purchasing strategies and by transferring price increases to customers by price increase notifications or surcharge mechanisms.

Firms that used only this approach were involved in transferring price changes forward to their customers by surcharge mechanisms incorporated into schedule orders. In addition, IMP firms often took on additional responsibilities and risks for customers, particularly during the recession. This indicates a level of interdependence between customers and suppliers, which would generate additional power for the IMP firm to transfer price changes to customers because they were both invested in the relationship and therefore benefited from its continuation (Gereffi *et al.*, 2005; Sturgeon, 2002). Firms that were able to transfer the risk of energy price fluctuations were relatively powerful given their size (two were part of larger groups) and capabilities (one firm was the industry leader in a production process).

Firms that deployed this approach in combination with others did so through both transferring the risk of price fluctuation forward to customers and the strategic purchasing of fixed price energy contracts. Firms with a strong schedule ordering relationship with customers attempted to utilise formal contractual relationships by including regular price review points and a surcharge mechanism. An interviewee from a large forge noted that:

> *[t]he easiest way of doing it [passing costs forward] is to have regular review points against perhaps universally agreed indices or some other recognizable benchmark. For example, aluminium prices can be controlled by the LME [London Metal Exchange]. So some contracts have an agreement at intervals to measure what the LME was at the start of the contract and what it is at the rate point and if it's gone up pass an increase, if it's gone down pass the reduction through (Interviewee 1, Forge Large 3).*

IMP firms which were able to formalise the transfer of risk associated with price volatility had distinct capabilities which enhanced customer's dependency. All these firms had invested in technology and capabilities such as early stage manufacture and prototyping. Customer-supplier relationships had moved beyond the manufacture of one particular product under a schedule order, towards higher value customised products. IMP suppliers could use this dependence on their technical capability to improve the pricing structure on higher volume orders. The capabilities of suppliers increased their relative powerfulness in customer-supplier relationships (Gereffi *et al.*, 2005), although there are also other influences. Several firms (3) were the sole manufacturer of products, which created considerable client dependency; and one firm was engaged in 'helping out' the customer when it was experiencing a production crisis, which evoked a form of benevolence in the relationship (Sako, 1992) increasing supplier powerfulness. Significantly, not all these firms were large (50% were SME). As such, this highlights the complexity of the power asymmetries in the relationship, which extend beyond the capabilities of supplier firms and asset specificity.

The most common purchasing method (18 firms, 40%) was to fix energy prices over a given period, usually 2-3 years, in an attempt to limit potential price volatility risk by matching factor and product agreement timescales. An interviewee from a large foundry supplying aerospace components highlighted the difficulty of managing long term agreements with principal customers by using utility input supply contracts:

> *I mean we've tried to do contracts, [Aerospace OEM] won't do anything less than 5 years. We struggle a bit because we can't get any more than 3 years, on particularly our utility costs, electric and gas. So we've managed to tie ourselves down for 3 of the 5 … So worse case, yeah if everything went up we'd be a bit at risk but that's one of the problems we've got (Foundry SME 2-PLC group subsidiary).*

Firms taking this approach were characterised by having large proportions of schedule orders, which increases their vulnerability to temporal changes in factor prices. The use of invoice discount financing was common for such firms, which highlights a reliance on external credit for cash flow. Discount financing or factoring also reduces the firm's margins as there is an associated financing cost (interest charge). This implies the need to fix input costs as there is limited working capital to fund fluctuations in prices.

6.5.3 Re-asserting Competitive Advantage Approach

The approach attempts to generate efficiencies in production processes and purchasing activities to retain or improve the profitability of firms under existing product and factor prices. Firms internalise risks and manage it through offsetting price increases with a reduction in production costs. This reduces the firms' vulnerability to price volatility as energy accounts form a lower proportion of the firms' cost base. This approach is a long term strategy aimed at retaining and improving price competitiveness by maintaining a cost base in line with competitors and generating suitable profit margins. Firms that engage in this strategy do so through investment in energy efficiency measures, restructuring production processes to utilise utility cost advantages and through sophisticated purchasing methods including energy brokers, consultants and buying consortiums.

The *Re-assert Competitive Advantage* strategy is the most popular single approach (8 firms, 18%) and was predominately used by independent SMEs (7/8 firms). This highlights a significant power asymmetry between transaction partners based on the relative size of enterprises (Christopherson and Clark, 2007; Zabin, 1997). Independent SMEs cannot generate relative powerfulness from wider group ownership and as a result, the significant size and purchasing power of larger customers constrains the IMP firm's ability to transfer energy cost risk forward in the supply chain. Consequently, these firms are forced to internalise the risk of energy price changes and make alternative adjustments, such as utilisation of funding scheme for energy efficiency (5 firms used the Carbon Trust scheme).

Those firms which engaged in multiple strategies, of which *Re-Assert Competitive Advantage* was one, were characterized by significant continuous levels of investment throughout the production system. The ability to invest is critical to this approach. Firms using this strategy had a high level of available funds, either through cash reserves (6 firms), credit availability (7 firms) or grants (5 firms) and management teams interested in innovation combined with cost control. This group also had a high level of export based turnover. During the recession credit availability, primarily through invoice discounting or overdraft facilities, was favourable to exporting firms. As a result, the institutional context enabled exporting firms to make efficacy investments (Dorry, 2008). Government schemes intended to increase efficiency in industry were critical for SMEs in the sample. Such schemes were used to reduce energy use and ultimately improved profitability as firms were able to re-balance their cost structure (Bassi *et al.*, 2009). Larger IMP firms were less active in making direct energy efficiency investments during the study period, partially because they had previously made significant investments that would make any further investment less effective. Larger firms also had high levels of asset specificity, in both equipment and knowledge, which generated a degree of interdependence, power in client relationships and consequently were more successful in transferring energy price risk to customers (Gereffi *et al.*, 2005).

6.5.4 Opportunistic Approach

The final approach to energy price changes is far more embryonic and of a much smaller scale, with only four firms engaged in it (3/4 SME). Under this approach IMP firms actively manipulate the pricing structure of their customer base to generate additional profit by exploiting energy price volatility. By doing this for specific types of customers, those which are small and less powerful, IMP firms can supplement losses made from pricing structures with the remainder of their customer base. Dependent or less powerful customers are used to offset the IMP firms' inability to transfer price volatility to less dependent and more powerful customers. In the case of *Foundry SME 18*, a jobbing foundry, the firm was able to pass on energy price increases to its smaller customers but, importantly, the firm does not adjust prices when energy costs fall. This allows them to generate additional income from a small portion of its less powerful customer base. A representative from this firm noted that:

> *I think we all benefited a bit from [surcharges]… [For] my small customers, I just put the price up. Then I put it up again, put it up again, then again. With the bigger boys, when the surcharges come down they benefit. The small ones, they've not benefited at all. Because we've looked around and said well it will cost them more to move and go somewhere else. It's a bit naughty but umm its well, financial, commercial, you know, you've got to stay with it (Interviewee 1, Foundry SME 21).*

This firm is able to manipulate surcharges to its advantage but only with customers that have a dependent relationship with the firm. This represents a form of 'lock-in'. Small jobbing foundries have relative power over some of their clients. It is extremely costly and time consuming to transfer small batch production to another producer as the tooling is located at and tailored to a particular foundry. Consequently, smaller customers are highly dependent on a foundry and the foundry has a much stronger governing relationship (Gereffi *et al.*, 2005). Firms which do not provide specialised foundry-specific capacities and manufacture mass produced components are less able to generate this form of ‘lock-in’ relationship and consequently are less powerful in exploiting price change mechanisms. Larger clients will avoid such lock-in by spreading the production of parts between firms and playing providers off one another. Due to the limited use of this strategy, it does not generate very significant additional profit for IMP firms. By exploiting this dependence an IMP firm could undermine the financial stability of these customers, but these customers only form a small proportion of the customer base.

6.6 Adjustment through Evolving Relationships: Embedded Understandings, Power and Risk Transfer

The strategies undertaken by IMP firms towards managing the energy risk illustrate the key role of inter-firm agreements in influencing the capacity of firms to adjust. There is little distinct correlation between the relationship types identified in Chapter Five (Section 5.3.1: 188) and the adjustment approaches identified here. This is in part a result of the limited number of cases identified in each approach (due to data variability) but also because of the multiple approaches used by most IMP firms to manage energy risk. There is a correlation between the *Lock-In* and *Interdependent* approaches to low cost competition and the *Protectionist* and *Re-asset Competitive Advantage* approaches to energy price management. This is because these cases are based on formalised long term agreements (schedules and early development work), which IMP firms have used to incorporate price transfers and on which energy efficiency investments are based. Firms that use the *Lock-In* and *Interdependent* approaches have a limited customer base that has been nurtured to develop a 'close' relationship. As such, these firms are more vulnerable to energy price changes because they are in longer term relationships with their customers: both formal and informal agreements have an implied precedent that can be difficult to change. A smaller customer base results in more significant impacts from the absorption of price escalations through profit margin and, therefore, these firms have a tendency to undertake long term and more sustainable adjustments be reducing the dependency on energy costs (through efficiency and innovative purchasing methods in the *Protectionist* and *Re-asset Competitive Advantage* approaches). The significance of agreements in the approach to energy cost management is also indicated in the variety of approaches: governance structures implicit in forms of agreement and the strategic action of IMP firms in manipulating these agreements generate a range of relationship dynamics. There are two elements that underpin the role of relationships in managing energy risk; embedded understandings and transactional governance. These will be examined in turn.

6.6.1 Embeddedness in Institutional Practices and Places

The embedded understanding of the supply chain has played a critical part in determining 'industry norms' (Storper, 1997) and the capacity for firms to transfer price increases through inter-firm relationships. This is particularly highlighted through two instances: the acceptance of metal, and not energy, as a commodity input, and the capacity to forward larger, rather than smaller, price changes to customers. Traditionally, metal alloy and ingot prices have fluctuated (UK Steel, 2010) and, as a result, manufacturing industries have adapted to this process and surcharges are common practice. Relatively recent energy price fluctuations were less grounded in industry experience and contractual norms. Although energy prices have had periods of considerable increase, particularly during the 1970s, the relative stability of energy prices has resulted in the industry perceiving energy costs to be the domain of the supplier. As one interviewee explains, their customer base

> *…generally accepts that steel is totally beyond our control and therefore is more agreeable to accept the steel clauses [surcharges]…the steel side has been like that for many years … Energy, up until probably six, seven years ago maybe, eight years ago, not so much of a cost for consideration in that respect … and therefore, it has not got that embedded understanding within the customer base that there is going to be a price premium to pay for energy (Interviewee 1, Forge SME 4).*

The scale of price changes also illustrates the importance of the wider acceptance of the responsibility of input price increases. Smaller price increases are difficult to forward to customers and as a result they are usually absorbed by the IMP firm. For larger increases IMP firms are able to forward some of the price change as "…they're well flagged, so everybody in our industry knows about it" (*Forge SME 1 – Fabricator*) and "…the whole world just passes it on. So, actually, if raw material prices are going to go up, go up by a lot once is an easier thing to manage than it is to say every year" (*Forge Large 2 – Fabricator*). Energy is perceived by IMP customers as an internally controllable cost, whereas metal is perceived as a globally traded commodity with the individual firm having limited control of its price. The process of negotiation between IMP firms and their customers is to determine the extent to which the IMP firm, not the market, is responsible for energy price changes. The difficulty is that these expectations are embedded in working practices but also in contracts and terms and conditions. The assumption is that energy is a cost managed by IMP firms and it is this expectation that is being challenged in negotiations between IMP firms and their customers to adjust contractual terms. This challenge has led to new working relationships or forms of adaptation and may eventually transform energy into a risk that is shared between IMP firms and their customers.

6.6.2 Power and Transactional Governance

The adaptive approaches developed by IMP firms in response to energy price changes are entangled with governance influences from both transactional partners and the institutional setting of the IMP firm's geographical location. As a result, firms have developed and implemented a range of adjustments, which are most commonly used simultaneously to address specific elements of the firm's transactional relationships and financial stability. IMP firms are engaged with multiple value chains that reflect a mix of products and order types, and have multiple and varied customer-supplier relationships. This is highlighted by the ability of IMP firms to use specific approaches with different segments of their customer base. The ability to manipulate relationships with customers as a means of adapting to changing environmental conditions is influenced by power differentials in individual buyer-supplier relationships (Fuller and Lewis, 2002; Grimshaw and Rubery, 2005; Sturgeon *et al.*, 2008). In some instances IMP firms were able to transfer the risk of energy price increases forward in the supply chain to their customers through price increase notifications or more formal surcharge mechanisms.

Those firms which were able to transfer the energy risk to some customers did so through two types of powerfulness. The first results from the significant size or capability of the IMP firms, as was the case of those firms which used the price transfer mechanism independently or the *Opportunistic* approach. This form of structural power allows firms to exploit the dependence of other firms on the relationship (Fields, 2006; Zabin, 1997). The second, more complex, power negotiation is illustrated in instances where firms are able to transfer part of the energy risk to some of their customers. In these cases, the relative powerfulness of supplier firms is constructed through the types of order and agreements between transaction partners. Formal contractual agreements allowed supplier firms to negotiate a price change mechanism into the contract, however, where the power differential between customer and supplier firm is less clear, IMP firms often attempted to build upon informal relationships. An example from a large foundry describes how an informal relationship of trust and reputation can allow firms to manage energy cost increases more successfully than a purely formal contractual agreement:

> *[we] did put a one year delta [surcharge] against the contract based on the electric . . . Yeah it's, to be honest that was a pretty big favour on the basis we've got a very good relationship with them all, so … the T&C's [terms and conditions] would say no, they don't do that (Interviewee 1, Foundry SME 2 - PLC group subsidiary).*

The current recession amplified power differentials between firms by making firms generally more dependent on customers and therefore reduced the enforceability of formal contracts and power in negotiating informal agreements. With lower volumes and batch orders IMP firms could, in some cases, take advantage of their relative powerfulness as customers required smaller orders and were consequently more dependent on rapid, short order runs. This dynamic between power and trust as a governance structure is dependent on the context in which the relationship is situated (Grimshaw and Rubery, 2005; Rowley *et al.*, 2000; Sturgeon *et al.*, 2008). Time and timing is important and this was the case for the IMP industry with the onset of recession that was also combined with enhanced energy volatility. The power differentials in individual customer-supplier relationships not only vary between customers but also through the duration of contracts. Ongoing adjustments to changing market dynamics and international competitiveness have changed the nature of contracts and agreements. This illustrates the complex and dynamic nature of adjustment as an *ongoing* negotiation of risk and cost distribution between transaction partners.

6.6.3 Adjustment as a Negotiated Process: Transfer of the Energy Risk

Energy as a risk is influenced not just by the spatial differentiation in price between places but also the institutional setting, particularly the market structure and industry norms, *and* the active involvement of firm as strategic entities (Christopherson and Clark, 2007; Clark and Wójcik, 2003). Both transactional partners in the buyer-supplier relationship want to minimise their exposure to such risks and resist taking responsibility. The energy risk illustrates how this responsibility is determined through *independent* negotiations between the supplier and *each* customer, drawing on the specific relationship characteristics to determine who will accept the additional cost.

IMP firms have developed multiple strategic approaches to manage the energy risk. This is a direct result of the multiple relationships, and, hence, governance structures, in which the firm is engaged. This variety of governance regimes means that a single approach does not reduce the risks associated with alterations to energy prices. Instead, firms are forced to develop strategies which can minimise risk related to energy price changes by adjusting specific governance structures. It is this mix of governance structures which affects the stability and vulnerability of IMP firms.

Governance models in the literature focus on the ability of lead firms to transfer costs and risks to their suppliers (Gereffi *et al.*, 2005; Sturgeon and Lee, 2001; Sturgeon *et al.*, 2008). However, here attention is given to the *suppliers'* ability to transfer risks to *their* customers through specific transactional relationships; suppliers' play different roles depending on the type of customer – from lead to dependent, from a position of power to powerlessness. This draws attention to the complex nature of power differentials in transaction relationships, influenced by order structures, agreement types and the product portfolio of supplier firms. These more complex forms of governance have a significant effect on the adjustment processes of IMP firms and need to be more fully incorporated into conceptualisations of governance structures.

In many cases, IMP firm were unable to transfer price increases to customers: the risks associated with energy volatility still rests with the IMP firms. Several other attempts have been developed by the firms to offset this risk, such as investment in efficiency improvements and purchasing activity. Purchasing activity has generated additional risks through the mismatch of factor and product prices and also the increasingly complex purchasing activity undertaken to reduce risk through the introduction of more flexible contracts. Under this situation, the IMP industry continues to face a significant risk from the energy crisis. Sturgeon's (2002) modular model suggests that the development of increased supplier competencies dissipates the risk which is transferred from customers through governance structures. In this case, the risks faced by IMP firms continue to be experienced due to the influence of transactional and institutional governance structures on the adjustment options of firms. This mix of governance forms affects the adjustment options available to IMP firms, particularly as IMP firms have no direct end user market access, and, therefore, their stability and vulnerability to risks from the external environment, such as energy. From the history of metal price practices, it seems clear that adjustment processes will evolve into a more standard convention over time, however at the beginning of a new challenge in the supply chain environment the adjustment is far more complex and influenced by transactional partners as well as the IMP firm.

6.7 Summary: Costs, Relationships and Adjustment

The energy risk, from price increases and volatility, has had a significant effect on the profitability of IMP firms. Rising input prices have made production agreements with customers potentially unprofitable unless the IMP firm is able to adjust the nature of the agreement through its relationship with the customer. This short term environmental change has a substantial impact on both the short term viability of IMP firms, through reductions in profitability, and the long term survival, through reduced investment that threatens the competitiveness of the industry. The IMP industry's adjustment to increasing and volatile energy prices has illustrated the complex relationship between costs, competitiveness and adjustment. Two key following points can be made:

(1) Costs and competitiveness

The analysis here has highlighted the temporal variation in cost structures that comes from the distinct combination of input contracts and their interaction with output orders within the individual firm. Cost structures are *dynamic* and require fluidity in relationships with customers to allow firms to adjust to such changes in order for the firm to remain competitive. The transfer of price changes through customer relationships is only one aspect of adjusting to changing input prices as ultimately IMP firms will become uncompetitive if they continue to increase their sales prices. However, it does form a critical aspect, both in the short and long term, to allow the firm to manage such volatility. This interaction of input and output agreements generates a dynamic and firm specific relationship between cost and competitiveness, shaped by the strategic action of the IMP firm, its relationships with its customer base and their capacity to purchase inputs at the best price.

(2) Adjustment is a negotiated process

IMP firms have developed multiple strategic approaches to manage the energy risk. This is a direct result of the multiple governance structures acting on firms that are part of specific transactional relationships, with their associated power asymmetries, and the institutional constraints and enablers on firm activity. This variety of governance regimes means that a single approach does not reduce the risks associated with alterations to energy prices. Instead, firms are forced to develop strategies which can minimize risk related to energy price changes by adjusting specific governance structures. As a result, it is this mix of governance structures which affects the stability and vulnerability of IMP firms.

The cost structure of the firm is both fluid *and* rigid. Costs fluctuate from market prices, particularly in commodity inputs such as energy and metal, and the efficiency of the production process. However, there are also distinct periods of rigidity from contracts. Purchases and sales are based on specified prices, fixed under contractual agreement between transaction partners, for specified periods of time. The analysis here identifies distinct periods of path dependency in the IMP firm from utility contracts: the fixed energy contract produces a *time limited* period in which a contracted utility price can impact on firm performance. The contract generates a conditional environment in which the firm can respond based on prior decisions (David, 1985; Martin and Sunley, 2006), constraining the potential range of options (Kirk *et al.*, 2007; Vogel, 2005). Prior focus within economic geography has been on the long term ‘lock-in’ effects of path dependency in regional economies (Hudson, 2002; Martin, 2010a). In contrast, the path dependency identified here is temporally defined and generated from specific contracts. The temporality of this rigidity is limited – i.e. it ends when the contract ends. As such, this form of path dependence has a distinct element of change incorporated within it. A focus on change, as opposed to continuity, in path dependency has been suggested by Martin (2010) as a more useful conceptualisation in understanding the evolution of firms and places. The rigidity found in the contract structure has implications for the fluidity conception in networked production systems (Castells, 1996; Uzzi, 1996). Contracts introduce a temporally defined period of rigidity: path dependency during the contract but also the change prompted by the cessation of the contract. The contract form of agreement, a distinctive part of the relationships identified between IMP firms and their customers and suppliers, needs to be incorporated into the conceptions of firm relationships to provide a more nuanced understanding of a firms capacity to adjust.

This chapter has identified a central role of agreement structures in determining the ability of IMP firms to adjust to energy price risks by transferring price changes to their customers. The following section further examines the nature, use and impact of the range of inter-firm agreements used by IMP firms. The focus is on the form of customer agreements and the governance structures that they generate.

7 PRODUCTION ORGANISATION AND THE COMPLEXITY OF INTER-FIRM AGREEMENTS: CONTRACTS, TRUST AND PLACE

7.1 Introduction

Client-supplier relationships have been a key aspect of the capacity of IMP firms to adjust to increased international competition (Chapter Five) and changes in the cost base (Chapter Six). The structure of the agreement between transaction partners has been shown to be complex, with varied forms of sunk costs throughout the production process. Contracts have introduced forms of temporal rigidity in the adjustment practices of IMP firms from interdependency in value attainment (Chapter Five, Section 5.4: 210) and path dependency from energy purchases (Chapter Six, Section 6.4: 247). Contracts are thus a distinct form of coordination and governance within the supply chain of IMP firms.

Contractual agreements of all types – written and tacit - between transaction partners are a fundamental component of the organisation of production. All exchanges involve some form of explicit or implicit arrangement that reflects the nature of corporate relationships. The increased fracturing of production activities between different entities in the production system intensifies the use, complexity and significance of agreements in shaping the organisation of production. The role of relational agreements between transaction partners has been a focus of much research on GPNs (Hess, 2008; Hess and Coe, 2006), clusters (Dicken and

Malmberg, 2001; Maskell, 2001b) and upgrading (Humphrey and Schmitz, 2000) and draws attention to the importance of complex relationship structures based on trust and dependencies. However, the significance of formal contractual agreements has a less developed critique in economic geography, despite the prominence of market based transactions and legally based agreements in the management and marketing literatures (Beuve and Saussier, 2012; Hodgson, 2002). The role of contracts in inter-organisational agreements is varied. The transaction cost economies approach traditionally views contracts as a control method to remove the threat of opportunistic behaviour. However, the resource based view approach sees contracts as performing more of a coordination role in interdependent relationships to protect mutual benefit (Mellewigt *et al.*, 2007). Contracts are increasingly viewed as a supplement to relationally based agreements (Vlaar *et al.*, 2007; Woolthuis *et al.*, 2005), with trust *and* contracts integrated into complex and evolving agreement structures. Contracts are a continuing aspect of inter-firm agreements (Rusten and Bryson, 2010) and are shaped by the social context in which the relationship is developed (Woolthuis *et al.*, 2005). The use and nature of both explicit and implicit forms of agreement needs to be better conceptualised in the organisation of production within economic geography.

The subsequent analysis specifically examines the use, structure and impact of client-supplier agreements in the IMP industry. The previous empirical chapters have been based on an extensive examination of the industry. In contrast, the following analysis will be based on a sub-set of IMP firms and their agreements with primary customers. The details of these relationships are outlined in Table 7.1. The sample of cases was determined through analysis of the most significant and visible client-supplier relationships evident in the IMP sample (for further details see Chapter Three, section 3.4.3: 100). Five cases have been used as the primary source for this examination. These cases include interview data from both transaction partners: the IMP firm and its customer. The approach is used to explore the intricate details of agreements in each case and to allow comparison across cases. A more contextualised understanding, based on views from both transaction partners and in most cases (4/5) from multiple supplier interviews, is therefore generated. This provides an insight into why both parties enter into particular types of agreements and the benefits/difficulties of these relationship forms, thereby helping to breakdown the complexity of relationships identified in earlier analyses. In addition, the remainder of the IMP sample will be used to provide contextual evidence and aid comparison between cases.

This chapter specifically explores the complexity and use of agreement forms, their transformation and the influence of space and place in shaping such agreements. An overview of the types of explicit and implicit agreements used between clients and suppliers is presented. Following this, the structure of agreements is discussed and two additional elements of complexity are proposed; the organisational separation of trust within agreements and the dynamic nature of agreement structures. These features are used to understand how agreements influence the stability of the firm and their evolution over time through an examination of the mixture of agreements within the individual firm. A transition towards more formalised contractual structures is identified in firms undertaking more valuable and complex projects, where intellectual property requires significant protection for the competitive advantage of IMP customers. This evolution has generated a shift in the relationship between buyers and suppliers, with suppliers actually bearing additional risks transferred from their customer through certain types of agreement structure. The role of place and space is a key element in the shaping of agreements for distribution of and protection from risk. The chapter concludes by providing a short discussion on the wider significance of these findings and the relationship between contracts and trust in production organisation.

Table 7.1 Transactional Case Studies

Customer Firm	Supplier	Product/ Volume	Customer Significance *(proportion of turnover)*	Status	Employment Size of IMP Supplier	Agreement /Position	Agreement Type	Direct Investment
MNE - Aerospace Component Manufacturer	*Forge Large 3*	Non-critical/low	Non-major	None	550	Direct (multiple sites)	Global LTA[17] (large supplier for other customer plants)	
	Foundry SME 2 - PLC group subsidiary	Non-critical/low	Non-major	None	410	Direct	Local purchase order	
MNE - Automotive Component Manufacturer 1	*Forge SME 9 - SME group subsidiary*	Non-critical/high	Major	Sole supplier (sole supplier for other parts to other customer plants)	26	Agreement with UK site (production at Indian site)	Global LTA with purchase orders	
	Foundry Large 1	Non-critical/high	Minor		672	Direct	Global LTA	
Large Pump Manufacturer	*Foundry SME 21*	Prototype & pre-production/low	Primary (43%)	Strategic use	93	Direct (multiple sites)	LTA (two year agreement extended to three years)	
MNE -Power Generation Manufacturer	*Foundry SME 13*	Jobbing runs/low	Primary (18%)	Preferred supplier	43	Indirect (through machinist)	Short term contract (per product) agreement framework	
	Foundry SME 14	Jobbing runs/low	Primary (25%)	Preferred supplier	35	Indirect (through machinist)	Single orders in agreement framework	

[17] Long Term Agreements (LTAs) are formal agreements between transaction partners for an extended temporal period (usually three to five years).

Table 7.1 Continued

Customer Firm	Supplier	Product/ Volume	Customer Significance *(proportion of turnover)*	Status	Employment Size of IMP Supplier	Agreement/ Position	Agreement Type	Direct Investment
MNE - Automotive Component Manufacturer 2	*Forge SME 10*	Critical standardised & small amount of prototype/high	Primary (indirect)	None	73	Indirect (through machinist)	'Loose arrangements' with forecast schedule	Interest free loan
	Forge Large 1	Bespoke & non-critical/low & high	Non-primary	Preferred supplier	326	Direct	Annual negotiation under non-contracted agreement	
	Foundry SME 17	Prototype & pre-production/low	Primary (27%)	Development site	42	Direct	'Gentleman's agreement' for project work	Interest free loan
	Foundry SME 22	Critical/low	Primary (65%) (direct and indirect)	Preferred supplier	28	Indirect (through machinist)	Open purchase order with forecast schedule	
	Foundry SME 3	Critical/low	Non-primary	Preferred supplier	75	Direct	Single orders	

Source: Interview data (2009-10)

7.2 Agreement Structures Explored: Explicit and Implicit Inter-Firm Agreements

Agreements between firms in a supply chain can be complex and intricate, related to product specificity, volume of supply or level of knowledge exchange between the companies involved. To understand the structure of such agreements, an overview of generic agreement types found in both management and geographical literature is provided in Table 7.2 below. A distinction is made between two broad forms of agreement; implicit (tacit) and explicit (codified). Each type has a series of forms and commitment structures which determine the governance mechanisms used and levels of security provided to support transaction(s). The transaction is defined here as the trade between two parties. The agreement structure is defined as the overall relationship between firms that supports such transaction(s), which may involve tacit and codified elements.

Table 7.2 Agreement Structures

Agreement Basis	Agreement Forms	Definition	Commitment Structures*
Explicit	Integration	Unified administrative control	Common ownership of technology/design Financial ties (Helper, 1993)
	Obligatory contracting	Formal contract	Legal rules
Implicit	Relational contracting with incentives from self-interest – economic reciprocity	Tacit based	Dependence (Ruigrok and van Tulder, 1995; Sako, 1992) Reputation (Helper, 1993) Switching costs/asset specificity (Gereffi *et al.*, 2005) Tacit knowledge/learning (common understanding) (Lundvall, 1993)
	Relational contracting with loyalty as basis from trust – social reciprocity	Tacit based	Trust (Nooteboom, 2002; Sako, 1992) Mutually implied rules/social norms (Nooteboom, 2002)
	Dialogue exchange*	Progressive tacit based understanding	Evolved email exchange
	Network*	Tacit based associations	Loose ties (Granovetter, 1973) Firm inter-dependency (Håkansson and Johanson, 1993)

Source: Adapted from Nooteboom (Figure 4.2 2002:127) (own additions to the table)*

The implicit contract forms are based on a shared tacit understanding of expectations, behaviour and responsibilities between transaction partners. Trust is said to feature highly in these relational forms of agreement as a foundation for loyalty between partners and a sense of shared interest (Ettlinger, 2003; Hess, 2008). Nooteboom (2002) suggests that there are two forms of trust in implicit relationships; that based on incentives for economic self-interest, i.e. economic gain, or a form of strong trust where loyalty is the underlying aspiration. These forms have different commitment structures. Self-interest trust is based on an economic benefit of continuing an existing relationship where asset specificity, tacit based learning and reputational gain generate incentives to continue the relationship and a sense of interdependence to reduce costs, including transfer costs associated with finding another supplier. Much of the GPN literature has focussed on the role of sunk costs as a form of governance and stability between transaction partners. Specifically, dependency relationships from investment in asset specific equipment, skills or shared understandings between partners has been illustrated to generate a strong commitment, replacing more formalised obligatory agreement types (Gereffi *et al.*, 2005; Håkansson and Johanson, 1993) . A more moral understanding of trust is used as pure moral guidance where transaction partners act according to mutually implied rules and social norms. These ‘strong’ forms of trust are less empirically observed and have been identified by Nooteboom (2002) and Sako (1992) to be an extreme form in a continuum of trust based relationships. In addition to these types, an evolved understanding of the relational expectations and responsibility, for example through an email exchange or long trading relationship, can develop implied agreements or codes of behaviour which generate or underlie exchanges between transaction partners (Eccles, 1981). The enforcement of implicit agreements is done through the termination of the trading relationship and the portrayal of the firm's image to the wider industry (Baker *et al.*, 2002). These implied governance structures are generated by the firm itself and through their own trading patterns and relationships. Implicit contracts can easily become codified or transformed into explicit agreements through everyday practices, procedures and all forms of communication between both parties to the transaction. In many instances, terms of trade underpin a transaction and these reflect an explicit, although often un-negotiated, legally enforceable contract.

Explicit agreements are defined by the overt depiction of terms of trade through formalised, legally based agreement structures, which can include specific details of the transaction, responsibilities of transaction partners and repercussions of misconduct. Explicit agreement types include common ownership of product and obligatory formal contracts (Grossman and Hart, 1986). Shared ownership of product design or supply rights can be through vertical integration or bilateral intellectual property agreements, where firms may have either purchased design rights or been involved in joint product development. Formal contracts between independent firms identify specific terms and conditions of sale/purchase. Both forms are based on enforcement through legal mechanisms, which are external to the firm and outside the remit of firm control (Baker *et al.*, 2002; Hodgson, 2002; Williamson, 1979).

These agreement types are structured within transaction levels, outlined in Table 7.3, based on Sako (1992). Each level of transaction offers a different amount of commitment. The agreement structure may contain several of these transaction levels, and their associated levels of commitment, or can be based on a single type.

Framework agreements set the rules of the relationship where both parties agree to certain expectations, responsibilities and commitments. They can be industry specific 'norms' or more clearly identified frameworks of understanding. A framework order, or more commonly referred to as a schedule, is an outline of a long term order, with an element of both forecast and fixed orders within a given period. It is usually here where prices and terms are decided for the order as a whole- although these can sometimes be reviewed at set periods. Framework orders are used by purchasers to order set volumes of goods at set periods. Their commitment is for the entire order over the entire period, not for specific amounts at specific points of time within the contract. A calling off agreement is for a specific product, at a specific price, for a specific volume, over a specific period through a purchase order. Under an evolved exchange the transaction is gradually formulated through continued dialogue between partners. In these situations, the details of the agreement (such as terms of trade and penalties) are implied through a shared understanding of each partner's rights and responsibilities based on layers of previous transactions and dialogue (Sako, 1992). As such, the formal aspect of the agreement is weak (as few details are explicitly set) but the relationship it is built upon offers greater stability and security. Framework agreements can include aspects of both explicit and implicit agreements as they have often evolved through the trading relationship and encompass multiple elements (Eccles, 1981).

Table 7.3 Transaction Levels

Level of Transaction	Definition	Specific Agreement Forms
Framework agreement	Over-arching agreement that maintains a relationship – limited specific orders, prices or timelines	Bilateral agreement/industry norms/tacit
Framework order	Long term order –specific quantities over an extended timeline	Schedule
Calling off	Specific order with exact quantities and delivery dates	Purchase order
Evolved exchange	Development of tacit based agreement through layers of contact	Email exchange

Source: Adapted from Sako (1992:117-8)

There has been considerable investigation into the forms of agreement between transaction partners (for instance Grimshaw and Rubery, 2005; Mellewigt *et al.*, 2007; Woolthuis *et al.*, 2005), but much of this debate has been in marketing rather than economic geography. Despite this rich literature there are several key elements not fully represented; the role of obligatory and trust based agreements in a single transaction, the dynamism of agreement types and the role of place in forming the type and extent of inter-firm contracts. It is these processes which will be explored in the subsequent analysis.

7.3 Agreement Structures in the IMP Industry

The study has identified a range of agreement structures in place between IMP firms and their customers, which are identified in Table 7.4 below. The level of formality associated with these agreements differs, ranging between formal legal contracts to informal ‘handshake’ agreements based on a shared understanding of the responsibilities of transaction partners rather than a formalised statement. Each type of agreement will be discussed and their commitment structures identified.

Table 7.4 Types of Agreement in the IMP Industry

Contract	Definition	Forms of Contract	Number of Firms Using Contract for Primary Customers
Formal written contract	Range of timescales with additional responsibilities/ rights	Long term agreement (LTA) (greater than 1 yr) Short term agreement (less than 1 year)	5 large 5 SME 1 large 10 SME
Formal transaction agreement	Single order with only details of transaction/exchange of terms of trade	Purchase order	1 large 10 SME (all firms use within customer base)
Informal agreement	Range of timescales and detail of what is included but is not signed	Gentleman's agreement Loose agreement	1 large 10 SME
Sunk costs	Existing investments in place	Tooling	All

Source: Interview data (2009-10)

7.3.1 Tacit: Handshake Agreements

Informal agreements are common in the IMP industry with one third of firms (11/33 who responded to the survey) utilising them with their main customers. The informality was conceptualised as not signing a contract or agreement and instead developing an understanding of the performance criteria and responsibilities of both transaction partners. Under informal agreements existing investments in equipment and knowledge become strong commitment structures that replace more explicit commitments made in formal contracts (Baker *et al.*, 2002). The equipment required to produce components for sale are customer and product specific and as such, generate a form of commitment or lock-in instead of a formal contract. The investments generated from set up costs, such as tooling requirements, have implied contractual criteria, such as a shared understanding of the performance, terms, and offer of sale. It is also the case that the agreement develops on the basis of experience or performance and may commence with a simple transaction governed by established terms of trade, as one interviewee explains:

> *It's, it's, you use the word contract, it's not as though 'you will supply that for twelve months', it's, really their contract with us is, we've got their tooling, they own the tooling, they give us a month's order, maybe they've got two months firm on order. So there's a commitment to take some stock, you know, for the future if it's a long lead time (Interviewee 1, Foundry SME 3).*

In this example the sunk costs act as a long term commitment between the transaction partners - to order from that particular supplier (by placing tooling with them) and to meet orders from customers (by storing equipment on site with the suppliers). In the majority of cases, there is inevitably multiple sourcing of these products by the customer. However, by retaining tooling at the supplier's site both parties are actively committed to the relationship, with or without orders placed. In this sense, the sunk costs act as an informal agreement framework between parties that generates a relationship based on trust of reciprocal benefit in maintaining the trading relationship**.** The structure of the trading relationship, such as infrequent batch orders or the life cycle of the product, also establishes an implied commitment between transaction partners through sunk costs as they can generate cost efficiencies in maintaining the existing relationship (Chapter Five, Section 5.2).

The use of tacit based agreements is common in smaller IMP firms because of the nature of the product and trading process (infrequent but repeat orders) and the limited resources available to the firm to generate and enforce more formalised contracts. Although the same commitment structures are in place with larger firms, the consequential higher volume of orders means that it is more likely the product is dual sourced and a formal agreement is in place. This replaces the security from the commitment structure (tooling) with explicit forms of commitment. The capacity to engage in legal discussions is often restricted in smaller firms that do not have adequate legal knowledge within the firm or the available funds to engage external expertise. As such, smaller firms can be at a considerable disadvantage in determining the implications of such formal contracts and their relative vulnerability. Formal contracts often have additional restrictions imposed on suppliers, which can increase the supplier's dependency on key customers because of the additional performance conditions established through the contract. One interviewee from a mid-volume foundry highlighted the additional criteria the supplier is forced to meet to secure a long term contract with their customer:

> *There are some what are called LTAs, long term agreements… some people do enter into those, I don't . . . and the reason I don't is because they are always very one way. So the customer says 'oh we'll give you an LTA agreement for 3 years', and we think 'oh that sounds good, get guaranteed business for 3 years', 'but we want, you've got to reduce your prices by 5% a year and if you let us down we're going to throw the agreement away, or if we can find a more competitive supplier'. ….And there's other reasons for that [not engaging in LTAs], other than just being sort of maverick; one is that all of our customers have got competitors and most long term agreements have, they either discourage you to supply competitors or you're outright not allowed to supply competitors (Interviewee 1, Foundry Large 2).*

By promoting the suppliers dependency on the customer through formalising a long term sale the customer is able to enforce additional requirements, such as price reductions, and enact an implied power asymmetry through this dependency. From the suppliers perspective informal agreements can actually provide protection to the firm specifically because of their ‘looseness’, which can enhance the suppliers negotiating power, as an interviewee in a mid-high volume forge illustrates:

> *So you have to buy the material with an expectation you’re going to supply for six months. And they [the customer] simply cancelled one day. And we’re left with x thousand pounds worth of product they no longer need. We asked the question why did you not tell us? ‘Well it’s a mistake in the business’. So what are you going to do about it? ‘Nothing, we go back to our schedule’. So they hide behind the schedule. And I say, well ok, I will now only buy to your schedule. And they say, ‘well what does that mean?’ Well it means I’m not going to supply you. ‘Well that’s no good, we need to discuss that’. Then it gets all lost and loose (Interviewee 2, Forge SME 10).*

As the agreement criteria had not been fully disclosed and both parties were working towards implied understandings through the schedule order, the supplier is able to negotiate the stoppage of the schedule. By purchasing inputs directly related to the customers schedule they are not breaking any agreement, despite it being disruptive to the customer. The threat of disruption to the customer’s production system generates negotiating power for the supplier and both parties work towards a more amicable solution.

The value of building a relationship with suppliers is discussed by two of the case study customers. *MNE Automotive Component Manufacturer 2’s* approach is interesting as they suggest that they actively collaborate with their suppliers and work in partnership, as the interviewee explains below:

> *… we are not an aggressive purchasing organisation, we want to work in partnership with our suppliers, we want to collaborate with our suppliers. Of course you have to negotiate with your suppliers so you have to find a way you can get a win-win. You don’t want to have a set of suppliers who are on the edge of bankruptcy or you can’t invest so you’ve got to look at it in the*

> *whole, you've got to look at it and understand the value you're getting from that (MNE Automotive Component Manufacturer 2).*

The perception of a supplier's value and position in the supply chain that is outlined above is disputed by one of their direct suppliers. *Forge SME 10* views their relationship as based entirely on price, with little recognition of the long standing relationship which has developed:

> *[MNE Automotive Component Manufacturer 2], its facility has been supplied for seven years. They will cancel their order tomorrow ...the relationship can be destroyed in a day…It's all about price. … [W]e sell [a component] to [them]….that's [worth] £30 on two thousand [pounds of the value of the total product]. If they had them free it wouldn't save them anything. But they would quite happily destroy your business to get a tick in their strategy box for savings (Interviewee 2, Forge SME 10).*

In another case, *MNE Aerospace Component Manufacturer* highlight the importance of developing a relationship with their customers, particularly in the current recession where orders have become more difficult to generate and require shorter lead time, the value of loyal and trustworthy suppliers have become more critical to the organisation. However, whilst the interviewee is describing the value of such a relationship they go on to explicitly illustrate through an attempted price increase from a long standing supplier, who is affectionately called 'Uncle [name]', how the trust-based relationship is actually formally benchmarked to test the validity of the supplier's claims about increases in their cost base. In this case the notion of building a relationship with their supply base is actually to generate increased customer power and significance to the supplier (by increasing their purchasing weight), as the customer actually purchases very low volume, infrequent orders and "…through necessity we have to work with our suppliers” (*MNE Aerospace Component Manufacturer*).

Both examples illustrate how relationships between buyers-suppliers are not based on the ‘strong’ notion of trust, to paraphrase Nooteboom (2002). In these examples relationships, and the implied trust between transaction partners, is utilised by firms for economic gain as suggested by Orderud’s (2007) examination of the Norwegian building sector. Cost remains a critical element in the success of a proposed transaction and relationships are built to support profit maximisation and generate additional influence in situations where more direct forms of power, such as value of spend or ownership rights, do not generate dependency from the supplier. Forms of dependency may be more important with buyers having limited options other than purchasing goods from their existing IMP suppliers. In many instances the suppliers may be less dependent than their customers on maintaining the relationship in the immediate term.

Firm size does not necessarily generate power either, illustrated clearly by the opposing governance mechanisms of the two sister plants of the same customer MNE. *MNE Automotive Component Manufacturer 2* used only direct forms of governance, specifically contract clauses, audits and cost reduction targets. Whereas, *MNE Aerospace Component Manufacturer*, with the same formal contract with its suppliers, utilised indirect governance mechanisms based on knowledge transfer, benchmarking and supplier status. Here, trust is enacted between buyer-supplier to support profit maximisation. Trust is used as a governance mechanism to generate relative power over a supplier, however, only in certain situations where direct forms of influence from supplier dependency are not available.

These examples illustrate that informal agreements are influenced by a range of factors and not limited to dependency or trust. Dependency between transaction partners is a key element, as suggested by relational approaches to GPN (Dicken *et al.*, 2001; Gereffi *et al.*, 2005), but this is influenced by historical relationships and the scale of production. Dependency from sunk costs (both physical and relational) is again highlighted as central elements in shaping the nature of the IMP-client relationship (Chapter Five, section 5.2.1). However, the agreement is also influenced by past trading and the evolution of the agreement framework within which sunk costs form one type of commitment structure. Larger firms tend to have the same informal commitments but this is often (4/5 cases) supplemented with an additional formal element. Trust is based on generating profitable trading relationships and strengthening the customer's position in the relationship, as opposed to inter-personal loyalty (Ettlinger, 2003). The following section will examine how explicit forms of agreement are used in the industry and the implications for conceptions of inter-firm relationships.

7.3.2 Formal Agreements: LTAs and Purchase Orders

Formal agreements are found in two types: long term agreements (over one year, with or without a draw off period) and short term purchase orders (for specific quantities of a given product over a specific period). The LTAs are primarily found in large IMP firms and with primary customers (4/5 firms), where large values are spent, as a means of legalising investment commitments. By contrast, purchase orders, despite being formal documents, are used by the majority of firms and mostly for secondary customers. These are also common for IMP firms that undertake batch production (jobbers), where volumes are infrequent and products changeable.

The formality of the agreement in both cases (LTA and purchase orders) differs somewhat on the type of product and the intricacies of the trading relationship. Basic formal agreements include a standard set of terms and conditions about terms of trading and transaction details. The negotiation of these terms is sometimes only implied as when "… purchase orders [are sent] out they have our [customers] terms and conditions on the back. Now, if a supplier confirms your order and has their terms and conditions on the back of their confirmation, theirs apply. Because it's as simple as the last piece of paper that changes hands" *(Multinational Aerospace Component Manufacturer)*. Under long term agreements, the formalisation of trading terms and specific contractual requirements is far more explicit and involves clear identification of additional responsibilities and restrictions. The depth of agreement is a reflection of the additional investments involved in LTAs (by both sides) in terms of retained capacity, price advantages and shared understanding. The obvious time and financial cost to generating these agreements means they are only used when it is justified by the level of security required by the customer, such as continuous production capacity, quality levels or prevention of illegal copying.

These agreement structures are often used separately to match the volume and product type being ordered- purchase order for one-off simple trades and LTAs for long term strategic relationships. However, they can be combined to provide an additional enforcement ability (through LTA and its added demands) whilst also reducing commitment by using purchase orders for specific components of the order. *MNE Power Generation Manufacturer* used this structure with two of the IMP firms in the study. A long term agreement framework was set up to formalise an understanding of the responsibility of the supplier and to maintain response time and service (key requirements of the customer's competitiveness). This has ensured a level of capacity is retained by the supplier and the supplier is aware of the trading terms and product requirements. From this understanding the customer was then able to purchase as and when required, knowing that the commitment from the supplier is prearranged. Here, formality in agreements was used to generate specific levels of commitment, and therefore the required level of security or separation for the customer firm.

In fact, only one large IMP supplier had an informal agreement with either its primary or five main customers (based on value), whereas ten SME suppliers had such agreements. There is a prominence of low value customer spends associated with informal agreements, with eight of the SMEs the customer represented below 30% of their turnover (five represent <10% of turnover, three between 20-30%), and in the case of the large IMP firm, the customer represented only 20% of turnover (in comparison to 27-50% of the other large IMP firm transactions). However, the proportion of spend, or the dependency of the IMP firm on its customer, cannot be the only factor in determining the level of formality of transactions as the difference between proportions of turnover are relatively small in some cases (a difference of only 7% between those firms with LTAs and those with informal agreements). Higher dependencies were also found in both SME and large firms in buyer-supplier agreements in various other forms. This could reflect resources available to large firms to have procurement professionals able to manage contracts but the nature of agreement is most often determined by the customer and irrespective of the suppliers ability to 'handle' a contract.

The agreement structure also seems closely related to the type of product manufactured and the firm's relative strategic importance to the customer. Those SMEs with LTAs all provided additional services to the customer such as logistics support, design involvement or new product manufacture, all of which generated a form of reliance on the supplier from the customer. As such, customers were keen to formally tie the supplier to them and secure their supply. The SMEs with informal agreement structures were predominately (8/10 firms) low volume and jobbing manufacturers not engaged in development work. However, the large IMP firm which has informal agreement structures with its main and primary customers was of key strategic importance to its customers. Here it is interesting to understand why this firm has not engaged in LTAs with its customer base despite this significance. *Foundry Large 2* has developed a strong informal relationship with the end manufacturer, a large MNE. The IMP firm actually directly supplies a second tier manufacturer but, because of having this relationship with the end manufacturer, the end manufacturer has stipulated that the second tier purchase off the IMP firm. Under this situation, the informal relationship with the end user provides security and therefore the firm does not need to secure its relationship with the direct customer in a formal agreement

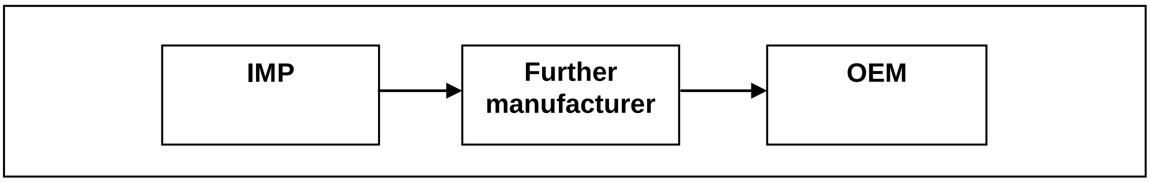
The range of agreement types used in the industry highlight some interesting points about inter-organisational relationships. Firstly, different types of agreements are used for different purposes, as the purpose changes the relationship is left with a history of relationship structures that can influence the overall dynamic and organisational structure of the relationship (Vlaar *et al.*, 2007). The varied and multiple forms of agreement used have different levels of commitment and separation, which are used strategically by both transaction partners. Dependency is only one form of commitment within the relationships and its function is influenced by other aspects of the relationship –strategic importance and layers of agreements. Secondly, the interaction of trust and contractual forms of agreement is multifaceted. Explicit formal agreements are a fundamental element of IMP-client agreements. Purchase orders are a simple form of explicit contract, based on specified commitments and obligations, with implied terms of trade. Long term contracts are far more complex, with an explicit outline of obligations that are actively acknowledged through the 'signing of the contract'. Implicit agreements, particularly those based on asset specificity and prior trading relationships, are evident across the IMP industry however these often interact with additional agreements structures. IMP-client relationships include aspects of *both* implicit and explicit governance.

Frameworks of agreements and dual use of formal and implicit ties generate a more complex structure to inter-firm relationships that changes over time. A critical departure from current conceptions of inter-firm relationships in economic geography is the prominent role of formal agreements between buyers and suppliers. It has been suggested that formal agreements are superseded by dependency relationships, where the need to collaborate – and the investment from this – removes the need for legally based agreements and instead implicit agreements based around a tacit relationships are the primary form of governance (Gereffi *et al.*, 2005; Herrigel, 2010; Sturgeon and Lee, 2001). The loose ties argument, based on the assumption that strong connections between firms generate a form of rigidity and negatively impact the performance of firms (Grabher, 1993; Rowley *et al.*, 2000), is not found in the IMP industry. The evolution of the relationship incorporates both loose and strong forms of inter-firm relationship and the explicit framework agreements actually provide some flexibility within a legal structure. To further explore the role of formality in IMP agreements, the following section will breakdown the agreement structures and specifically examine the complexity and dynamism evident in IMP-client relationships.

7.4 Mapping Inter-Firm Agreements

Mapping of inter-firm relationships has traditionally been based on the division and subcontract of production activities between firms, as shown in Figure 7.1. There has been a tendency to equate agreement structures between firms as either a formal contractual or informal trust based relationship. Although these simple structures are present in the study firms, the agreement structures identified illustrate a far greater complexity of inter-firm relationships than a ‘one or the other’ classification or a static link (Taylor, 2006). This form of agreement structure has implications for the governance and division of risk and responsibility between firms within a production network. Therefore, it is critical to understand their form, use and stability in order to assess the consequences for IMP firms.

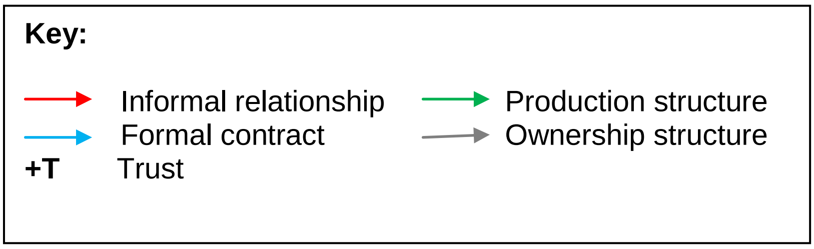
Figure 7.1 Standard Subcontract Relationship



Source: Author (2012)

The types of buyer-supplier agreement structures will be illustrated through a series of diagrams where the components of the agreement are broken down. This is to demonstrate the complexity of inter-firm agreements and the specific constructions of the component parts: product supply, transaction and relationship. Where trust is specifically used as a relationship component it will be demonstrated by **+T** (Figure 7.2).

Figure 7.2 Key for All Diagrams



7.4.1 Fracturing Inter-Firm Agreements: Networks of Production, Contracts and Relationships

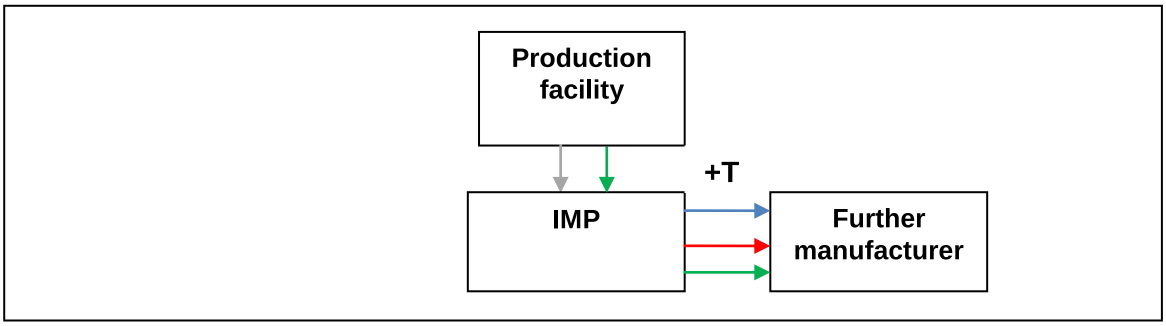
The study has identified three types of separation of the relationship and contract in buyer-supplier agreements: subcontract manufacture, multisite agreements and direct end-user relationships (Figure 7.3, Figure 7.4, Figure 7.5 respectively). The types of separation are based on analysis of production agreements between the IMP firm and the end manufacturer. Each form will be discussed and the reasons for its use identified.

Type 1: Subcontract of manufacture

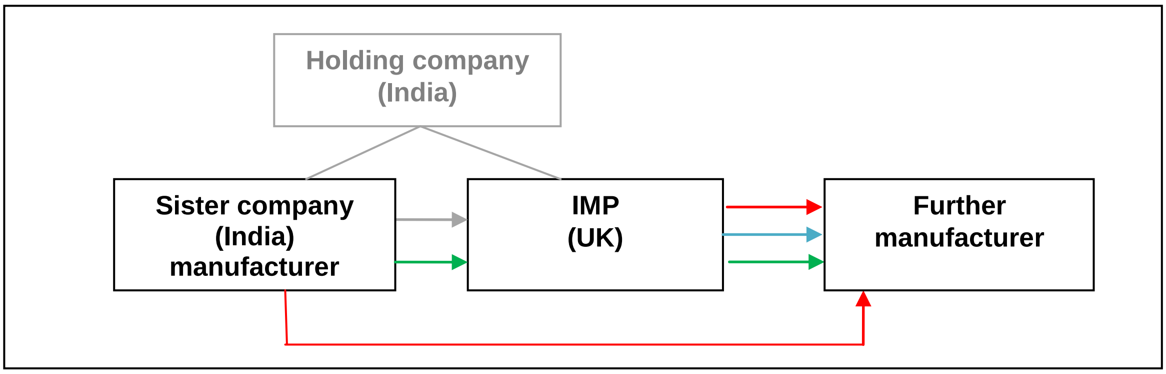
Under this agreement structure the IMP firm acts as a ‘factorer’ of products, where by the purchase agreement is agreed with a UK based IMP who then purchases the product from other suppliers which are usually based in low cost production region, illustrated in Figure 7.3a. This arrangement is used for two fundamental reasons: (1) to reduce cost (thereby the UK IMP can continue to supply products at an internationally competitive rate) and (2) to generate additional services for the customer. These services include the logistical management of distance supply, the maintenance of a backup emergency production facility (the UK site) and the ability to source both low and high skill products through a single supplier. This allows the customer to rationalise its supply base with the use of only first tier suppliers and reduce its exposure to risk from changes in demand (extended lead times from low cost suppliers reduce the flexibility in adjusting demand).

Figure 7.3 Subcontract relationships

(a) Product factoring relationship



(b) Case study relationship: MNE Automotive Component Manufacturer 2 and Forge SME 9-SME group subsidiary



Source: Author (2012)

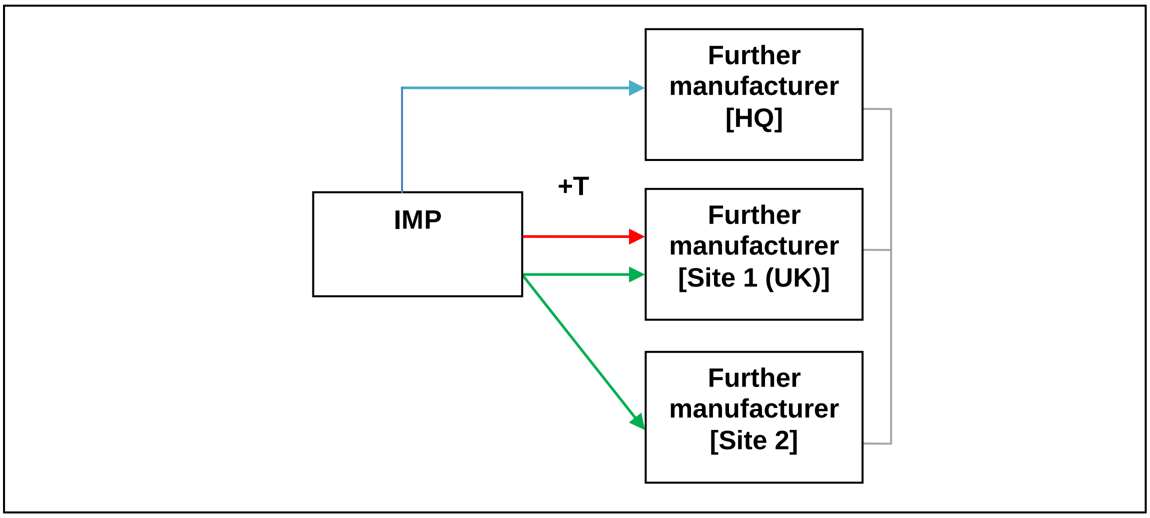
This agreement structure is used by five IMP (SME) firms, all of which have been proactive in identifying low cost producers themselves, either pre-empting customer price reduction demands or in response to them. The arrangements with the low cost producers range from shared ownership, partnerships or factoring through intermediaries in the low cost regions. A clear illustration of this type of agreement is Figure 7.3b which illustrates a factoring relationship between *MNE Automotive Component Manufacturer 2* and *Forge SME 9-SME group subsidiary*. The relationship with the UK plant was long standing and the UK site has historically manufactured the components for them. However, the customer encouraged the IMP firm to source from a low cost country to reduce costs. This was actually part of the IMP firm's long term plan and as such they found an Indian based manufacturer to purchase the UK site in order to establish a production system whereby high volume work would be manufactured at the Indian site and bespoke or emergency products manufactured at the UK site. The UK site would also manage the logistics of such a production system.

Under this type of production agreement the IMP firm is able to continue supplying products which would be not be economically feasible to produce in a high cost location, i.e. low cost products, by taking a service charge for the sourcing responsibility. In addition, by maintaining this supply the customer is more likely to use the IMP firm to produce higher value products where a price premium can be charged (e.g. emergency runs and bespoke products). All IMP firms who engage in factoring have achieved additional revenue streams from it. However, this service also generates additional responsibilities to manage distance sourcing. This is the particular advantage for the customer firm, who can engage in value sourcing without the risks attached to it by paying an IMP firm to provide contingency production capacity, to stock purchased supply and manage inventory. The costs associated with these services are undertaken by the IMP firm through the service charge and price premium on the associated products. The IMP firm is willing to undertake these additional services because of a prior trading relationship and the development of a tacit, trust based relationship. In return, the customer does not undertake sourcing themselves because they trust the supplier to effectively, and more efficiently, undertake the task themselves. This generates a distinct spatial relationship structure. Although production subcontracts are taken with firms located overseas, the tacit relationship remains with the UK site.

Type 2: Breakup of product supply, contract and relationship in a customer company

The second agreement structure identified in the study is that used to supply multiple sites of a customer organisation. In this situation the relationship is maintained with a single site, usually the initial contract holder based in the UK, whilst production is undertaken to supply several other sites for the customer, either nationally or internationally, as illustrated in Figure 7.4. Nine firms were found to be engaged in this production system, all of which maintained a tacit based relationship with the original UK contract site only. These firms were of strategic significance to their customers, either due to the volume of spend by the customer or their distinct capabilities. By locking suppliers into supply relationships with several sites the customer is able to increase its influencing ability with the supplier by increasing their order volume and therefore the supplier’s relative dependence on them. It also allows the customer to retain a smaller set of key suppliers with whom it has a level of dependence with.

Figure 7.4 Multisite Production Relationships



Source: Author (2012)

In this situation 'global' agreements are common. This is where a formalised contract is in place between the IMP supplier and the customer as a whole (i.e. the head office), stipulating the general terms of trade, rights and responsibilities held by both transaction partners. This makes the process particularly time consuming and expensive, which again restricts the number of instances in which it is used. Purchasing under these agreements is carried out at a group scale. By centralising the customers purchasing activity the customer increases the relative weight of its purchasing power. Under these agreements the customer can enact a more direct form of governance over price reductions, trading terms and increased displacement of risk onto the IMP firm. The 'global' agreement highlights the divergence between contracts and relationships in agreement structures, as the individual customer site does not necessarily develop a relationship (i.e. trust) with the supplier. Two examples of case study relationships which use global agreements will be used here to illustrate this point. *MNE Power Generation manufacturer* utilises a local agreement (i.e. between the IMP firm and one customer plant) that is tailored to the specific circumstances of the transaction. Under a localised agreement there is less consistency or formalisation of agreement and relationships and transactions are closely related. Although *MNE Power Generation manufacturer* utilise their global presence for negotiating power, its use reflects the nature of the specific buyer-supplier relationship which is based on a level of respect between transaction partners.

In the second example *MNE Aerospace Component Manufacturer* also use global agreements to generate a more powerful position over their supplier when ordering a relatively low value of product. However, in this case the customer was unable to enact the instilled power asymmetry from a global agreement because it did not have an associated relationship with the supplier, unlike its sister plant:

> *So there are benefits of going with those suppliers [already in a global agreement with the company], as in you can drop the 'we spend £6m a year with you'. So it can help in one respect but then the flip side of that, if that supplier has got a problem because their machine's down and I'm chasing my one bit and [sister site] are chasing their £6m worth of bits, my bit keeps going to the bottom of the pile (Multinational Aerospace Component Manufacturer).*

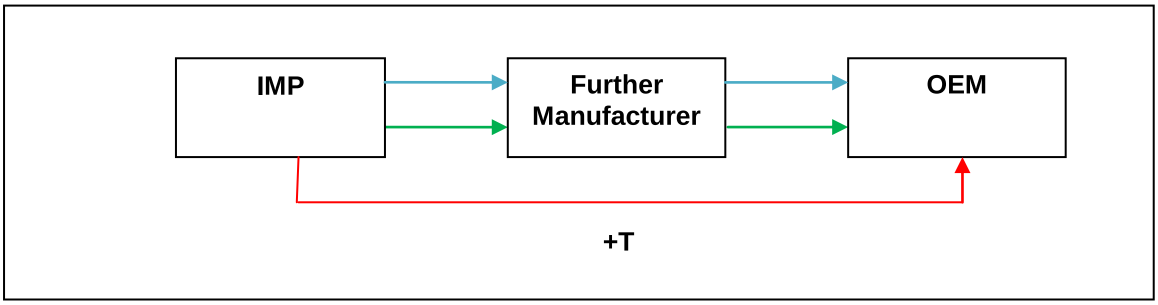
Here the supplier is protecting its dependence on the main customer plant. Although the global agreement is the same between the IMP firm and both customer sites, the IMP firm has a tacit based relationships with the main customer plant that has evolved through a historical trading relationship and interdependence from the significance of the customer spend. This informal relationship acts as a driver of power dynamics, not the agreement itself. On its own the global agreement was not enough to induce the IMP firm to give preferential treatment to the customer site with a lower, and more infrequent, spend.

Both examples illustrate the use of different forms of governance over suppliers based on the management preferences at individual sites and the specificities of order/product. However, both examples required a tacit based relationship to enact the power asymmetries generated through global agreements.

Type 3: Direct end user relationship

The third type of agreement structured identified in the study is the separation of contract and relationship within the supply chain. Here contracts or formal production-payment relationships are maintained through the supply chain between direct transaction partners (i.e. IMP firm to further manufacturer, further manufacturer to end manufacturer), as shown in Figure 7.5. However, relationships are developed between non-direct transaction partners (i.e. IMP and end manufacturer). This is different to Type 1 in that the tacit relationship is with the end user (and may in fact skip several levels in the supply chain) and also the tacit relationship and transaction are separate (in Type 1 these elements were maintained together, with production subcontracted from the IMP firm under a new transaction). This separation of contract and relationship has been identified in six of the IMP firms and two of the transactional case studies. Under these situations, the IMP firm already has some form of relationship with the end manufacturer, either through historic trading, product development or networking. The end manufacturer actively either installs a formal tiered supply chain or adjusts the existing supply chain to reduce their risk and liability within the production chain, whilst maintaining a tacit relationship with sub-tiered firms.

Figure 7.5 Direct End-User Relationships



Source: Author (2012)

Relationship structures such as these are utilised to formalise where in the supply chain liabilities and responsibilities lie. By having a nominal contract with the direct customer the financial and legal responsibilities remain with the direct customer, not the end manufacturer. As one interviewee points out, this technique is instigated by the end manufacturer, utilising their influence to direct supplier purchasing patterns rather than engage in direct transactions with the IMP firms:

> *…the design of the shape [the end manufacturer] are looking to create comes from the foundry. So the end customer [end manufacturer]…'that foundry can make that kind of shape, …[b]ut we actually need to machine it or do this to it, and that company, they're the experts at that, so what we'll do is we'll tell that company to buy that because we need the shape J and they're going to do some added value'. And then what they try and do is force a tiering relationship, where they try and get … the machinist [to] be responsible for purchasing the castings. But it never works because the foundry always end up talking direct … to [the end manufacturer] (Interviewee 1, Foundry Large 2).*

The IMP supplier firm can be vulnerable under this type of structure because the transactional, and theoretically legally binding trade relationship, is with the further manufacturer, who are predominately other SME manufacturers with less financial stability than the large end manufacturers. An example of this is *Foundry SME 1-fabricator* who suffered an unpaid debt by its direct customer after this type of forced tiering relationship had been established. The IMP firm felt that their long standing trading relationship would evoke a sense of responsibility from the end manufacturer, despite the formalised trading relationship being between the two local intermediate manufacturers. The tiered relationship allowed the end manufacturer to transfer payment liability to the further manufacturer. The existing relationship and trust between the IMP firm and the end manufacturer did not provide any protection to the IMP firm.

What is interesting in both examples is the ability of the end manufacturer to establish a tiered agreement structure whilst maintaining the ability to influence decisions within the supply chain without a direct and formalised relationship. The influencing ability of the end manufacturers is enacted through the maintenance of a tacit based relationship with IMP firms. They have no other form of direct relationship, unlike in Type 1 and 2. By separating the relationship, or tacit, element of the agreement from the formal transaction, the end manufacturer is able to reduce its own liabilities whilst retaining influencing ability over suppliers. The majority of IMP firms (5/6) have attempted to protect themselves from this loss of security in the transaction by building a tacit relationship with the end manufacturer in return.

The three examples illustrate how inter-firm relationships have multiple elements (trust and agreements) and that these elements are often organisationally, and sometimes spatially, separated. This illustrates another level of complexity evident in inter-firm agreements: tacit and formal agreements interact within one agreement structure to generate specific advantages, primarily for the customer. The separation of trust and formal agreements allows firms to more easily distribute risk. The location of trust (both organisationally and spatially) is a key element of this. The maintenance of trust provides a form of governance without legal responsibilities. The next section will examine how these structures change over time and draw conclusions for the implications of both complexity and dynamism in inter-firm agreements.

7.4.2 Dynamic Structures: Evolving Agreements and Recessionary Adjustment

The agreement structures identified in the study were subject to change and adjusted through the evolving nature of inter-firm relationships. The nature of transactions and relationships has adjusted in response to changing product types, order and ownership structures of customer firms. As such, formalised transactions can become quickly outdated and unrepresentative of the nature of work undertaken or the specific responsibilities of trading partners. The dynamic nature of inter-firm relationships may explain the prominent use of terms of trade through purchase orders and informal agreements as fundamental commitments.

Many of the trading relationships held by IMP firms in the study have been long term. In four cases the initial trade was from the subcontracting of work from a competitor who was unable to meet demand or when a supplier closed and the customer asks a nearby competitor to step into the breach. At one firm their

> *…first turbo-charger housing [the product] was produced as a subcontract to another foundry. And at the time, there were very, very few producers of turbo-charger housings in the country. And once [current customer MNE] … found out that we produced the turbo-charger housing, and they were short of capacity from people…suddenly a truck load of patterns appeared and we were starting to produce turbo-charger housings for a range of products for [them]. [Another current customer MNE] … found out that we were producing turbo-charger housings and they gave us a book of patterns (Interviewee 1, Foundry SME 26).*

In these situations speed of installing new production relationships is critical to maintaining supply and the IMP firm needs to respond quickly to capitalise on this advantage. As such, the development of the specific transaction is often sidelined until production is up and running. The specificalities of the relationship, and sometimes even the price, are not determined before production begins. The IMP supplier is in a relatively powerful position because the customer is highly dependent on their manufacturing capacity. However, this position of power is short term. The customer can actively look for other suppliers where they can negotiate a better deal because they are no longer desperate to source their supply. This occurred in several instances when *Foundry SME 19* absorbed customers from the closure of a local foundry. Without installing an agreement structure (whether a formal contract or tacit relationship) the customers were able to take advantage of the IMP firm despite their initial reliance on them.

A common approach to managing this evolvement is to install levels of transactions (Table 7.3), specifically to develop an overarching agreement framework that specifies the general terms of trades and responsibilities. This has particularly been the case in the case study relationships which involve development work (*MNE Power Generation Manufacturer, MNE Automotive Component Manufacturer 2*). In these situations, the speed of product change or exact responsibilities of the transaction partners is difficult to define and as such a specific formalised agreement structure would need constant revamping. These structures then rely quite heavily on more tacit based relationships between transaction partners, where a common understanding and shared learning provide the basis for terms of trade. However, in the case of *Large Pump Manufacturer-Foundry SME 21* the agreement structure was instead highly formalised despite the development nature of the work undertaken. In this case *the customer* was in the process of launching several new products and therefore the security of their new product route was important. The customer failed to bring the Chinese high-volume manufacturers online in the correct timescales and therefore the IMP firm had to maintain production whilst the problems were resolved, in a sense acting as their volume supplier. As a result, the security of manufacture at a specific point in time became critical in determining the nature of the transaction. Prior to this there was no long term formalised agreement in place. Due to the re-launch the customer decided to install a more formalised contract because of the strategic significance of the *Foundry SME 21* as a prototype manufacturer. This was set at two years, with a staggered declining order volume incorporated to cover that period (to reflect the reduction in development work over the product life cycle). However, when the volume suppliers failed to become operational the customer extended the LTA to incorporate the changing order because the IMP became more critical to the product supply. As a result, the agreement evolved due to the changing circumstances of the product launch.

The significance of the transaction structure (contract) may actually decline over time because of the development of other forms of commitment including during the period. The sunk costs involved in equipment/tooling, learning and a shared understanding of practices can act as a reinforcement of the tacit based relationship which can develop. As such, the formalised contract does not necessarily have to reflect the true nature of exchange, product or order for the transaction partners to successfully trade. But critically, the contract retains a legal protection that can be enforced at any point. This underpins the tacit based relationships through both an overarching framework and a specific LTA.

Temporary agreement structures

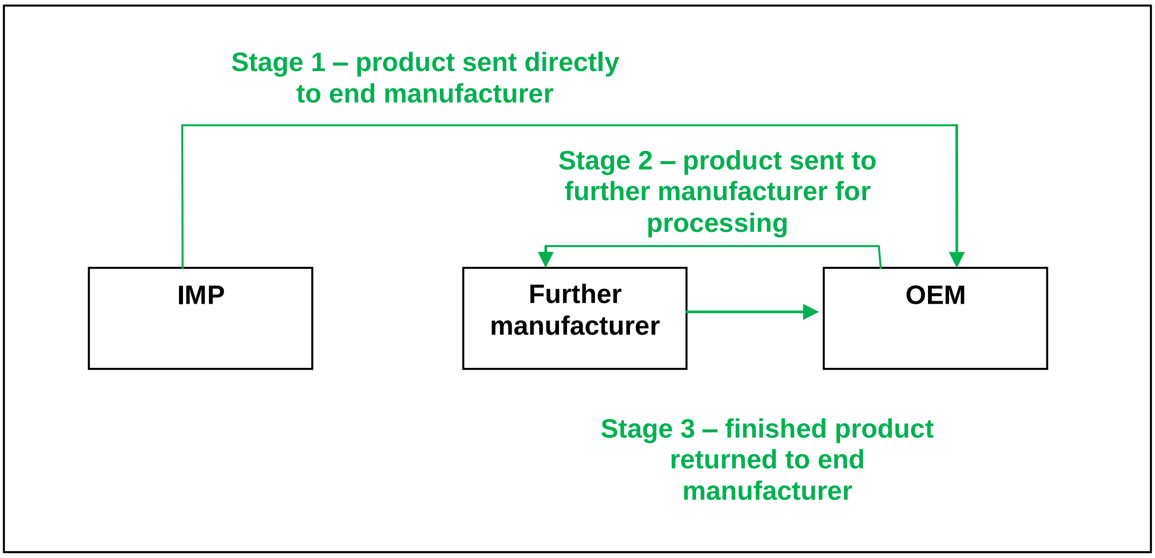
This study has identified specific instances of adjustment in agreement structures related to periods of ‘crisis’, such as the financial stress in the supply chain, specifically with the direct customer of the IMP firms (further manufacturer), during the ‘credit crunch’ that commenced in 2007. In this situation several firms faced unpaid debts by their direct or indirect end customer and were unable to protect themselves with credit insurance because of the perceived financial instability in the industry. As such, under the ‘every day’ agreement structures production would grind to a halt as cash flow at individual firms was reduced (from a reduction in orders and credit restrictions) which restricted the movement of product and cash through the system (unable to fund working capital requirements) and increased the liability of unpaid debts (large scale removal of credit insurance). To maintain the supply chain the payment and production links had to be reorganised as illustrated in Figure 7.6. The supply of products was sent directly to the end manufacturer, who had the financial capacity to pay for the semi-finished components. This was then sent to the further manufacturer to continue the manufacture and then the final components returned to the end manufacturer (Figure 7.6a). This reduced the working capital requirements of the further manufacturer as they did not have to ‘purchase’ the semi-finished components for the IMP firm. It also sped up payment in the system because firms were paid directly by the end manufacturer for their respective parts (Figure 7.6b). As a result, the IMP firm had no transaction or relationship with the further manufacturer during this period (Figure 7.6c). As the interviewee below explains, this adjustment increased the financial security of the IMP, and further manufacturer, during this period:

> *In some cases during the recent recession where we supply …an intermediary who might do something with our product to add value to it and then sell it on. We've done it where we've been paid directly by the end users. We have certain product that's gone directly into the [large public organisation] and we feel comfortable at getting our money through the [large public organisation]. But it went via a subcontractor who did other things to it. So we had an agreement that we would supply, give them copies of our invoices and got paid direct. That helped him with his cash flow as well because he didn't have to pay (Interviewee 1, Foundry SME 19).*

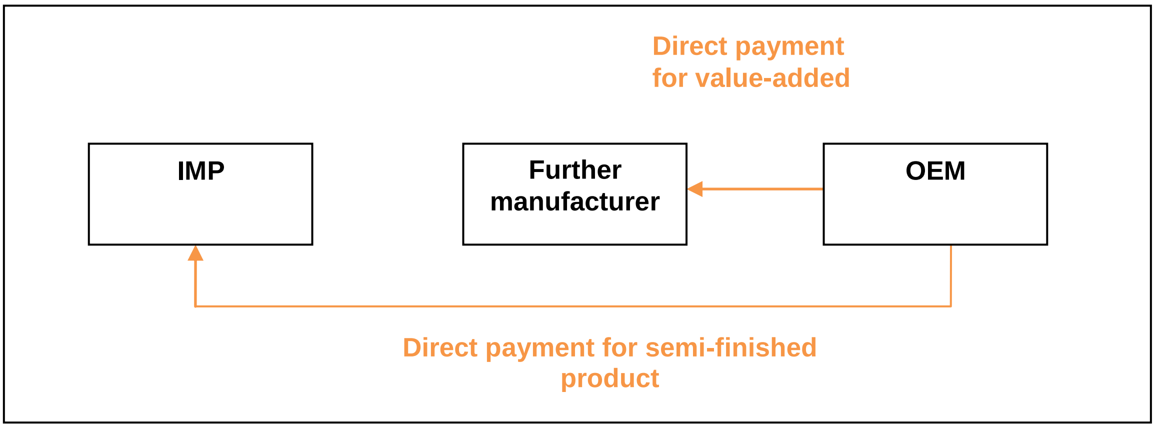
This type of payment agreement or structure was not beneficial for all IMP firms. Those who utilised a certain type of credit finance system (CID) faced a subsequent problem. Under this system the financial stability of the firm is measured by their relative dependence on each customer (or concentration ratio) and the firm's own financial resources. This then determines a level of pre-payment (credit available based on the completed order and the invoice sent to the customer) and a total credit limit for each customer. During the recession, automotive based supply chains were deemed high risk and as such those firms engaged in them faced reduced overall credit limits and pre-payment levels (from 85% to 60%), which dramatically reduced cashflow. In addition, the adjusted payment structure (Figure 7.6b) meant faster and direct payments from the end manufacturer. Their relative dependence (concentration ratio) on other customers because of the speed of payment by one customer lowered the level of outstanding debt; the IMP firm was deemed a higher risk because it was now over-reliant on the remainder of its customer base. This further reduced the amount of credit available and the working capital available to the firms. Ultimately this prevented firms taking new orders because they were unable to fund the purchase of materials and as a result, the financial input structure of some of the IMP firms is at odds with the changes in output agreements, further constricting adjustment and growth.

Figure 7.6 Adjusted Agreement Structures

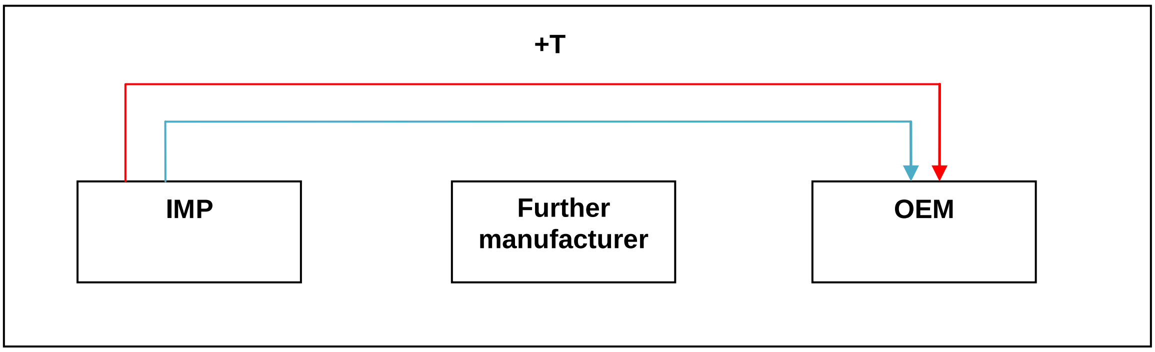
(a) Product Route



(b) Transaction/Payment Route



(c) Agreement Structure



Source: Author (2012)

The prominence of nationally based agreements generates credit problems. A relative competitive advantage of IMP small firms in the UK is their ability to support other UK based manufacturing sites with rapid response times and low volumes. Advanced manufacturers in the UK use these services to maintain their production structures. With more preference to non-UK based transactions from credit institutions favouring export growth, the IMP firm's ability to produce and the ability of more advanced manufacturers is threatened. Ironically, the majority of products made by IMP firms are ultimately exported, although their direct transaction is in the UK. As such, the relative position of the agreement (i.e. whether with the tier 1 or the end manufacturer) had far reaching implications on credit availability during the 'credit crunch'.

The structure of agreements is important for the relative power of firms and their ability to influence their transaction partners. This section has identified how the nature of the transaction links between buyer-supplier firms is associated with the movement of risk and liabilities between transaction partners. Integral to this premise is the separation of agreement components and the ability of firms (either buyers or suppliers) to reconfigure them in response to changing environmental conditions. Geography plays an interesting role in the relationship between risk and liabilities and firms with different trading geographies may have better balance sheets or are perceived as having reduced risk. Grimshaw and Rubery (2005), Ettlinger (2003) and Sako (1992) have also clearly illustrated how agreement forms are formulated in response to the temporal and spatial conditions in which they are formed or influenced by. The evolution of the agreement structure is path dependent – highly influenced from prior interactions, the build up of trust and also existing frameworks of agreement.

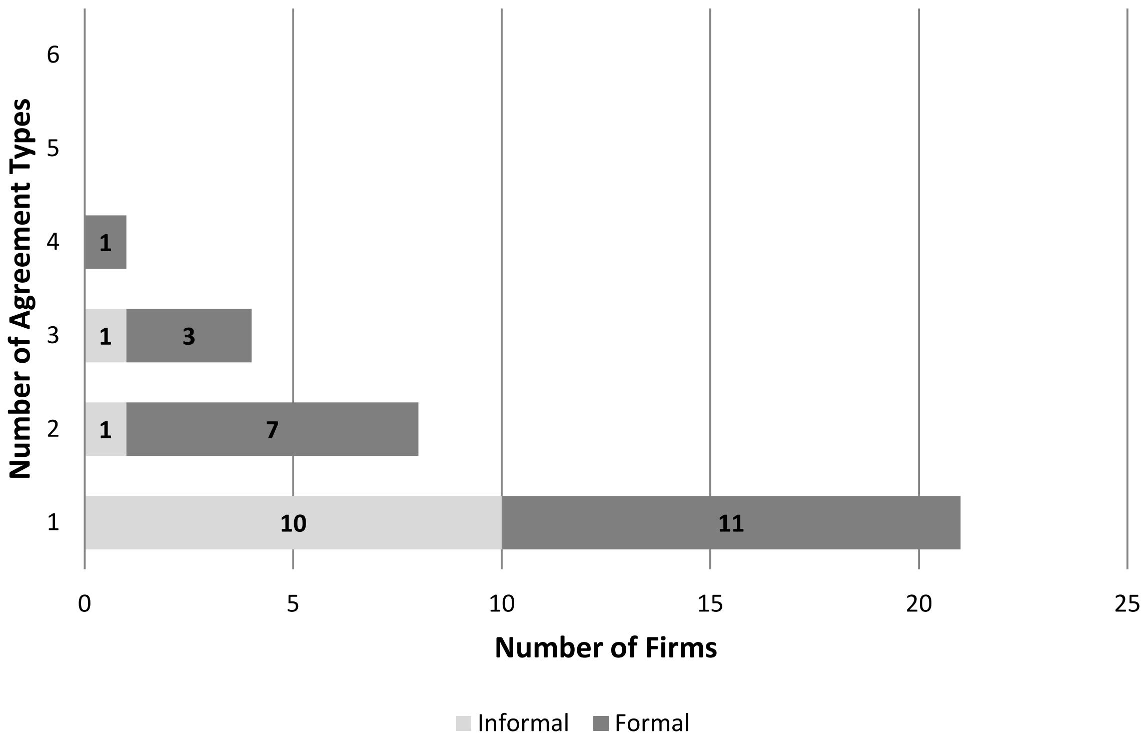
The complexity and dynamism of relationships identified in the IMP industry is significant because it illustrates additional influences on corporate practices (i.e. more than a single governance structure) and the organisational, and sometimes spatial, location of these influences. Loyalties can be separated within an organisation, through a contract with one part of the organisation and a trust based relationship with another. The use of commitment structures (assets and dependencies, trust, reputational effects and legal implications) within the relationships has a more complicated relationship to the firm's performance and capacity to adjust. The location of the commitment structure that influences the nature of the relationship may be more important than the actual existence of the commitment – governance from the head quarters of a customer may be more significant than a tacit relationship with a branch plant. Temporary structures found during the recession highlight a more significant aspect of relationships than purely adaptation practices to cope with demand problems. It illustrates the dynamic nature of relationships and the importance of relationships in firm performance. Alliances lie not necessarily where production agreements are and these connections (beyond production agreements) are more significant for the firm. These alliances are complicated. They often involve an element of trust and distrust, but more importantly a form of dependency that cannot be directly measured through a simple construction of buyer-supplier relationships. Governance is multifaceted and a single aspect of the relationship does not represent the different forms of governance acting on the individual firm. Trust itself is selective within an organisation and often structured differently to other agreement structures. It is a key aspect of governance, shown in the earlier examination of agreement structures (section 7.3: 288), but it interacts with other forms of agreement (Mellewigt *et al.*, 2007; Mudambi and Helper, 1998). At different times certain forms of agreement are more significant in shaping firm performance than others.

However, the role of corporate practices cannot be overlooked in this process. The evidence has shown that there are various interpretations of the agreement configurations to certain environments, influenced by the management practices of the individual firms and historic trading arrangements. The following section will examine the suppliers own role and capacity to influence the agreement structures in its own customer portfolio through an analysis of the mix of agreements in the firm.

7.5 The Agreement Mix

IMP firms predominately use single type of agreement within their customer portfolio (21/34 firms), as shown in Figure 7.7. The agreement type is roughly evenly divided between contractual or tacit based agreements (11 and 10 respectively) and is not related to the size of the IMP firm, with 3/5 large firms also only having a single type of agreement (Table 7.5). There are however, 13 (38.2%) IMP firms that have multiple agreement types in their customer portfolio.

Figure 7.7 Blend of Agreement Types in IMP Firms



Source: Interview data (2009-10)

Table 7.5 Division of Agreement Mix by Firm Size

Number of Contract Types Used in Firm	Firm Size		Total
	Large	SME	
1	3	18	21
2	2	6	8
3	0	4	4
4	0	1	1
5	0	0	0
6	0	0	0

Source: Interview data (2009-10)

Firms are characterised by a bundle of relationship types, ranging from those based entirely on trust and those with no trust. The conception of trust based inter-firm relationship within network approaches (Murphy, 2011; Uzzi, 1996; 1997) is limited as it does not include those relationships not based on trust. Those firms with multiple agreements types also have a prominence of formal contracts.

There is a distinction in the strategic direction of the firms with a blend of agreement types. The firms with a mix of agreement types include the *Boundary Spanning* group of IMPs identified in Chapter 5 (4/13 firms). Of the five SMEs which utilised LTAs with their main customer, four (the *Boundary Spanning* firms) did so as part of a wider agreement portfolio. By having a portfolio of order structures that have with them associated timescales of agreement length, responsibilities and transaction structures, the firm is able to protect itself from loss of contracts and price changes. Counter to this, those firms with a single agreement type include *Lock-In* and *Interdependent* firm types (6 and 2 firms respectively). These firms have attempted to generate commitments from their customers through stronger relationships and joint investments, providing a level of tacit based security from loss of customer through trust. In doing so, the IMP firms are significantly dependent on a single customer. In addition to this, there are firms which have a single order type based specifically on the nature of the product i.e. 'jobbers'. The vast majority of SMEs (9/10 firms) with a single agreement type had tacit based agreements. These firms have relatively low value and infrequent orders, with the majority of them (6/9 firms) 'jobbers', where the rate of product change means formal contracts are uneconomical and the commitment structures of tacit relationships (sunk costs, speed of response) are sufficient for security.

This pattern suggests the active role of IMP firms in influencing the type of buyer-supplier agreement, either through negotiation over agreement structure or the diversification of products and consequently their agreement type. The ability for the supplier firm to influence the type of agreement in place differs between individual firms and individual relationships; customers are also strategic entities. Many firms reported their inability to engage in negotiation with their customers over the terms of trade. In these cases the prominence of formal, legal, contracts is the preference of customers enacting direct forms of governance and clear legal responsibilities and rights (or lack of), rather than the suppliers own preference. The suppliers have limited power in shaping the nature of the agreement, which can leave them vulnerable to customer preferences and sudden order loss (with or without agreement in place).

A small group of firms are able to influence their blend of agreements and are attempting to formalise their agreements through common ownership as they have relatively large investment capital. By owning some form of IPR in the product design the suppliers are attempting to retain their revenue sources by locking customers into joint design ownerships or developing their own design rights. One interviewee at a small foundry and fabrication firm recently rebranded the company to establish a specific design input division to help lock customers into these forms of agreement, as explained below:

> *We were naïve for a long time and not set up proper contracts to sign up people. So we've now, literally in the last few months, said as soon as we get into negotiating with people, if we don't have the intellectual property right into it, we're going to design it, they've got to sign some form of agreement (Interviewee 1, Foundry SME 1 - Fabricator).*

These firms see formalisation as providing additional protection from loss of order, through legal requirements for notice periods or common product ownership. The ability to prompt this form of formalisation is down to the type of work undertaken by the IMP supplier, development work that involves substantial sunk costs in one-off equipment and potentially property rights. However, several other IMP firms which could potentially promote this, as they also engage in development work, do not do so. The strategic direction of the IMP firm seems to be significant in determining the take up of formal agreements and forms of contract lock-in, where the individual preferences, historical trading relationships and specific dependency relationships may affect the utilisation of such forms. In addition, their view on the ability to enforce these legal contracts may be a factor. The financial expense, time delay and legal resources (own knowledge or access to legal experts) has prevented many IMP firms from enacting any of their legal requirements. The most significant factor is the loss of additional work once any proceedings to voice supplier upset is used, thereby damaging the relationship between buyer and supplier. However, this movement to formalisation is not evident in all firms in the study. There remains a reluctance to formalise agreements, particularly from those firms who already have some form of interdependence with their customers. In these cases, the supplier firms have other forms of protection from this dependency, such as sunk costs, and the formal agreement offers little additional benefit.

The ability to enforce agreements, whether through formal legal channels or through tacit reputation- or loyalty-based relationship structures, is a key tool of IMP firms in protecting them from sudden changes in customer demand or poor trading practices. The move towards formalisation by a segment of IMP firms engaged in development work is surprising. Due to the innovative and quick changing nature of development work it is often assumed that trust will form a more important role in inter-firm relationships because the specific details of the product and trading terms are constantly evolving (Aoyama *et al.*, 2006; Nooteboom, 2002). As such, it is difficult (and costly) to specify these details in a formal contract and keep it up to date with developments. However, evidence here suggests that although this may be the case, and particularly from the perspective of the customers (such as *MNE Automotive Component Manufacturer 2* and *MNE Power Generation Manufacturer* who attempt to develop tacit agreements), the IMP supplier in some cases sees this as an opportunity to install formal protection methods (long term legal contracts or co-ownership) which tie buyer-supplier together. Mudambi and Helper (1998), however, suggest that formalisation of relationships does not in itself generate protection as enforcement is extremely difficult without a trust based relationship. The vulnerability of IMP firms to customer agreements will be discussed in the next section.

7.5.1 Vulnerability: Input and Output Structures

The composition of agreement structures in the firm has direct implications for its vulnerability to change and adjustment. The structure is influenced by three key elements of contracts: profit distribution, level of formalisation and temporal range. IMP firms are characterised by multiple customer relationships and input agreements. The convergence of these structures within the firm, the nested agreement structure identified in Chapter 6 (section 6.4), generates specific and complex risks for the firm. To minimise the firm's vulnerability to such contractual risks the firm must offset it with increased protection in other relationships and generate a blended risk profile.

The distribution of profit can vary between products and customers, but also during the contract period (Chapter Five, section 5.4.1). As such, some IMP firms have attempted to generate a mix of profitability in their customer agreement structure. Profitability during the contract is difficult to maintain as output sales prices are difficult to adjust to changes in input costs and continual price pressure from customers drive down sales prices. As such, the IMP firm often suffers an erosion of profitability over time through the contract agreement. To balance this, the firm requires a continual generation of new orders, from both new and existing clients, to supplement margins. The interviewee below illustrates the difficulty in retaining profit levels on existing and reduced orders from its primary customers and its attempts to increase the mix of orders:

> *Well I suppose the one strategy is that we want to try and find new opportunities, new markets because if you can bring new product in then you are going to bring it in based on current costs, rather than existing product which is largely driven by costs at the time you quoted the work. We have also spoken to major customers with the view to saying that you know, with your volumes disappearing, and we are very volume necessary, we need a volume to ensure we have a viable business, and your volume is disappearing, if we can't have the volume then we might have to put a price increase…[and] some of our customers are trying to find alternative products that they can bring to us (Interviewee 1, Foundry SME 26).*

The erosion of profit can also occur during the customer relationship, not just the specific product contract, as ongoing relationship dynamics set price precedents which can be difficult to move away from. In the example above, the firm is actually developing additional work from its existing customers in new product development, which is distinctly different to the mid-volume manufacture they currently undertake. In this sense, the firm has a greater capacity to generate 'fresh' profit margin, less influenced by precedents from prior orders, as this is a new type of production with this customer. In addition, by moving into new markets or products the firm has the capacity to increase its level of value-added products.

Without this blend of customers and contracts, the firm becomes vulnerable to profit erosion over time, eventually threatening the financial stability of the business. The capacity to generate profit in each relationship or product type varies and as such, the firm must generate a blend of more and less profitable products. The continuation of less profitable, and sometimes unprofitable, contracts is vital to the firm because it supports the generation of future orders and the maintenance of more profitable orders they currently have. IMP firms are characterised by repeat business, whether that be through repeat batches or ongoing schedule orders, which means the relationship between value and volume is closely related, even in low volume manufacturers. Profitability is supported by the volume of production from the particular customer (not necessarily particular order of product) and therefore the maintenance of the relationship to support future orders is critical. The generation of new customers is fairly rare and only generally through the transition into new markets through own product development of strategic investments. The volume of orders themselves (i.e. number of actual orders) protects the IMP firm from loss of margin in any particular order. The resultant blend in profitability across orders (contracts) is a direct result of maintaining customer relations for future work: the maintenance of a particular production order (which can potentially be unprofitable) supports the generation of other orders (hopefully more profitable).

The structure of the relationship and the level of relative supplier power in shaping profitability and ongoing demand security vary according to the nature of the agreement structure in place. The agreement structures used, a continuum between formal contracts and tacit based agreements, varies across the customer base. These agreement types offer different levels of demand security and commitment to the IMP firm. The transition towards the production of increasingly complex products has also increased the level of formalisation and risk burden associated with these order types to the IMP firm. This is in stark contrast to the suggestion in the literature of the increase in trust based agreements in high-cost production locations because of the increased level and speed of development in production agreements in these locations, where the level of detail cannot be maintained in formal contracts that quickly become outdated (Casson, 1991b; Nooteboom, 2002). However, this study has identified the reverse of this, where more formalised agreement structures are used because of the sensitive nature of the product.

In conjunction with this, there is an additional transfer of risks from the customer to the supplier through formal ties. A common risk which is transferred to suppliers is that of stock management. Customers are increasingly demanding the management of stock by their key suppliers in order to reduce cash tied up in stock, outsource its logistical management and to generate the benefits of global value sourcing without the risks from extended lead times. *MNE Aerospace Component Manufacturer*, *MNE Automotive Component Manufacturer 1* and *Large Pump Manufacturer* have formalised long term agreements which include the management of stock by suppliers to provide a just-in-time production system. Here the responsibility to hold stock, and in the case of *Large Pump Manufacturer* to produce and ship to a hub close to the customer, are formalised in extensive agreements which stipulate strict financial responsibilities for stock levels. Those case study customers without such formalised agreements manage their stock intake through single orders within formal ‘agreement frameworks’. This gives them the flexibility to only house the required level of stock because they buy as and when required. The agreement frameworks provide outline schedules of forecasted need, for which the suppliers can adjust their production too, and also means the customer is not financially responsible for anything outside a specific order, unlike in a stock management agreement. Both these management systems add additional risk to the supplier. The supplier has attempted to manage such increased risk profiles by balancing their overall risk levels between customers.

The risk profiles of suppliers significantly changed in the majority of cases during the recession period. With reductions in demand suppliers became increasingly dependent on their customer bases, which allowed customers to transfer an increasing amount of risk to their suppliers. A common case was the extended use of trade credit without insurance because of the reduction of banking credit and credit insurance services. This reduction in creditability of the customer meant suppliers were unable to secure insurance on the trade credit they gave to their customer and as such were left to either take on the risk themselves or refuse to trade. The blend of the firms risk profile in these cases was significantly reduced as they faced loss of credit insurance for the majority of their customers and as such, their vulnerability to unpaid debts increased dramatically for individual customers and overall. During the recessionary period these additional risks were usually undertaken informally rather than included in up to date buyer-supplier agreements. As a result, the additional risks the IMP firm was undertaking were not supported by any increase in commitment or security by the customer.

The blending of contract structures to reduce vulnerability to profit erosion and risk is in constant flux due to the changing nature and compositions in the structure of the firm over time and between customers. The blend is used to achieve a mix of increased security of demand and reduce the vulnerability associated with the agreements developed for this security. Securing demand through increased formalisation or invested relationships with customers has the potential to limit the search or innovation capacity of supplier firms as they are not as exposed to different customer and market environments (Collinson and Wilson, 2006; Miller and Chen, 1994). As such, by maintaining the blend of agreements it allows the supplier to maintain a level of security from certain agreements while remaining engaged with a wider set of agreements (not necessarily customers or markets) to promote search capacity. By engaging in multiple agreements the supplier is able to generate changes more easily in their overall relationship with the customer base. This dynamism in the contractual structure has direct implications on the ability of the firm to undertake change.

7.5.2 Contracts as an Integral Aspect of Agreements in IMP Firms

The purpose of contracts found in this analysis is twofold: contracts provide an additional level of agreement and they allow efficient risk transfer from customer to supplier. Contracts have been used to provide protection from loss of customer competitive advantage. This is particularly evident with the increased formalisation of relationships between customers and strategic suppliers/prototype developers where the value of the product requires additional protection (Cox, 1996; MacPherson and Pritchard, 2007). In the cases discussed in this analysis, firms are increasingly transitioning to formal agreements for additional control functions (through enforcement of rights). As such, implicit agreements are being surpassed by an additional level to the relationship. The ability to specify clauses in the relationship, such as ‘subject to sourcing at a lower price elsewhere’, allows customers to remove themselves from the relationship without any legal damage. This use of contract resonates with the transaction cost approach that has traditionally viewed contracts as providing a control function in relationships (Williamson, 1979). For contracts to provide protection they need to be enforceable. Enforcement of contracts can have detrimental effects on the reputation and therefore future business of both firms involved. In addition, the supplier is often unable to enforce contracts due to their limited time, financial and knowledge resources to undertake such a task. Despite this, enforcement continues to occur in supply chains (Helper, 1993; Rutherford and Holmes, 2007). In both these examples, the enforcement of agreements had no significant long term damage to business rates despite the OEMs building a reputation for aggressive purchasing behaviour. This is reflected somewhat in the evidence from the IMP industry (*Forge Large 1, Foundry SME 4, Foundry SME 21, Forge SME 10*). IMP firms are dependent on their existing supply base, with relatively few new customers or markets because of the individual firm’s strategic direction and also the consolidation of markets. As such, suppliers are increasingly dependent on repeat business from existing customers and therefore continue relationships with firms with such a reputation. Framework agreements aid this use of contract enforcement for customers. A nested set of agreements allows the customer to maintain some form of relationship even if it disrupts a specific element (for example severs a contract), as an overarching relationship is maintained.

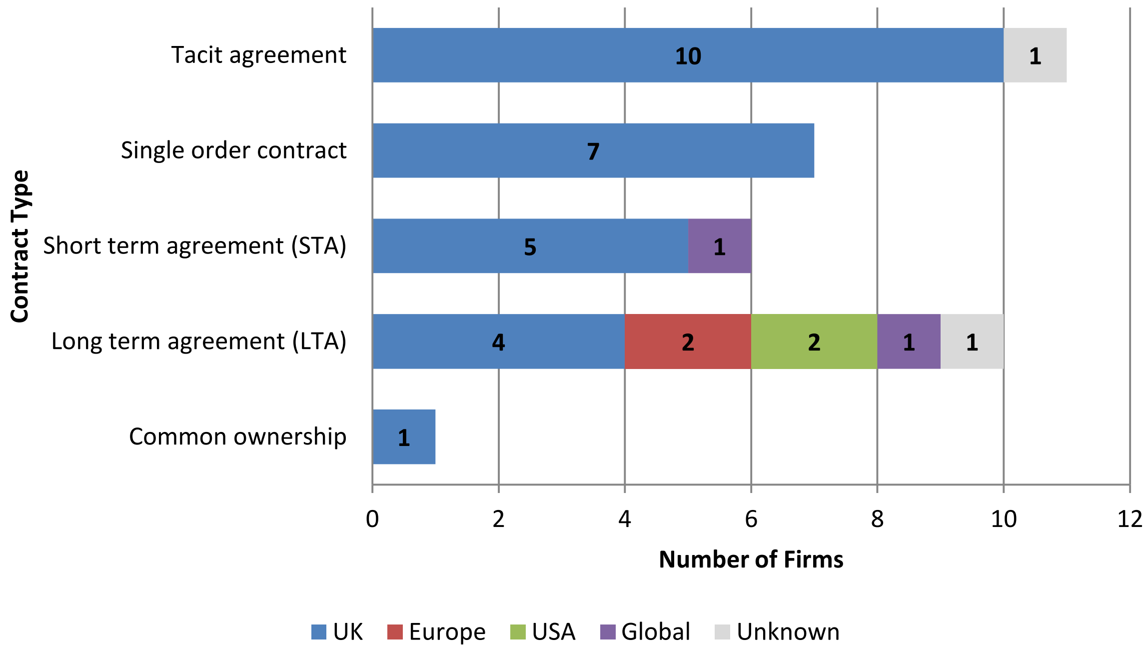
Contracts are also used to transfer risk between transaction partners. Contracts act as a form of coordination, in addition to their control function (Vlaar *et al.*, 2007; Woolthuis *et al.*, 2005). Formal agreements allow the dissemination of risks through the supply chain, such as stock management, as they can be specified in agreements. From the supplier's perspective, contracts tend to add additional responsibilities to the relationship, such as activities or targets, and actually make it easier for customers to resource whilst limiting their reputational damage. However, contracts are also seen as a form of commitment in maintaining the trading relationship because of the investment in formulating the agreement by the customer. Some suppliers view contracts as a safeguard to the relationship because of this investment.

Trust is a fundamental part of production relationships. Trust is a factor in all relationships because not everything can be specified in a contract a priori and therefore transaction partners need some level of trust in the function and commitment of their partner to meet the obligations of the trade. Contracts are also expensive to establish. They can require extensive legal counsel, are time consuming and can involve difficult negotiations on its content. For these reasons, explicit contracts may not feature in all relationships. However, evidence from the IMP industry illustrates that agreements are composed of multiple elements that evolve over time. Formal contracts are part of this relationship construction.

7.6 Space and Place in Agreement Structures

The majority of agreements for IMP firms to supply are held with UK based customers, as illustrated in Figure 7.8. Only five SMEs and two large IMP firms had only agreements based with overseas customers. This appears to be irrespective of the relative dependence of the IMP firm on their customer (in terms of proportion of turnover they represent), as a range of agreement significances are found in the nationally based agreements (between 25-75% of turnover attributed to a single customer). However, the location of agreement does seem to be affected by the agreement type (Figure 7.8). For the primary customer, informal agreements are only based in the UK, whereas more formal agreements, and particularly those with a long timescale agreement, have a wider range of customer locations. This proposition will be examined further in section 7.6.2.

Figure 7.8 Agreement Location by Contract Type (Primary Customer)



Source: Interview data (2009-10)

7.6.1 National Agreements: Historical Plant-Plant Relationships

The prominence of UK based agreements could be related to the origin of the trading relationship. In a number of cases (4) the initial trade was from the subcontracting of work from a competitor. Over the course of trading long term relationships have been generated with site workers and product specific tooling having been developed which has generated a pre-requisite to continue to purchase from existing IMP firms over the course of customer ownership or restructuring changes. The asset specific investment acts as a form of lock-in for the customer because of the relatively high level of investment and time resource needed to duplicate. This is particularly the case for lower volume work. As such, the relationship and agreement become tied to specific sites within the business – as the form of lock-in is product specific and site specific (other sites will have their own sources which may or may not overlap).

A significant number of firms have their agreement with the UK site of a multinational enterprise. Their relationship and agreement is solely with the UK site which generates vulnerabilities if the site reduces production levels or closes. It is particularly interesting that the agreement is based at a specific location (tied to a specific plant) and not extended to the wider company. These agreements are structured in a large part by historical relationships with the individual site, through several ownership changes or product diversifications, as one interviewee explains:

> *…we've managed to get an older customer … tied down to a long term agreement, which actually is very good because they were quite a small company, who then got bought out by, well they expanded the company quite well actually and expanded their product range quite well and they got bought out by a Scandinavian company (Interviewee 1, Foundry SME 1 - Fabricator).*

Here the IMP firm was able to establish global trading relationships with multiple sites within the company from their original relationship with what is now the UK site of the MNE. However, expansion into additional plants of the customer has been more difficult in other cases. One interviewee highlights the importance of geographic location for accessing new agreements within existing relationships. The IMP firm has been attempting to enhance its relationship with its existing customers by expanding its production into prototype and development work. This has been established for its prime customer, however has proven more difficult for its secondary customers who have their technology centres outside the UK, as an interviewee explains:

> *So [resin pattern moulds used for prototype and early production] has given us a big advantage and we are certainly the nominated new product introduction [NPI] route for [prime customer]. We are gaining a greater foothold in [secondary customer 1]. Umm, we have started to get that work with [secondary customer 2], umm, we are early days yet. The NPI division of [secondary customer 2] is offshore … which is why it is harder for us to break into that (Interviewee 1, Foundry SME 26).*

The reason for the slower progress could be a result of a weaker relationship between transaction partners (i.e. they have a lower value spend) but the IMP firm clearly identifies the difficulty arising from access to their new product divisions because the existing relationship is with the UK site, which is not a technology centre. In the case of the prime customer, *Foundry SME 26* supplies the UK site, which is also the worldwide technology centre and, therefore, it already has a relationship with them.

In both examples, the ability to expand sales into other customer sites was successful when agreements and relationships were already held with customer sites that undertook product development (whether that is in the firms before it was purchased by a MNE or with the technology centre of the MNE). This is because these IMP firms are seeking prototype/product development work from their customer and therefore proximity to these customer sites is essential for further orders of this type. This notion will be explored further in the following section.

7.6.2 From Sticky Products to Sticky Agreements: Governance and Competitiveness through Place

This study has identified the location of the buyer-supplier *contract,* not necessarily the location of production, to be a significant factor in determining sourcing activities of customers. As illustrated earlier, the location of agreement and production can be separated in several ways. This separation is intentional due to the specific benefits, capabilities and relationship characteristics which can be generated from arranging a contract in a particular location. As such, the type of agreement plays an important role in generating these benefits. The study identifies three primary reasons for locating agreements (i.e. the formal contractual or framework agreement) in particular locations; additional services, proximity to supply and trust.

Separating Agreements

By fragmenting the components of agreements customer firms are able to generate additional benefits, as are suppliers. This fragmentation has a spatial pattern, where certain parts of the agreement structure are located in particular areas in order to generate these benefits. In the example of *Forge SME 9-SME group subsidiary - MNE Automotive Component Manufacturer 1* (section 7.4.1, Figure 7.3), the contract and relationship was with the UK site of an Indian forge (the site the transaction has historically been with). The purpose of this design was to retain the official, formal agreement with a supplier in the UK, as the interviewee explains:

> *We still operate some types of, we say in the UK we buy the product from [Indian owner] and we sell it in our name, ok, if it goes to a continental country initially we do that until everybody is comfortable with the supply chain but then we transfer ownership of the contract back to [Indian owner] and we just manage the contracts (Interviewee 1, S Forge SME 9 -SME group).*

It is interesting to note however, that despite the success of the production relationship with the Indian plant, the agreement still remains with the UK subsidiary.

In a slightly different example, *MNE Power Generation Manufacturer* has benefited from locating its supply contract in Japan and indirectly influencing the suppliers own sourcing activities to generate cost savings. By implementing an indirect 'value sourcing' approach, *MNE Power Generation Manufacturer* is able to benefit from cost reductions whilst retaining the security of the activity by maintaining a formal contract with a trusted and long standing trading partner in a developed economy. Here the customer can retain a contract for key parts with an existing supplier in a particular location but is still able to generate cost savings on input prices.

In both examples the location of the formal contract proved critical to the sourcing behaviour of the customer firms. It allowed the customer to reap the benefits of low cost manufacture without the associated risks and responsibilities of ensuring ethical and correct corporate procedures. In this sense the firm is able to distance itself from particular activities where it would be more difficult to ensure the correct safety, human rights and corporate practices were being followed. The practice of deflecting responsibilities has been highlighted by Hughes (2012) in his coverage of corporate ethical practices during the recent recession. However, unlike the manufacturers in the Hughes study, the IMP firms here are left with additional sourcing responsibilities and associated risks of logistical or quality errors. The deflection of responsibilities by the customer leaves suppliers increasingly vulnerable. In addition, the legal agreement is retained with a UK based firm and therefore they remain under UK law. If production contracts are located overseas these may be more difficult to enforce and therefore even the threat of enforcement is reduced (Casson, 1991a).

Proximity

Proximity between trading partners remains important for certain types of transaction. Where low volume or development work is undertaken the key drivers are proximity and intellectual property protection, as illustrated by one interviewee;

> *… the package parts of the engine are easier. It's like a car. If you go back to looking at the vehicle of the car, the package elements are quite, I wouldn't say easier but they're more straight forward to try and source globally. Whereas the engine components tend to have more intellectual property and let's say core ownership. They are more difficult. The part that we're in, the core engine, it's more difficult for us to buy components from further afield. You could say I suppose intellectual property on the one hand, but also the development (MNE Power Generation Manufacturer).*

Low volume manufacture relies on close proximity as orders are often infrequent, require fast response and do not generate economies of scale in transportation that larger volumes do. As such, it is more economically rational to manufacture close to sale. Development work on the other hand requires expertise, trust and a co-ordinated development program. The specific skill sets IMP firms in the West Midlands have, combined with their willingness to produce at extremely low volumes (sometimes a single product), makes the firm an ideal source for project and development work.

Here proximity is, as Scott (1998) describes, a factor of order volume, standardisation of order and requirement for interpersonal contact. However, if we recall the example in section 7.6.1 of the ability of IMP firms to expand their trading transactions with other sites of their customer organisation, this notion of proximity is not complete. In this example the proximity to particular areas of the customer organisation proved critical to their expansion. Although physical distance between trading partners was quoted as being important, in the cases in which the IMP firm had successfully integrated (in the *Foundry SME 1 - Fabricator* case and the primary customer of *Foundry SME 26*), there was an existing relationship with the key site in the larger organisation, i.e. the technology or development site. This would suggest that past experience, or relational proximity as Gertler (2004) termed it, is a factor in successful integration into the wider company. However, following on from Gertler's notions of proximity, the physical distance highlighted in the quote was 'offshore' and therefore not necessarily geographical distance but 'institutional proximity' *(2004: 150)*. From this it could be suggested that proximity, geographical, relational and institutional, remain significant factors in transactions that require co-development.

Trust

In cases where the intellectual property in the product is high, the location of production is less significant but the location of the agreement remains important. The purchase of critical components with a high value of intellectual property in them is preferred to be located in 'Western' - such as western Europe, United States or Japan - based organisations because there is a high level of trust required to protect the value of the product, the intellectual property rights (IPR), as one interviewee explains:

> *The sourcing of the majors [critical components] is, I think, y'know, foundries are, foundries in those markets [low cost regions] are developing, that's logical stuff to move. Stuff like fuel injection and injectors [critical components], I still think they are predominantly European or US because of the technology. … So you move the stuff that you're happy to move, you don't move the stuff that you believe is your IPR (MNE Automotive Component Manufacturer 2).*

Protection of product value is based on preventing illegal copying of IPR, securing confidentiality during production and ensuring procedures and legislation are followed in production. The most common way of protecting the customer from this is to install requirements in supplier agreements, where the formality of the agreement is based on the 'criticality' of the product:

> *… I would say that the type of the agreement or the strength of the agreement all depend on the criticality of the components, so you won't have an in-depth detailed supply agreement for a simple component but where the cost and complexity and strategic importance grows then you put more rigorous work behind your supply agreements (MNE Automotive Component Manufacturer 2).*
>
> *… lots of our propeller technology is highly confidential, highly sensitive so we have pretty tough confidentiality rules in place at all of the foundries [that produce prototype work] (Large Pump Manufacturer).*

Both of these customers have supply agreements with UK based IMPs for their high IPR value products that are critical to the manufacture of their products. However, each has a different agreement structure in place (see Table 7.1): *MNE Automotive Component Manufacturer 2* uses informal agreements based on a strong relationship with suppliers *and Large Pump Manufacturer* has installed a formal LTA with its primary supplier (*Foundry SME 21*). *MNE Automotive Component Manufacturer 2's* lack of formalisation seems surprising given the above statement; however this could be a result of several factors. The build up of tacit knowledge between transaction partners acts as an informal governance mechanism where knowledge transfer is limited to firms outside this relationship because of their capacity to absorb and utilise it (Howell 2002). The actual location of IPR in the manufacturing process could have an effect on the type of agreement used. In the case of *Large Pump Manufacturer* the technology is actually shared with the prototype developer (*Foundry SME 21*) because it is involved in the work undertaken by the supplier. However, *MNE Automotive Component Manufacturer 2* actually retains the manufacturing process which creates the IPR in-house (its own machining process). Of course, the approach to confidentiality remains rooted within a wider management style of each firm; *MNE Automotive Component Manufacturer 2* heavily emphasises the value of building a relationship with its suppliers and their loyalty to existing suppliers and *Foundry SME 21* are currently acting as a high volume supplier, which could explain the more structured contract.

For agreements to be an effective protection of IPR their enforceability is critical. Enforcement is encountered through two means: formal legal structures and informal norms of practice, both of which are place specific. Take firstly the role of formal institutions. The institutional setting in this case is comprised of the legal structures in a given location and the ability to enact such structures to enforce contract infringements (Casson, 1991a; Nooteboom, 2002). Secondly, informal conventions and norms of practice have a strong influence on the enforcement of agreements. Their relationship to place is more complex than the physical location of institutions as above. Both Storper's (1997) and Scott's (1998) work identified the process by which practices establish in a given location and ways of working develop. The combination of physical and social relations within a place creates an asset for that particular location. This asset, the confidence in enforcement, can influence the location of agreements if it is required for a particular task, such as protection of product value. The task, and not necessarily the firm, is then important in the spatial organisation of production.

Contract structures have been shown to be used to protect customers from losing the value of their intellectual property through both informal relationships based on cultural norms and formalised agreements based on strong legal institutions, both of which act as enforcers of agreements. Here the institutional setting is important and a key differentiator between the location of manufacturing activities. Previous work identifies the role of place in shaping contract types in accordance with the cultural/institutional setting and the design of corporate practices in response to difference between these institutional settings. Although trust is required in all transactions, certain parts of the production process require more overt forms of trust. Bryson and Rusten's (2011) production tasks approach allows for a more precise examination of how and why the separation of agreement and production can be important in these circumstances. Under this approach, specific *tasks,* rather than firms or production entities, have specific production requirements. The tasks that involve issues of confidentiality and IPR require protection and therefore a *confidence* in the ability to enforce the agreements that are put in place to protect them: both actual enforcement and the threat of enforcement. Enforcement is related to place-based institutions and conventions as discussed above, therefore, trust in a place becomes a critical factor in determining where the task is carried out. The actual location of the contract (to utilise these place-based assets) is a significant factor in the ability to enforce and protect the ownership and value of IPR. It is these production tasks, and the firms which undertake them, which benefit from the regional asset of strong legal institutions and conventions that generate a level of trust in a place. Here, trust is identified as a place-based association, addendum to transaction specific trust between buyer-supplier.

The role of trust outside the specific transaction has also been identified by Ettlinger (2003) who suggests, however, that trust is built through layers of previous experiences in the individual, which are themselves tied to place and location, and therefore trust itself is not place-bound, instead tied to the individuals within that place. Again, Orderud (2007) also suggests that trust is not tied to a territory despite it being bound to tacit knowledge comprised from proximate relations and networks. Under these assumptions, trust is tied to proximity, not necessarily to a place, through inter-person relation. However, both conceptions look essentially at place-based associations as anchored through proximity and a path dependent process in a certain location through the people that are involved. The evidence from this study instead illustrates that the foundations of trust in a place are anchored through institutional structures, both formal and informal. Personal interaction in the development of trust is a secondary aspect of the development of personal relationships over time. Trust as a factor in the location of agreements is not a result of proximity per se, as identified in the studies above, and instead is centred on place-based structures: legal institutions and working practices. No personal interaction, or necessarily sustained engagement, is required for the development of trust for property right enforcement. These structures act independently once established and no longer require proximity or personal interaction (Storper, 1997).

7.6.3 Institutions and Perceptions: Brand UK?

The place-specific benefits of generating additional services and offsetting responsibilities, closeness to suppliers and trust attract certain production tasks to be located in certain areas that posses these characteristics. Formal contracts have been identified above to require place-specific institutions and conventions for enforcement: enforcement is important as this type of contract is used to protect product value in IPR. These elements together generate a ‘brand’, a form of regional competitiveness, that sits side by side with individual firm capabilities or competitiveness. By placing an *agreement* with a firm within the brand location, these competitive characteristics can be utilised by firms: protection of value through enforcement and reputation. As such, there is a tendency for certain things to be purchased from certain locations.

Although the study has identified place as being a significant determinant of how production agreements are fractured to generate specific qualities, it is unclear whether these qualities are place based or firm based. An interviewee of a large PLC suggested that certain products that were important for the companies brand would only be made in certain locations in order to protect that brand, thus

> *…this ‘everything’s going to come from China/India’ I get sick of hearing, because it won’t. And here’s why. Firstly, commoditised products, my shirt, your pull over, will always go to the lowest cost economy because they are a commodity product. And those commodity products left the UK, the Western World, went years ago, many years ago. But things for branded goods, almost indefinitely, will have an element of Western in them (Interviewee 1, Foundry Large 2).*

The interviewee goes on to differentiate between the firm's own quality capabilities and the instilled capacity to develop products:

> *[Interviewer] Sort of a quality reputation? [interviewee] Err, yes. Yeah, quality is the wrong word 'cause defining quality is always very difficult and it's the ability to be able to manufacture or engineer a product that a customer might want to change significantly or have on-going dialogue with its performance and have people he can talk to. And the quality is kind of a given (Interviewee 1, Foundry Large 2).*

Here the production capabilities are not a form of competitive differentiation. Instead the ability to engage in dialogue and joint development is. For these capacities proximity and common cultural norms/ways of working are important. These are to some degree out of the direct control of firms. Of course, their own capacity to engage in dialogue and generate a successful working relationship is down to the specific personal attributes of those employees. However, there is a wider element of cultural practices (i.e. work routines, common languages, business etiquette etc) which is related to doing business in certain locations (Casson, 1991a; Hess and Coe, 2006; Storper, 1997) and specifically enforceable legal institutions (Hodgson, 2002).

The strength of institutional and cultural aspects in trust is illustrated through the experience of *MNE Aerospace Component Manufacturer,* who had to source independent approval of one of their products before it was accepted by their customer. Certification was sought from an approval centre based in the UK however, *MNE Aerospace Component Manufacturer* felt this would not be sufficient to satisfy their customer and therefore sought a second approval from a specific test centre in Germany. In this case the reputation of the specific test centre seemed to be more significant than the cultural or institutional background (in which both the UK and German based test centres operated) in forming the required trust from the customer.

The perception of place-based qualities is derived from historical reputations based initially on firm-based capabilities and success. However, over time these firm-based reputations have generated specific place-based reputations from historical industrial centres in the Western world, such as ‘German quality’ or ‘British innovation’ (Bryson and Rusten, 2011). These perceptions, or reputations, influence sourcing activities of firms.

Places have been shown to play pivotal roles in certain production systems because of historical practices, place-based associations with products or firms (Pike, 2009; Rusten *et al.*, 2007; Tokatli, 2012), the accumulation of power (through the sitting of several key players in a particular location (Hughes, 2000) or the instillation of cultural practices in large firms which displace these practices to their wider multinational organisations (Christopherson, 2007; Christopherson and Lillie, 2005). Here firms play a critical role in developing reputations through their collective action, developing “…regional economic commons…[where]…elements of economic advantage that emerge out of the collective order of agglomeration, but that by their nature cannot be reduced to individual ownership and control” (Scott and Storper, 2003: 587). This economic advantage could be the development of a reputation of firms in certain places possessing certain capabilities (for example, key skill bases, working practices), which can generate ‘positive externalities’ beyond the ownership of the individual firm (Storper, 1997). This perception of firms located in a particular place generates a confidence in their ability to carry out certain manufacturing tasks.

In terms of the evidence generated in this study, certain capabilities have proven important in determining the location of production in the UK – namely trust for the manufacture of high intellectual property value products. By utilising the place-based differences in institutional structures and behavioural norms through agreements, a place begins to develop a brand which differentiates itself from other places due to both structural and behavioural factors and the evolution of firm based reputations.

Obviously the significance of a place's brand in sourcing activity is determined by the specific product characteristics and what they require to be installed in the production agreements. The actual capabilities of firms and cost of manufacture are fundamental, but the brand of a place can be a significant influence in the initial sourcing decision for particular products that demand additional properties in their *agreement* to protect the value of the product (perceptions of trustworthiness and the ability to enforce contracts). Therefore, it is proposed that the sourcing location (i.e. where the contract is held, not necessarily the production) is determined in two stages based on product characteristics:

1st stage decision making: Product type (IPR, production cost, development level) –

location (cost structure, institutions, cultural norms)

↓

2nd stage decision making: Firm (capabilities, relationships)

Cost remains a significant determinant of sourcing decisions. However, the study has identified two decision making levels: the location and the firm. The type of product to be manufactured is critical in determining where it is made. Initially, the cost structure, institutional structures and its brand determine the region (i.e. either high- or low-cost location) of manufacture. Products of relatively high value require additional protection of intellectual property and often involve development collaboration. In this situation the ability to enforce agreements and common behavioural practices are critical to forming trust in the relationship and for the protection of valued assets of the customer (i.e. enforcement of IPR). Once this has been determined the sourcing decision is based on individual firm characteristics, capabilities and competitive differences. Obviously, historical relationships complicate this picture as there is a tendency to continue rather than change sourcing behaviours. However, the location is a critical element because of its inherent cost structure and enforcement capabilities, or its ‘brand’.

This brand can offer some protection from competition from low cost production areas as it is these areas which are perceived not to have the right resources or capabilities - trust, proximity and services - for the production of this particular product, confidential and high value, illustrating a differentiation of market type (Bryson and Rusten, 2011). The industry views low cost locations as not presently (or in the near term) having the regulatory institutions to protect IPR, despite individual firms having the capabilities to manufacture such products. As a result, customers will not directly source in these locations and retain contracts in branded regions with the perceived ability to protect their IPR (both cultural norms against illegal copying and formal institutional frameworks). However, the sustainability of this locational competitive advantage is questionable as the locations will, over time, develop their resources and capabilities to meet this need.

Contracts of all levels (simple purchase orders to intricate long term agreements) act as a distinctive and separate form of governance based on control and financial power for enforcement. Contracts have a different spatiality to trust and relational forms which are based on both geographical and relational proximity between transaction partners (Gertler, 1995; Murphy, 2011). Formal agreements are characteristically aspatial – terms of trade are passed between organisations but are not rooted in particular geographical locations. More extensive contracts have a more complex relationship to place. Global agreements are usually tied to head office plants and encompass generic terms of trade used across multiple suppliers and national borders. The local agreements are tied more specifically to the characteristics of the plant-to-plant relationships and specific requirements of certain locations. In addition, the use of contracts can also be related to place through the ability to enforce them (either cultural conventions or legal structures) (Casson, 1991a). This more intricate spatiality of inter-firm agreements is not incorporated into current conceptions of relationship spatiality based on proximity and specifically trust and collaborative based relationships (Bair, 2008; Gertler, 2004; Murphy, 2011; Uzzi, 1996).

7.7 Summary: Contracts, Trust and Agreement Layers

Trust remains a fundamental aspect of the coordination function of contracts (Fuller and Lewis, 2002; Mellewigt *et al.*, 2007; Mudambi and Helper, 1998). Trust and contracts are supplementary forms of coordination and “…neither trust nor formalization should become ends in themselves, as this could lead to naiveté or rigidity, respectively. Inquires into interorganizational governance should therefore be accompanied be performance assessments, which help to make sure that trust and formal coordination and control do not become final aims” (Vlaar *et al.*, 2007: 422). Both trust and contracts have been used in the IMP industry as supplements to each other: trust is a pre-requisite for the use of extensive formal agreements that require considerable investment; trust enables a contract to remain flexible through the evolution of the relationship; and trust continues to remain important after the installation of such formal contracts because coordination requires trust in the ability to enforce or threaten to enforce contracts.

The role of formal contractual agreements is an important element of production relationships and provides a more nuanced understanding of relationships in economic geography. Building on the development of the complexity of inter-firm agreements discussed in Chapter Five (section 5.5) and the flexibility of networked relationships in Chapter Six, the above analysis allows a revised discussion of both elements of inter firm relationships. The flexibility of agreements can be viewed differently from the customers and suppliers perspective. The multiple elements to agreements help maintain relationships, even when contracts are severed. Framework agreements provide an overarching relationship structure, usually based more on a tacit relationship (trust, prior trading), but also formal overriding agreements (framework agreements). These structures allow customers to disrupt particular elements of the agreement, such a particular production contract, without necessarily ruining the overall relationship. Of course, there are limitations to this and suppliers' overall dependency will feature highly in the customers' ability to do this but the framework provides flexibility in long term relationships. In contrast, formal agreements introduce rigidity into the supplier firm because of the additional responsibilities and risks transferred from the customer through the agreement. However, they also support the relationship because long term contracts are only entered into after a trust relationship has developed. The contract adds an additional level of protection and coordination for firms involved in particularly valuable products to continue the relationship, acting as a sign of commitment.

The generation of a long term contract is often associated with an increased dependency from the customer to the supplier (for instance for strategic parts or prototyping). In relational conceptions of inter-firm agreements dependency is the reason for limited use of formal agreements because trust, investments and common understandings provide protection and commitment in the relationship (Gereffi *et al.*, 2005). The evidence from IMP firms suggests that in some cases the increased dependency prompts some firms to formalise the relationship. Customers want to commit the supplier under the contract to increase the supplier's dependency, increase their flexibility to exit the relationship and therefore rebalance the mutual dependency in favour of the customer through contractual clauses and additional risks to the supplier. Other conceptualisations of mutual dependency in the supply chain suggest that dependency removes the need for formal contracts (Herrigel, 2010; Sturgeon *et al.*, 2008; Sturgeon, 2002). Herrigel (2010) also states that mutual dependency is unsustainable long term because of the need for firms to learn, expand and avoid lock-in in particular relationships. However, he suggests that firms will separate in search for other opportunities. The evidence here suggests that formalisation of the relationship may be another route from mutual dependency in certain production relationships. The notion of flexibility based on weak ties (Brusoni *et al.*, 2001; Castells, 1996; Grabher, 1993; Granovetter, 1973; Uzzi, 1996, 1997), is not fully evidenced in the IMP industry. Customers generate some form of flexibility through *formalisation* of relationships, in *addition* to trust aspects. The proposition that shorter product life cycles require trust based relationships to allow for knowledge transfer for innovation (Aoyama *et al.*, 2006; Casson, 1991a) does not include the evolution of the relationship. As the relationship progresses dependency becomes an increasingly prominent issue and customer attempt to reduce this through the formalisation of relationship and the use of get out clauses.

The significance of formal contracts in the IMP industry has been evidenced through this analysis. The following chapter provides some overall conclusions to the research study and in particular will explicitly examine the role of trust and contracts throughout the empirical evidence.

8 CONTRACTING TRUST: FOUNDRIES, FORGES AND FLEXIBILITY

> *Economies throughout the world have become globally interdependent, introducing a new form of relationship between economy, state, and society, in a system of variable geometry… Capitalism itself has undergone a process of profound restructuring, characterized by greater flexibility in management; decentralization and networking of firms both internally and in their relationship to other firms (Castell, 1996:1).*

8.1 Understanding Adjustment in West Midlands IMP Firms

This research commenced by focusing on exploring firm adjustment strategies in a mature manufacturing industry, with a focus on foundry and forging businesses in the West Midlands region of the UK. The increasingly complex integration of production tasks between suppliers and core manufacturers, and the resultant connectivity between firms, was a key focus of analysis. The initial research questions were designed to examine the process of adjustment, specifically how firms are connected, how adjustment varies across different timescales, the involvement of actors in shaping adjustment and the resultant vulnerability from change. The study explored these issues through an intensive study of 45 IMP firms and 10 transaction-partner firms in the supply chain. Qualitative interviews with decision makers were the primary research method and combined with secondary data sources, including financial records (FAME dataset) and industry statistics.

The research was focussed on processes of adjustment because of the ongoing transition of manufacturing firms in the UK to increased international competition from firms based in lower labour cost regions. *Forge SME 2* was a prime example of this. The firm traditionally manufactured high volume automotive components. It has increased its product portfolio and made a transition towards lower volumes and higher value components (prototypes, tool design). It has also invested in technology and site upgrades, and integrated into regional manufacturing networks to successfully compete against both domestic and international firms. It has strengthened relationships with its key customers: opened a low cost distribution centre to source components for customers oversees, taken on additional responsibilities and capabilities (particularly, increased its service provision of stock management) and become intricately woven into its customers production process, so that both were mutually dependent on the management of the relationship to maintain production. Despite these adjustments, the firm entered administration in 2009. Adjustments to strengthen relationships, build interdependency and add value have not been enough to ensure the survival of IMP firms. Profitability remains a key element of survival and the industry has suffered a prolonged decline in the profit margin it can achieve, as the forge explains:

> *…[T]he margin of this business, it's never been a hugely profitable business but you know, it was a comfortable seven or eight percent return on sales... But ultimately we were down to two or three percent. And that's very close to not making enough money to put resources in. So yeah I think this squeeze has been on the metal industry for the last ten to fifteen years. And which is why lots of businesses closed because there just wasn't the margin there… the margins were getting tighter and tighter (Interviewee 1, Forge SME 2).*

This squeeze of profit margin has not been rectified through a transition to higher value-added products or integration of production activities between customers and suppliers. Customer-supplier relationships, and the distribution of value within them, are a key aspect of manufacturing firms because connectivity in the supply chain, and therefore relationships, are a central element of an individual firm's competitiveness. The IMP industry provides an insight into how relationships influence adjustment capacity, as they are characterised by a series of input and output relationships with other manufacturers.

The empirical chapters reflect particular challenges facing the IMP industry that were identified during fieldwork. It became clear during analysis that the practices of adjustment were varied, dynamic and complex. Isolating specific elements of adjustment would reduce this variety – an important feature of adaptation in itself. It became clear that significant issues (low cost competition and energy price changes) were occurring across the industry and, therefore, these challenges provided a unifying focus to the empirical discussion, rather than directly addressing the research questions. In addition, the initial research questions did not fully capture the intricacy of current issues in the industry. By structuring the thesis around key challenges and relationship structures it provided a clearer illustration of this complexity. The following section will outline the significant findings from the empirical investigation. The wider contribution to theoretical understandings in economic geography will be explored and areas of further research identified. Finally, the key contributions of the research study will be explicitly outlined to conclude the thesis.

8.2 Relationships: Hierarchies and Bundles

The conceptual framework (Chapter Two, section 2.4) identified knowledge gaps in the conceptualisation of production relationships, specifically the hierarchy of relationship types and the bundling of these within the individual firm. Formal aspects of relationships, and particularly contracts, were identified as a current gap in understanding. These gaps were explored through the context of adjustment. The focus of the research was to understand adjustment in the framework of connectivity and relationships in the supply chain. The industry analysis (Chapter Four) identified two key areas of adjustment in the industry -transitions to higher value-added products and services (Chapter Five) and energy input cost changes (Chapter Six) – which were subsequently examined as specific examples of industry adjustment. This analysis highlighted the role of relationships in shaping the nature, capability and extent of adjustment practices undertaken by IMP firms. An in-depth analysis of relationships and agreements between IMP firms and a sub-set of their customer base was then undertaken to explore this further (Chapter Seven).

The findings are related to the overall aim of adjustment within the context of connectivity. The research questions were used as a framework to understand and construct the relationships and their impact on adjustment. The overall findings are built across the empirical chapters and will be discussed individually below.

Dynamism in relationship structures

Client-supplier relationships in IMP firms in the West Midlands illustrate elements of short-term dynamism based on the variability in value during the relationship. This takes two forms. First, relationships are structured through multiple stages of sunk costs in the production relationship that can generate distinct combinations of relative power for or against the supplier. The value of the sunk costs varies during the course of the relationship (according to production demand) and therefore … *sunk costs have a temporality in which they are effective in shaping operation decisions. Formal contracts reflect the temporality of value in sunk costs and provide IMP firms with a means of capturing some of the value at discrete periods of time within the contracts* (Chapter Five, section 5.5: 221). Secondly, profit structures are related to contract length, which generates distinct temporal interdependencies between buyer and supplier to recover and attain value. Value is not achieved based solely on asset levels and product complexity but varies over time in relation to the structure of the product and when profit can be extracted through the production contract. In addition, contracts are important for retaining value throughout the production contract through the transfer of price increases. The focus on capturing value has centred on product upgrading (Pavlínek and Ženka, 2011) but contract structures are a vital element in determining and retaining the associated profit margins in such upgrades.

Interdependency in the value chain partners has a distinct temporality. *Bargaining and power struggles occur within a production contract and are heavily associated with the value of existing investments in the relationship. As the value of these investments changes, the relative power relationships between transaction partners are adjusted* (Chapter Five, section 5.5: 222). The combination of various forms of asset specificity, contract structure and value generate short term dynamism in IMP firms’ relationships with their customers.

Adjustment as a negotiated process between transaction partners

IMP firms have responded to environmental changes through innovative methods of adjustment. This has included the intricate manipulation of relationships with customers, as evidence in the construction of *Lock-in* and *Boundary Spanning* relationship forms by a select group of firms (Chapter Five, section 5.3.1: 188) and the management of escalating energy costs through the attempted transfer of price increases to customers (Chapter Six, section 6.5: 255). The capacity of IMP firms to adjust to these changes has been reduced through prior adjustments and the structure of customer agreements.

Contracts introduce rigidity in to the network. Time and timing become critical elements of the contractual relationship (Chapter Six, section 6.4.1 252). The procurement contracts for energy inputs illustrate the formal, fixed and rigid nature of some input structures. *The sequence of factor and product agreements increases the rigidity of the firms cost structure, leaving firms less able to reflect input costs accurately in output prices. As such, the risk from short term price changes becomes internalised into the firm and the reduced flexibility to adjust to them makes short term changes more detrimental to the firm* (Chapter 6, section 6.4.1: 254). Existing conceptualisations of network relationships highlight fluidity as the central element of modern global economies (Castells, 1996; Urray, 2000). In this conceptualisation, structures (people, locales, activities) reduce their significance because flows between them generate power (Castell, 1996) and ‘an open architecture’ (Uzzi 1996; 678) that allows cooperation between transaction partners, promoting flexibility. Interactions between IMP firms and their customers and suppliers illustrate a far more fixed form of association through contracts. These forms of fixity have a temporality, generated through the combination of contract lengths within the *nested set of contracts* of the firm (Chapter Six, section 6.4: 247). The fixity generated from contracts interacts with trust based relationships, often underpinning the relationship. Trust allows some negotiation and flexibility in the relationship but the capacity to utilise trust varies. Larger firms are able to choose to enforce or ignore contractual agreements, whereas smaller firms are more susceptible to the rigidity of contracts because of increased dependency. This dependency varies between firms, influenced by product and service portfolios and alternative supply arrangements, generating an intricate agreement structure with varying forms and periods of fluidity and fixity.

Relationship hierarchies

Examination of IMP firms and their relationships with customers has identified a hierarchy of relationships that range from those based entirely on trust to those based on formal contractual frameworks. The nature of the agreement is influenced by the type of product manufactured, the firms location and prior trading relations. There is an increased utilisation of formal agreement structures, largely based around contracts of varying timescales, due to the transition in the industry towards the manufacture of new and complex products, with high levels of intellectual property (Chapter Seven). Customer strategy has directed the protection of IPR through the use of formal contracts rather than informal trust based agreements and also strategically sourced production contracts in geographical regions where contract enforcement is more certain. Despite this transition for particular production agreements, there remains a large variant in the types of client-supplier relationship because of the historical evolution of the relationship. The adjustment of relationships is illustrated through the discussion of the energy risk in Chapter Six. Here responsibilities are determined through *independent* negotiations between *each* supplier and customer, drawing on the specific relationship characteristics to determine who will accept the additional cost. Both the evolution of the product and the relationship influence the unique composition of the agreement structure in the individual firm.

The variability in relationships, over time and between customers, affects the stability of IMP firms. The composition of contract structure across the firm affects the level of security and vulnerability from profit changes (Chapter Five) and risk distribution (Chapter Six). Firms attempt to manage this by blending contract types, timescales and profit distributions. This allows them to balance vulnerabilities and manage change in the overall composition of agreements and relationships between firms (Chapter Seven, section 7.5.1: 324).

Relationships identified in the analysis of IMP firm adjustment practices distinguish a complex structure drawn from multiple elements of the relationship. Relationships are based on a mix of influences, both soft and technical, generating a dynamic, negotiated and intricate composition that illustrates the complex nature of client-supplier interactions. Formal contracts are an integral element of these relationships, influencing value attainment, introducing rigidity and affecting the stability of the firm. Time and timing are key aspects of contractual agreements, generating distinct periods of interdependency, commitment and influence through sunk costs and path dependency in contract structures. The complexity of agreement structures found in IMP firms suggests a need to reconfigure the way the firm is conceptualised in economic geography. *The firm should be conceptualised as a bundle of different* *types of contracts that range in form – from those based entirely on trust to those which have limited use of trust as a coordination mechanism. The firm is an active constructor of relationships for strategic value or competitive advantage. As such, firms should be reintegrated as a central element in the structuring and operation of relationships and networks.* Castells' notion that "…the power of flow takes precedent over the flows of power" (1996: 469) does not take into account the significant role of firms in shaping the power asymmetries in relationships through sunk costs and path dependencies of contracts. The flows of power matter but the flows themselves are shaped, manipulated and coordinated to achieve strategic objectives. Varied forms of relationships exist because of the strategic intent of actors in shaping particular product relationships (Herrigel, 2010). It is this variety and complexity that needs to be integrated into conceptualisations of firms and their relationships. The mix and intricacies of relationships within the firm are significant to firm competitiveness and long term survival and require careful and specific management to reduce rigidity and increase the stability of firms in the IMP industry.

8.3 The Wider Significance of Contributions: Building Formal Contracts into Relational Understandings of Firm Competitiveness and Survival

Relational approaches to inter-firm agreements have been a central focus in recent years (Bathelt, 2006; Yeung, 2005). This approach has emphasised non-rational forms of economic engagement, based largely on social aspects of economic action where the social-economic context of interaction is a key influence on the nature of inter-firm engagement. Based on this approach a stream of work that focuses on collaborative inter-firm relations has developed (Cooke, 2004; Porter, 2000a; 2000b) that emphasises proximity – both spatial and relational (Amin and Roberts, 2008; Gertler, 1995; Murphy, 2011) and trust between firms (Hess and Coe, 2006; Uzzi, 1996). The conceptualisation of production systems as an integrated network of relationships based on knowledge exchange views interaction as the primary source of organisation (Castells, 1996), structured through informal bonds of trust that generating flexibility (Uzzi, 1997). Trust has been a central aspect of the network and relational approach to the economy and is seen as an alternative, and fundamental, aspect of commitment structure. Thus;

> *…a significant outcome of trust is that it facilitates the extension of benefits to transacting partners and invites the receiving partner to reciprocate when a new situation arises. The particular quality of these transactions is that they are not easily priced at a "cash value" or bound by contracts; no exact repayment or penalty is devised a priori. This situation creates an open architecture of exchange which promotes the exchange of services that are critical for survival but are difficult to price or specify contractually beforehand (Uzzi, 1996: 678).*

Trust is seen as a resource in networks (Bathelt and Glücker, 2005), built from embedded and specific experiences in the relationships that shaped obligations and coordination.

Formal contracts are an integral part of agreement structures found in IMP firms. Their incorporation introduces a far greater complexity to inter-firm relationships that generates periods of path dependency, rigidity and interdependence that are unrelated to the relational aspects of the agreement. Time is a fundamental element of these rigidities. *Contracts lock firms into relationships for periods of time, which* *allows trust to develop and supplement contractual arrangements. The temporal extent of the relationship is outlined, whether for a very short period of time or indefinitely, which introduces a discrete temporality to relationships. This temporality is evident both in terms of rigidities from path dependencies and sunk costs but also in the cessation of the contract. The end of the contract will have different effects for each firm and may signal a new procurement process.* The economic transaction is the fundamental aspect of inter-firm relationships. How firms buy and the process of the transaction should not be lost from understandings of inter-firm relationships. Procurement needs to be a fundamental aspect of value chain analysis, incorporating both formal and informal aspects of agreement structures, to provide a more nuanced understanding of firm relationships. Procurement involves negotiation (Ruigrok and van Tulder, 1995), which is shaped by social relations and trust but also formal contracts. When social relations breakdown or value attainment from intellectual property is too great, formal contracts are an essential element of the relationship. Protection through contracts relies on enforcement – whether actual or threatened – to protect the firm from financial losses. Procurement processes can destroy trust (Helper, 1993; Mudambi and Helper, 1998; Rutherford and Holmes, 2007) and ultimately disputes can be settled legally if the benefits for one firm out way the reputational damage that may result.

8.4 Further Work

The study generated a very interesting account of adjustment in metal component manufacturing businesses which identified a series of avenues for further research. Procurement is a prominent issue. The focus of this study has been on both the purchasing of inputs, particularly energy, by IMP firms and the procurement behaviour of customers to IMP firms. The location of procurement contracts used by customers has been illustrated to be a significant factor for certain types of products, namely strategic components, and in certain places (Chapter Seven, section 7.6: 332). These are only preliminary findings on a small sample of procurement activities but it does draw attention to the potential significance of *contract* location, not necessarily production, in shaping purchasing decisions. Further work on a wider sample of firms and their agreement structures and location needs to be undertaken.

The procurement of energy by IMP firms also warrants further exploration in two areas. Firstly, the use of brokers as intermediaries to purchase energy is a significant, and growing, method which has resulted from the complexity of the energy market, and commodities in general, that requires external (and specialised) knowledge to optimise purchases (Chapter Six, section 6.3.3: 238). This illustrates a more complex production chain, where purchasing itself is outsourced, than is currently conceptualised. Secondly, the increased cost of oil and transport costs has been suggested to potentially drive a re-localisation of production to reduce distribution costs (North, 2010). However, increased costs and the focus on reducing carbon emissions through the climate change agenda may instead drive a more complex distribution of production activities, where the most energy intensive activities are located in the least cost, or least regulated, locations [for a review of the pollution havens debate see Brunnermeier and Levinson (2004)]. Procurement contracts would then become far more significant in the distribution of energy between locations and for the configuration of embedded energy in particular contracts [for quantitative analysis on embedded energy see Lenzen (1998) and

Limmeechokchai and Suksuntornsiri (2007)]. Procurement contracts can illustrate the distribution of costs, and associated legal responsibilities, between firms and places. Purchases may be made in areas such as the UK (where additional benefits such as firm capabilities, legal structures or proximity are provided) but production outsourced elsewhere. The embedded energy within these contracts could provide a more accurate illustration of effects of industrial activity on carbon emissions.

8.5 Summary and Conclusions

The IMP sector has received relatively little academic attention, particularly recently, despite providing interesting and significant insights into industrial adjustment. Economic geography has neglected to explore key industrial sectors in recent decades in favour of ‘newer’ industries and ‘high tech’ firms. However, the study illustrates how one such industry is evolving and undertaking complex and varied forms of adaptation to compete with low cost producers, which has involved transitions into customised, higher value added products and services but also a more intricate manipulation of customer relationships (Chapter Four, section 4.6; Chapter Five, section 5.3). The transition into sophisticated product manufacture has involved an innovative form of integration with advanced end-manufacturers through the formalisation of product design services. These forms of adaptation are bound up in historical relationships with customers, a developed skill base and also innovative methods of capturing value in the manufacturing process. The analysis of IMP firms illustrates that mature industries are able to generate new forms of adaptation that utilise their historical development in innovative ways, rather than constraining them to prior activities. Firms are able to shift towards value-added manufacture through the absorption of core tasks but also through the adjustment of inter-firm relationships. The ability of firms to modify relationships with customers to benefit from the redistribution of tasks has been central to their viability and has been achieved in complex and innovative ways. Mature industries offer an alternative and novel understanding of adjustment which has the capacity to utilise and move beyond a particular path. These issues are important areas of research in industrial activity and regional growth.

Supply chain relationships are a critical element of successful adjustment and the attainment of value in higher value-added manufacture. In particular, the intricate structure of individual client-supplier relationships and the composition of these relationships across the firm generate distinct temporality and vulnerability that requires careful management within the firm. Formal contracts are a key element of these relationships and influence;

- the attainment of *value* through product ownership agreements and risk and cost transfer between transaction partners,
- introduce *rigidity* in the adjustment practices of firms through procurement practices and the bundling of input and output agreement structures within the firm, and
- add *complexity* to the nature of relationships, which vary across the portfolio of agreements within the firm – from those which are based solely on trust to those which trust acts as a minimal governance structure.

Contracts need to be incorporated more fully into conceptualisations of networked production systems to more accurately reflect the *complexity*, *rigidity* and *formality* of flexible networks of production. This is an exciting research agenda that would make an important contribution to the on-going development of economic geography. In many respects, this is to call for the development of a new emphasis within economic geography on legal and contractual matters.

9 APPENDICES

9.1 Input-Output Analysis Methodology

Data sources and Method

Based on the 1995 Analytic Tables of United Kingdom Input-Output Analyses, Published May 2002.

Input-output tables

The input-output tables provide a representation of the national economy based on the transactions between different segments of the economy (sectors, industries etc) (Jensen and West, 1986). A transaction shows both a sale (by industry A) and a purchase (by industry B) within the economy and therefore illustrates the overall structural composition of the economy at a point in time. The tables differentiate intermediate demand from final demand, thereby identifying and mapping the significance of inter-relationships (Jensen and West, 1986; Wood, 1988).

The tables allow for two principal forms of investigation; significance and impact analyses (Jensen and West, 1986). Significance studies ‘measure’ the importance of a particular entity (sector, industry, product of firm) to the overall economic structure. Impact investigations however, are used as a modelling tool to explore how changes in final demand, the transaction table (through technology or import changes) or outcome considerations (such as employment change or environmental issues) affect the operation and nature of the economy (Jensen and West, 1986; Ruiz, 2002).

Impact assessments are achieved using multiplier analysis techniques. The technique is based upon adjusted analytical tables to remove the ‘price’ associated with the transaction in order to generate the fundamental structural relationship. This avoids the influence of growth and inflation over the time period of analysis (Ruiz, 2002). The process has two parts:

1. *Coefficient (A matrix):* represents the proportional relationship between products i.e. the amount of product A needed to produce a unit output of Product B.

2. *Leontief Inverse:* is the multiplier effect of a unit increase in final demand for the intermediate products sector. The change in the requirements for each product generates a cascade effect through the economy, reflecting inter-relationships between product groups.

Essentially, these tables provide a framework structure of the economy to assess the impact of changes in final demand, such as employment changes (Valadkhani, 2003; Wood, 1988) and environmental impacts (Lenzen, 2003).

Multiplier analysis: environmental and economic linkages

Several studies have been undertaken to investigate the relationship between the economy and its environmental impacts as a way of identifying sectors to target for environmental action (Dahlstrom and Ekins, 2006; Shadbegian and Gray, 2006). The input-out model allows examination of environmental effects from economic activity, specifically to identify and trace environmental impacts through the inter-relationships structure of the economy (Leontief, 1970; Valadkhani, 2003). The procedure is again based on the proportional relationship between industries defined by coefficients. ‘Externalities’ are incorporated into the economic structure by replacing price (monetary values) with physical values (Duchin and Steenge, 1999; Lenzen, 2001; Leontief, 1970). Multipliers then reflect physical flows rather than monetary.

Identifying ‘key sectors’ that are responsible for particular impacts is a technique developed by Rasmuen (1956) (cited in Alcántara and Padilla, 2006: 3). The technique can identify industries against a specific criteria, such as employment generation (Valadkhani, 2003), carbon dioxide emissions (Alcántara and Padilla, 2006) or resource use (Lenzen, 2001), by tracing the impact through the economic structure. This study has used a key sector approach as outlined by Lenzen (2003) to identify industries that have above average forward and backward impact links. This allows for the identification of industries that are significant intermediate producers, both economically and environmentally. The following procedure was followed:

Step 1: calculate forward and backward linkages

Using,

Sectoral production factor = Total output for sector x environmental Indicator for sector

Generate a multiplier:

Factor multiplier = (sectoral production factor per unit of total output) x (Leontief Inverse)

The significance is calculated by the relative significance of an industry by the factor multiplier (e.g. emissions, water use etc) to the global average significance. This generates a ratio, whereby any value over 1.0 represents above average links to other industries. This procedure is undertaken for each industry for both input (X, generating U_j) and output (X, generating U_i).

Step 2: Identification of key sectors:

The forward and backward linkage values were mapped graphically to highlight those sectors with both input and output significances above 1.0.

The key sector multiplier illustrates a unit change in final demand (i.e. is not weighted) and therefore assumes a no variability in the influence of changes in final demand between sectors (Lenzen, 2003). It illustrates the structural characteristics of the economy rather variability.

Limitations

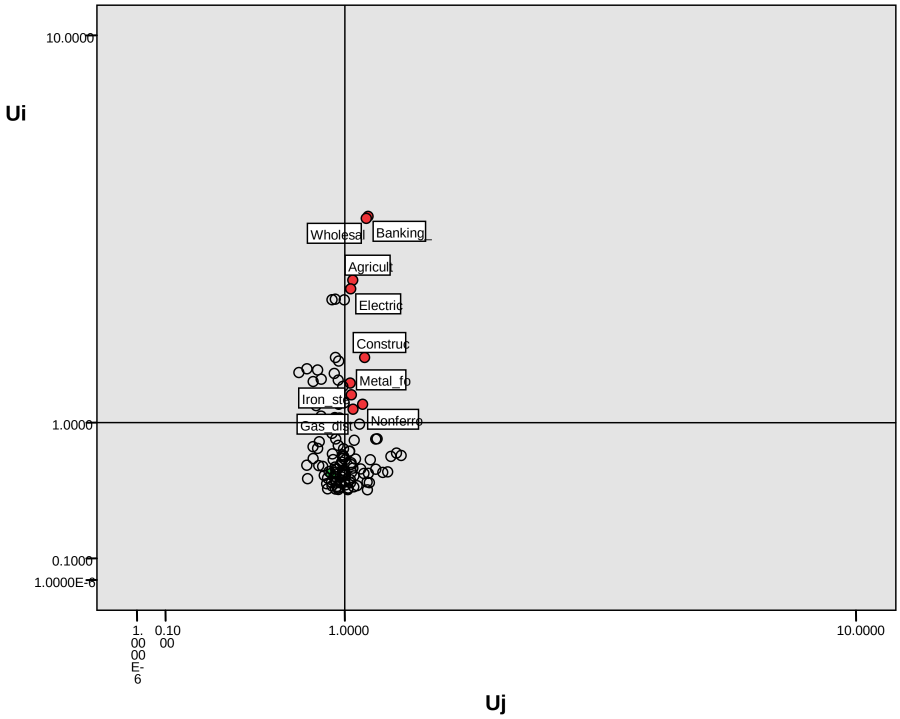
There are several limitations to input-output analysis. Firstly, the tables are a static representation of the economy. The use of multiplier analysis does allow for consideration of change in the economy because it is based on a coefficient value for each product which relates to the products structural position in the economy (Wood, 1988). However, this is a very gradual change over time (Ruiz, 2002). Secondly, the analytic tables are limited to include only domestic production because imports cannot be represented in the table configuration (Ruiz, 2002). As a result, imports have to be considered separately to the analytic tables. A third limitation is the classification of industries (Wood, 1988). The method only identifies interdependencies between the broad product/industry groups, which are assumed to be homogeneous (Ruiz, 2002), and does not identify other relationships within the industry. Finally, the data is relatively old. The most recent accounts are the 1995 tables. The multiplier technique also has significant limitations. The Leontief Inverse does not allow for economies of scale related to changes in final demand, which may adjust the nature of input sourcing and output sales patterns (Ruiz, 2002). The values are linear and do not reflect changes in production techniques, efficiencies, expansion of industries (Jensen and West, 1986) or availability of resources (Valadkhani, 2003). In addition, the multiplier is assumed to have an equal increasing or decreasing effect (Valadkhani, 2003). However, for the purpose of this study, to identify broad structural relationships within the economy, the method is suitable and generates useful results.

Results

The key sector analysis was undertaken for economic and environmental linkages. Environmental linkages were based on availability of suitable data and included; emissions, water use, acid rain and fuel use. The results indentified a series of key sectors for each indicator (see Figure 9.1 and 9.2 a-c). Economic and environmental indicators did identify different industries as the most significant (see Figure 9.3 for comparison example). This indicated that the significance of certain industries varies between economic and environmental considerations. Sectors were far more dispersed in environmental indicators, illustrating a more variable significance of particular sectors for particular impacts. However, the results were dominated by large industries (such as banking and finance) and processing industries (such as electricity generation and iron and steel) (Table 9.1).

The method was limited in its ability to identify a sector for further analysis in the study because the output was dominated by basic processing, rather productive industries. A key sector that was identified was metal forgings. It was the only goods manufacturing sector to be identified in the economic analysis. Although it was not shown to be environmentally significant, it was a key pathway industry to several of the other industries that were identified as key environmental impact sectors; electricity production, transport industries and iron and steel. This was highlighted through structural path analysis (Lenzen, 2002; Wood and Lenzen, 2003). This approach is used to identify pathways in the economy for a more detailed analysis of the location of impacts, rather than their cumulative effects. The statistical procedure for this application was undertaken by Richard Wood at the Norwegian University of Science and technology on behalf of the project in July 2009.

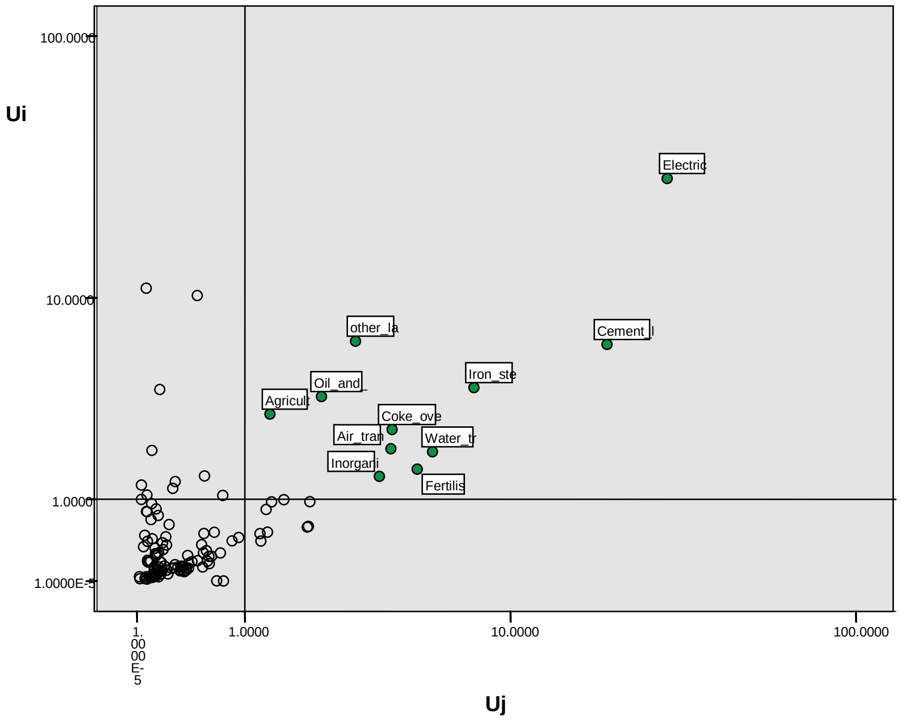
Figure 9.1 Key Sectors by Economic Linkage



Data source: Mahajan (2002)

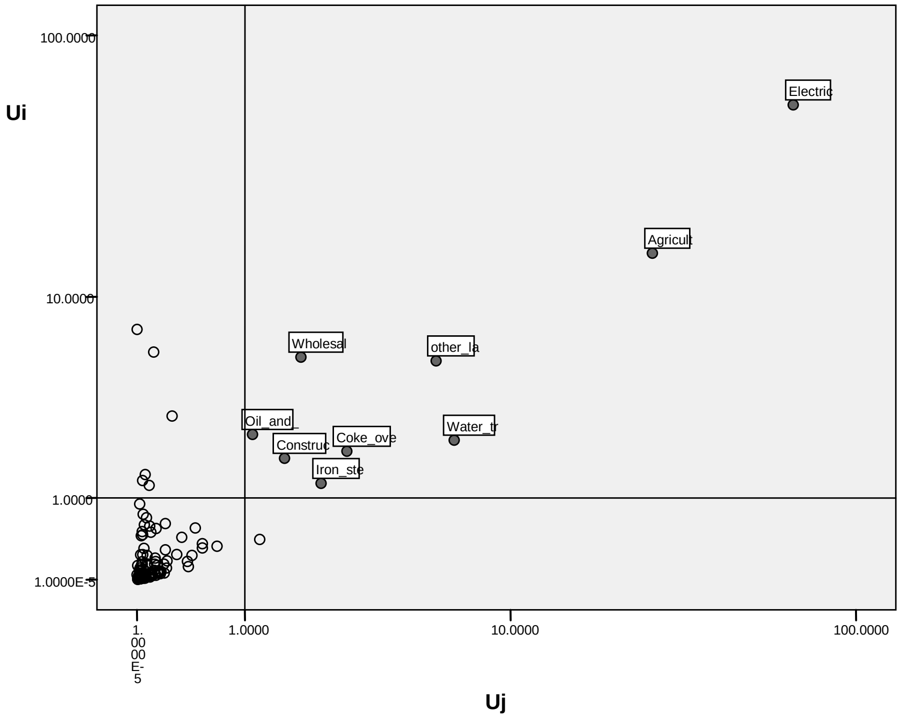
Figure 9.2 Key Sectors by Environmental Linkage

(a) Emissions



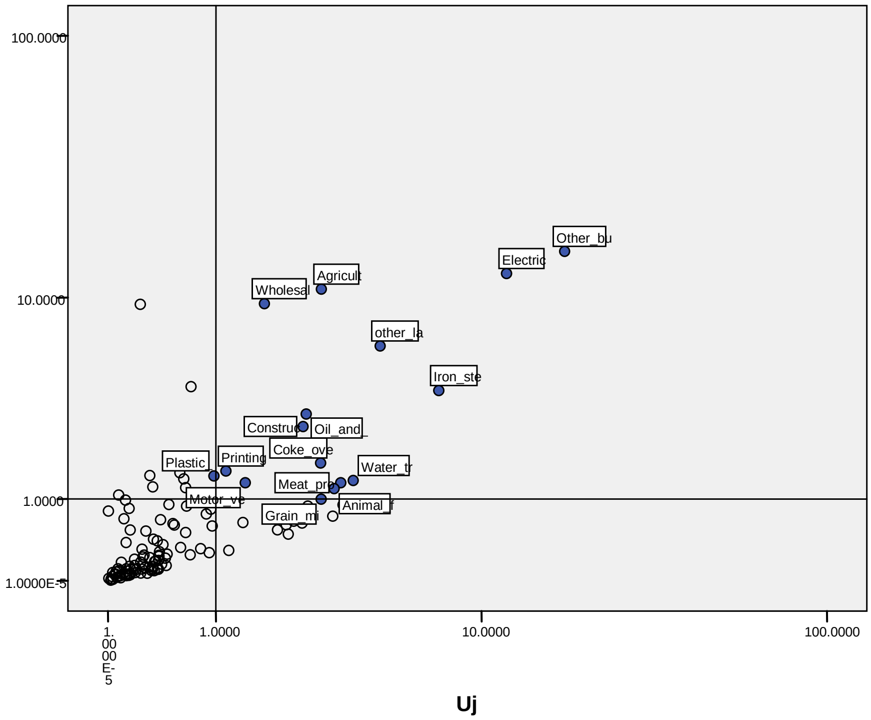
Data source: Wiedmann et al. (2008)

(b) Acid Rain



Data source: ONS (1995a)

(c) Fuel Use



Data source: ONS (1995b)

Figure 9.3 Key Sectors by Economic and Emission Linkage

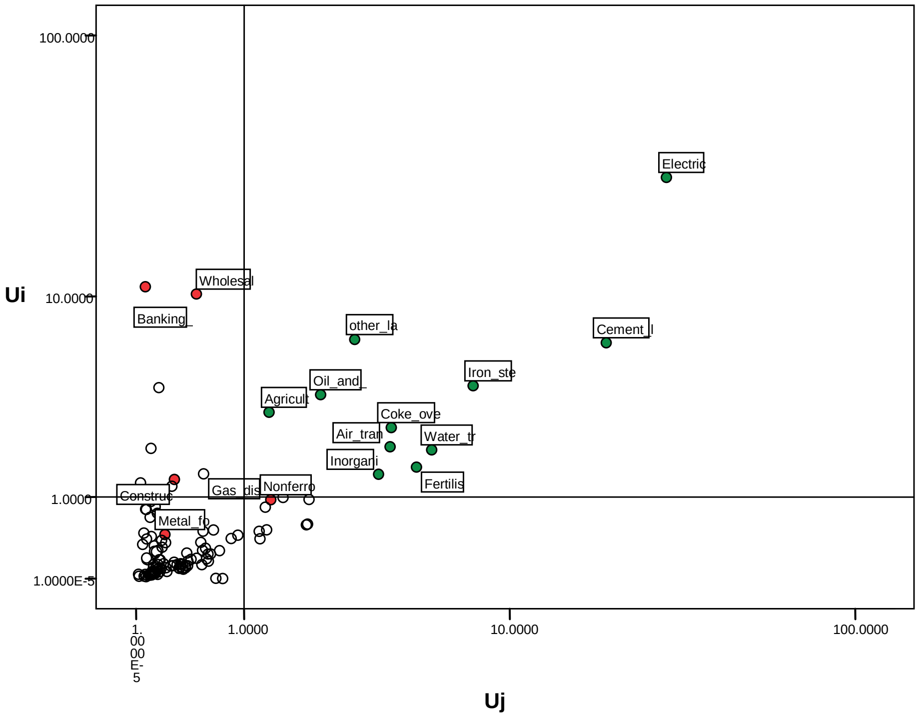


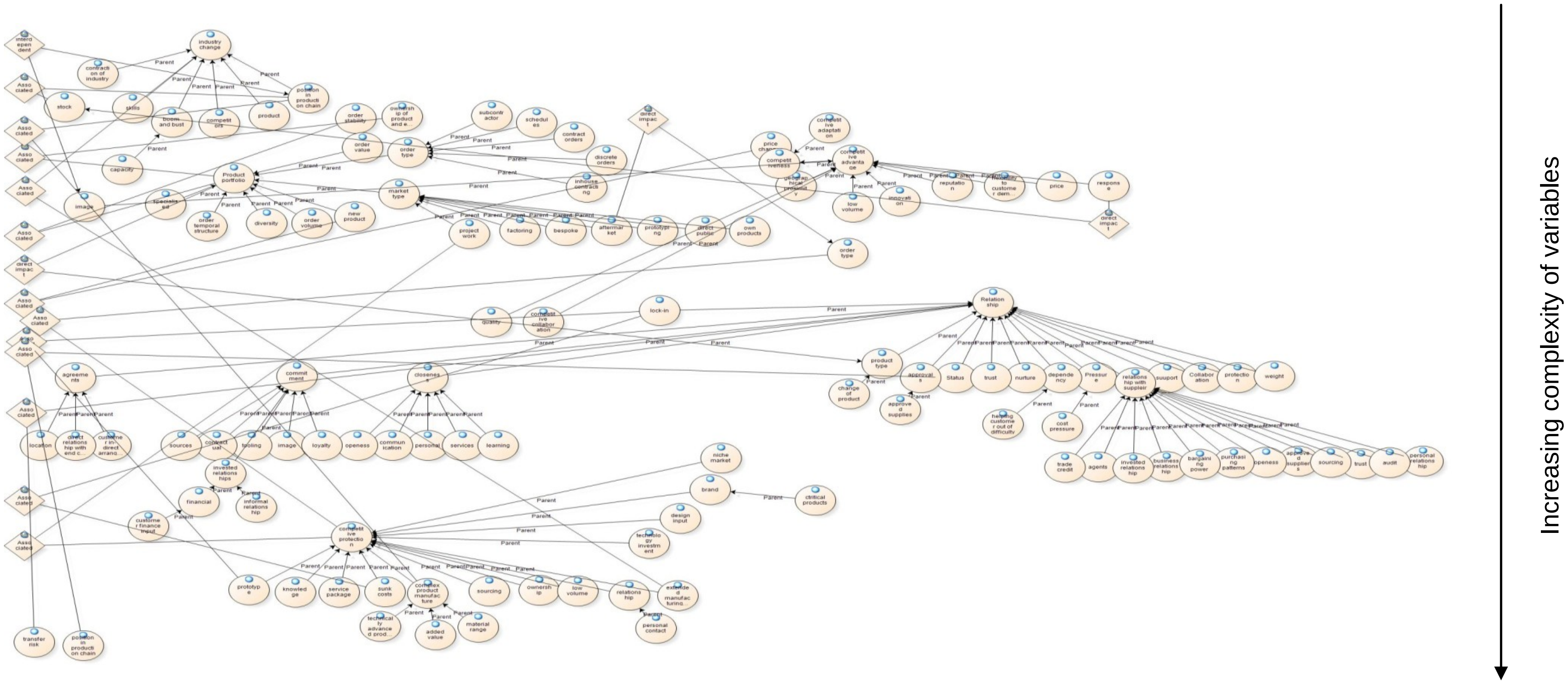
Table 9.1 Key Sectors by Individual Indicator

Economic			CO^2 Emissions			Fuel Use			Acid Rain		
Sector	**Ui**	**Uj**	**Sector**	**Ui**	**Uj**	**Sector**	**Ui**	**Uj**	**Sector**	**Ui**	**Uj**
Banking & Finance	3.96	1.16	Electricity Prod. & Dist.	29.24	29.07	Other Business Services	15.28	17.75	Electric Electricity Prod. & Dist.	55.01	66.54
Wholesale	3.91	1.15	Other Land Transport	6.63	3.07	Electricity Prod. & Dist.	12.49	11.92	Agriculture	14.92	26.34
Agriculture	2.75	1.05	Cement	6.41	19.44	Iron & Steel	4.01	7.37	Water Transport	2.26	6.66
Electricity Prod. & Dist.	2.60	1.04	Iron & Steel	4.15	7.70	Other & Transport	6.30	4.74	Other Land Transport	5.39	5.82
Construction	1.66	1.14	Oil & Gas	3.77	2.27	Water Transport	1.34	3.83	Coke & Associated Fuels	1.97	2.85
Iron & Steel	1.38	1.04	Agriculture	3.11	1.35	Meat Production	1.29	3.46	Iron & Steel	1.26	2.26
Metal Forging	1.26	1.05	Coke & Associated Fuels	2.61	4.14	Animal Feed	1.18	3.27	Wholesale	5.60	1.87
Nonferrous Metals	1.17	1.12	Air Transport	2.07	4.11	Agriculture	10.82	2.94	Construction	1.80	1.58
Gas Distribution	1.12	1.06	Water Transport	1.99	5.67	Coke & Associated Fuels	1.71	2.92	Oil & Gas	2.43	1.10
			Fertiliser	1.58	5.04	Oil & Gas	3.11	2.57			
			Inorganic Chemicals	1.43	3.74	Construction	2.69	2.50			
						Wholesale	9.45	1.73			
						Motor Vehicle	1.29	1.41			
						Printing	1.53	1.13			

Source: Author (2012). Dominance of basic processing industries highlighted in grey.

9.2 NVivo Output

Figure 9.4 Example of Visualisation Map (Chapter Five)



Source: Created using NVivo relationship tool to link related themes and hierarchical structure of codes

9.3 Statistical Indices

Table 9.2 Magnitude Analysis Indicators

Factor	Indicators	Data source	Measurement
Structure			
Ownership	Structure of company	Company report – FAME Database	Legal classification: limited liability, PLC
Age	Number of years since established	Company report – FAME Database	Base year = 2010
Size	Total employment	Company report – FAME Database	Number
	Turnover	Company report – FAME Database	£th from financial results 2010
	Sites in company	Company report – FAME Database	Number
	Subsidiaries	Company report – FAME Database	Number
Transnationality	Sites under control in other countries	Interview	Yes/no
	Agents	Interview	Yes/no
	Agreements with foreign firms	Interview and company report – FAME Database	Yes/no
	Overseas turnover	Company report – FAME Database	% of total turnover generated in overseas site
Integration (product type divisions)	Product type divisions	Interview	If manufacture includes: own product, bespoke, product factoring, design involvement
	Customer divisions	Interview and desk-based research	If sell to: end customer, direct to public
Differentiation	Product portfolio	Interview and desk-based research	Scale of the mix of product types
	Order structure	Interview	Scale of the mix of order agreements
Stability			
Financial	Profitability	Company report – FAME Database	% from financial results 2010
	Borrowings	Company report – FAME Database	Use of credit facilities as a proportion of turnover
Performance	Turnover per employee	Company report – FAME Database	£th per employee

Table 9.2 *Cont.*

Factor	Indicators	Data source	Measurement
Ability to bear losses	Liquidity ratio	Company report – FAME Database	% from financial results 2010
	Working capital	Company report – FAME Database	£th from financial results 2010
	Ratio of trade creditors to debtors	Company report – FAME Database	>1 or <1 from financial results 2010
Credit streams	Overdraft	Company report – FAME Database	If used, from financial results 2010
	Invoice discounting	Company report – FAME Database	If used, from financial results 2010
	Bank deposits	Company report – FAME Database	£th from financial results 2010
Market	Markets	Interview	Number
	Main market dependency	Interview	% of turnover
	Export	Company report – FAME Database	% of turnover
Risk			
Risk factors	N/A	Interview	Identification of key risk areas
Scale of risk	N/A	Interview	Geographical scale of source of risk
Control of risk	N/A	Interview	Scale of level of control firm has
Power			
Ownership	Ownership of manufactured products	Interview	Product/design rights
Position in supply chain	Status as a preferred supplier	Interview	Main customer & top 5 customers: Yes/no
	Single supplier	Interview	Main customer & top 5 customers: Yes/no
	Direct supplier to end customer	Interview	Main customer & top 5 customers: Yes/no
Inter-firm power	Size of counterpart	Interview	Main customer & top 5 customers: Bigger or smaller than study firm
	Proportion of turnover they represent	Interview	Main customer & top 5 customers: % of turnover
	Contract structure with transaction partner and location	Interview	Main customer & top 5 customers: Scale & contract types by length and formality

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11 PUBLICATION

Mulhall, R. A. & Bryson, J. (forthcoming) The Energy Hot Potato and Governance of Value Chains: Power, Risk and Organizational Adjustment in Intermediate Manufacturing Firms, Economic Geography.

Abstract

Cost competitiveness remains a significant element of firm advantage in developed economies. Input costs, and particularly non-labor costs, are important factors underlying the competitive position of firms competing both domestically and internationally. Energy costs are becoming an increasing threat to the long term survival of firms due to their more volatile nature. The distinct geographical structure of energy prices combines both inter-national markets and intra-national policies and supply structures. It is vital to understand how the risk generated from such a complex input is managed by firms. The article explores the adjustment process of intermediate metal processing firms (IMP) in the West Midlands (UK) and their wider supply chain to the energy price risk and its interaction with existing, long term adjustments to globalization pressures. Formal and informal relational agreements between customers and suppliers are identified as critical factors in determining the

capacity of supplier firms to transfer energy price risks to their customers and to adapt to energy related pressures.

1. Introduction

The nature of firm competitiveness in developed economies has been widely debated with a recent focus on non-cost based forms of competitiveness (Bryson *et al.* 2008; Bryson and Taylor 2010; Bryson and Rusten 2011; Tokatli 2012). Cost control is still critical (Giarratani *et al.* 2006; Kalafsky 2007) as each factor input (raw materials, energy, labor) poses different challenges, constraints and opportunities. Rising energy prices and price volatility has transformed energy into a more significant cost component (Leonard 2003; Goldsmith 2008; Cook and Van Horn 2011; Forfas 2011; Rudge 2011) forcing firms to adjust to changes in their cost structure once a cost threshold has been surpassed. At this point, energy costs become a critical element of the cost competitiveness of firms (Leonard 2003; Goldsmith 2008; Bassi *et al.* 2009; Guidi 2009; Hammond and Norman 2010). The price of energy is determined by *inter*-national political and market drivers and *intra*-national governance mechanisms including taxation, government policy and market structure. This complex, multi-scalar structure differentiates firms located in different places (Maskell and Malmberg 1999) and with different purchasing requirements. Firms are being forced to adapt to an increasingly volatile cost base; labor costs are a predictable cost compared to many other inputs including energy. For manufacturing the ability to cope with input price volatility plays an increasingly important role in the viability of enterprises.

This article explores the survival and competitiveness of manufacturing firms in an age of increasing energy price volatility. This is the first in-depth analysis of the ways in which manufacturing firms located in the West Midlands, the UK's industrial heartland, are adapting to energy volatility. The focus is on analyzing adjustment strategies to short term variability and the ways in which organizational resources and the configuration of input-output contracts influences adaptation. These issues are explored by examining adjustments to energy price volatility risk in the intermediate metal processing (IMP) industry. This is an energy intensive industry, particularly vulnerable to energy price volatility or the '*energy hot potato*', which produces components for further manufacture (Hammond and Norman 2010; DECC 2011; HMT 2011). The IMP industry provides design, development and production processes to other manufacturers (Wood 1976; Mahajan 2006) and is a significant indirect exporter (HMT, 2011:136). The industry has and continues to face cost based competitive pressures from international restructuring of production activities to lower cost regions.

The *energy hot potato*[18] refers to the risks generated from energy price volatility outside the direct control of individual firms. The 'hot potato' metaphor refers to something that is unwanted and difficult to manage (OED 2011). In the energy context, firms attempt to avoid the risks associated with energy volatility by transferring price increases to transaction partners, who try to resist the additional costs. The negotiation process between actors in the supply chain, specifically energy providers, component manufacturers and lead firms, is a means of adapting

[18] The term 'hot potato' developed from a children's game in which an object is passed between players, often to music, and whomever is holding the object when the music stops is eliminated from the game (Maguire 1990).

to the threat and highlights the significance of the transitional period of adjustment to the competitive position of firms and their associated vulnerabilities. Industry conventions have played an important part in managing other input price fluctuations, namely metal, by establishing standard supply chain practices (Storper 1997; Scott and Storper 2003). Conventions have yet to be established that cover energy price volatility and its implications. Energy volatility threatens profit margins rather than turnover; reduced margins make it difficult for firms to invest in energy efficient equipment and to innovate. The key concern is the (in)ability of firms to transfer the cost of energy to customers. New lessons can be learnt about adaptation and survival from exploring the challenges firms face in an industry already undergoing long-term transition.

The article is structured into six sections. The methodology is detailed in section two. The theoretical framework is developed in section three by exploring the significance of costs in firm competitiveness and the influence of governance structures on firm adaptation. Section four provides an overview of the IMP industry and section five examines energy costs and adaptation. The article concludes by exploring the wider significance of this research.

2. Methodology

The analysis is based on qualitative fieldwork on the IMP industry in the West Midlands, which has the highest concentration of metal processing industries in the UK (Eurostat 2011a). The Standard Industrial Classification (SIC) identifies two subgroups within the IMP sector, casting (SIC 27.5) and forging (SIC 28.4), and was selected for two reasons. First, it is a critical intermediate supply industry for many advanced manufacturers. The survival of the industry and its ability to adjust to energy volatility has repercussions for the long-term vitality of British manufacturing. Secondly, IMP firms are energy intensive and research into their experience of managing energy costs will inform other industries which are beginning to face energy cost pressures. The threshold identified is applicable across industries as it represents the point at which energy becomes significant enough to be managed as an individual cost component.

An intensive research strategy was followed based on 54 interviews in 45 firms (Table 1). The FAME database was used to construct a working sample with firms selected randomly. The average response rate was 61.1%, although this varied by access method: 39.0% (cold call letters) to 83.3% (snowballing from initially randomly selected firms). All firms are UK registered companies, reflect the size distribution of the industry (a prominence of SMEs) and together represent 3.81% of the British IMP industry (BIS, 2010). Large firms are over represented due to the small number of large IMP firms. The division between foundry and forging firms is reflected in the sample (Table 1), although forging enterprises are slightly under represented due to access difficulties. Several additional methods, such as web searches, discussions with industry experts and snowballing were used to create a wider sample of these firms. Several forging businesses were identified that had diversified into fabrication activities, a sister industry to forging (SIC 28.4). These firms were included in the forging group but sub-categorized during analysis as they now undertake quite different activities to core forging businesses.

Table 1 Structure of IMP Industries at National, Regional and Respondent Group Level

		Foundry (casting of metals SIC 275)			Forge (forging, pressing, stamping and roll forming of metal, powder metallurgy SIC 284)			IMP Total
		SME	Large	Total	SME	Large	Total	
UK Population [a]		470	5	475	695	10	705	1180
West Midlands Population [b]		365	10	375	4395	25	4420	*4790*
Respondent Group	Number of firms	26	2	28	14	3	17	45
	Number of interviews*	30	3	33	16	5	21	54

Note: SME (1-249 employees), large (250 or more employees)

Source: a= BIS (2010), b= Wetherill (2009) [note: figures only available at the 2-digit SIC (Manufacture of basic metals (SIC 27), Manufacture of fabricated metal products; except machinery and equipment (SIC 28) and therefore only illustrative of the size distribution of firms],

**Multiple interviews conducted in some firms*

Intensive semi-structured interviews were conducted over eleven months (September 2009-July 2010) with decision making representatives (managing director, finance director, operations manager). The interviews explored three main topics; how the firm relates to the wider industry (specifically relationships and transactions with customers and suppliers, including inputs), challenges the firm has faced over recent years (including the impact of the 2008 recession) and risks the firm faces. Multiple interviews were undertaken in seven of the larger firms. Four of the interviews involved multiple participants (between 2-3 from each firm). Follow up emails were used for clarification (Giarratani *et al.* 2006) and secondary data (financial data and trade reports) were consulted to validate the interviews (Markusen 1999).

3. Costs, competitiveness and governance in production chains

3.1 Costs, price and competitiveness

Economic geography has a long history of research on 'cost surfaces'. Smith (1970) built upon Alonso's (1967) approach by incorporating other factors of production beyond simply transportation cost, where costs vary according to distance such that;

> *Conceptually there is thus a cost surface for each input … and the sum of the individual input-cost surfaces gives the surface of total costs … [T]he cost surfaces reflect all spatially-variable expenditures on the inputs in question, and not simply transportation charges (1970:15, emphasis original).*

Webber (1972) suggested that a cost surface is a factor of uncertainty, where distance from market creates greater uncertainty which is reflected in the pricing of key inputs and investment decisions of individual enterprises. Differential pricing of factors of production influences the structure of production over space (Scott 1983) and has direct implications for firms competing between different geographical locations (Krugman 1990; Jonkeren *et al.* 2011).

Competitiveness is not based solely on input costs, particularly in advanced industrial and service industries where non-price based forms of competitiveness are critical (Tokatli and K1z1lgün 2004; Tokatli 2012). The revenue generated from products also varies between places, influenced by differing market prices for such goods and differences in the significance of a firm's cost base between locations. Costs have a complex relationship to competitiveness; they are an important influence on strategic decision making (Clark and Wrigley 1997; Coe *et al.* 2004), linking trends and actions across multiple scales (Zabin 1997). To Maskell and Malmberg (1999) the competitiveness of firms can be related to particular production inputs and resources, purchased outside the organization, which have a locally specific cost structure. Thus, firms:

> *…need resources acquired on factor markets at a local, regional and national or sometimes even global level. But as long as not all factors are acquired on global markets, the competitiveness of otherwise identical firms diverges as a result of the way in which difference in location shows up in their strategy (1999:10).*

The purchase of inputs creates price differentials between competitors based in different locations. The localization of some factor inputs highlights the difference that location makes to firm competitiveness. Globalization converges capabilities across space through a process of 'ubiquitification', leading to an evenness of some input prices. Nevertheless, globalization amplifies the differentiation of localized costs, namely labor, but also energy. Even those inputs traded on global markets, which theoretically are less spatially sticky and therefore should generate a relatively even price for any buyer, can create price differentials between locations based on availability, buyer behavior and the purchasing structure of the location (Giarratani *et al.* 2006). As a result, the market context of production inputs/resources, the political economy of individual firm's dependence on such inputs and their interaction with wider strategic decisions determines the significance of these price differentials (Clark 1985; Clark and Wrigley 1997; Dicken and Malmberg 2001; Coe *et al.* 2004). Local institutional structures around purchasing markets and the organization of production activities generate a more complex structuring of costs over space, particularly for strongly localized cost inputs. Prices for output and input costs are not only determined by these spatial factors; in some cases market controlling firms directly influence the price and availability of goods.

Adaptation to cost differentials, notably to labor costs, has been examined through studies of transnational enterprises and the organization of production chains (Christopherson and Clark 2007) and internal enterprise restructuring (Clark and Wrigley 1997). Despite the significance of cost related restructuring and adjustment, there has been relatively limited examination of the impact energy costs have on firm competitiveness. Energy costs and regulations have been identified as a threat to firm survival through a wider examination of cost pressures (Markusen and Teitz 1985; Giarratani *et al.* 2006; Kalafsky 2007). Studies have been undertaken on the impact of energy price rises on reducing total manufacturing output (Hutchison 1994; Guidi 2009) and the influence of price volatility on industry structure (Bruno and Sachs 1982; Hammond and Norman 2010). The relationship between energy and industry has been shown to be complex and influenced by credit availability and capitalization (Bruno and Sachs 1982; Hutchison 1994; Guidi 2009; Hammond and Norman 2010).

The impact of energy prices on firms and its wider role in production networks has not been addressed to any great extent. Birch (2008) draws attention to the wider implication of factor costs on production chains by weighing cost advantages against cost disadvantages to construct the most competitive production chain. As such, the competitiveness of individual firms is determined by their ability to develop strategies to enhance the certainty of their cost base.

3.2 Cost as risk: the role of governance

A firm can be conceptualized as a set of factor and product contractual agreements, which vary between location, time and stakeholder (Cheung 1983; Clark 1985; Taylor and Bryson 2006). Agreements are a cost to a firm which must be managed. In this context a firm:

> *… deals with two different sets of measurements, absorbing any gain or loss by directing and monitoring the performance of input owners and providing to consumers total commodities with specified characteristics (Cheung 1983:7).*

The relationship between spatially and temporally different costs represents a risk to firms (Gertler 1984). Clark (1985) highlights the significance of temporal variability in factor prices, which can generate short-term spatial variations in costs between competing firms. Geographically differentiated input costs not only place a firm in a position of competitive disadvantage or advantage, they potentially strip the firm of investment capital that could be used to enhance the firm's ability to adapt to changing circumstances; uncertainty and the cost structure can become a source of risk for enterprise survival.

Governance defines the ability of a firm to transfer risk and cost out of one firm, the more dominant, and into another firm, the less dominant (Sturgeon 2002; Gereffi *et al.* 2005). Individual firms are influenced by strategic decisions made by stakeholders positioned within the wider production network and which are negotiated through a series of transactional relationships with other firms at various levels within the production process (Birch 2008). Power inequalities, such as firm size, resources and political weight, between firms in the value chain act to displace and transfer costs and their associated risks between enterprises (Zabin 1997; Fields 2006; Christopherson and Clark 2007).

There has been a considerable debate over the generation of power inequalities between transaction partners. A prior focus on structural forms of power, generated from positionality and formalities in the production network (Rutherford and Holmes 2007), has focused attention on lead firms in production chains (Christopherson and Clark 2007). A more contextualized understanding of power has developed, where inter-firm alliances at multiple scales (Birch 2008), informal institutions (Dorry 2008) and interdependencies (Fields 2006) contribute to the formation of power asymmetries, and specifically enhancing the powerfulness of non-lead firms.

Smaller firms, and particularly SMEs, in inter-firm relationships have different resources and capabilities (Dorry 2008). The composition of resources and capabilities ultimately impacts the stability of smaller firms and their dependence and vulnerability to the governance structures of larger firms. The conceptualization of transactional governance structures has begun to explore the characteristics of supplier firms within inter-firm relationships, particularly in respect of supplier capabilities and asset specificity, in the development of network forms of governance (Sturgeon and Lee 2001; Sturgeon 2002; Gereffi *et al.* 2005). The 'modular' value chain model considers how larger, or lead, firms dissipate risk to suppliers (Sturgeon and Lee 2001; Sturgeon 2002). Research has explored contract manufacturers in the electronics industry and specifically the changing division of production between firms in value chains, which has enabled lead firms to transfer costs and demand risks to suppliers because they have developed generic capabilities to absorb risk (Sturgeon and Lee 2001). This notion of risk in the supply base is reliant on supplier firms having significant resources available and the independent development of generic capabilities.

The modular value chain approach does not take account of the multiplicity of governance structures in firms. Institutional governance has been identified as critical to the adaptation processes of individual firms (Sturgeon and Lee 2001; Bair and Gereffi 2002; Tokatli and K1z1lgün 2004; Pavlinek and Zenka 2011). The complexity of governance structures increases in firms that have many order agreements with many customers and therefore are engaged in multiple value chains. These agreements have differing spatial and temporal structures that affect the distribution of costs and risks between transaction partners because of asymmetric power between buyers and suppliers. The configuration of such agreements within non-lead firms has not been fully explored. Energy provides an interesting case study of these relations given increasing volatility and the localization of price structures.

4. The IMP sector

4.1 Industry structure and organization of production

Between 1996 and 2007, the British IMP industry experienced a sustained period of decline in employment (32.9% forging, 60.2% casting) and number of enterprises (9.0% forging, 23.8% casting) (Wetherill 2009; Eurostat 2011b). This decline has been consistent with the pattern observed in British manufacturing more generally. Both industries increased value added per employee through automation and a move towards higher value products (Bryson *et al.* 2008; Hansen 2010). Profitability has been eroded as firms compete with companies based in lower labor cost areas;

average profitability in the industries was 2.3% (interviewee answers ranged between -11.2% to 17%).

The greatest decline has been in larger firms, those with over 250 employees, who traditionally manufactured high volume, standardized components and competed on price based on economies of scale. This section of the industry experienced a reduction in firm numbers by 77.8% (casting) and 33.3% (forging), compared to an industry average decline of 18.8% (casting) and 11.7% (forging) between 2002-2007 in the West Midlands (Eurostat 2011b). In response to this, IMP firms continue to adjust to globalization through a series of non-price based competitive advantages, such as customization of products, products bundled with service provision and the development of skills and processes which are difficult to replicate (Bryson *et al.* 2008; Bryson and Taylor 2010). Firms have moved to more complex manufacturing based on a close dialogue with customers and combined development work between supplier and customer. Competitiveness is increasingly based on trust, service, image, capability and quality, but price and cost control remain important for IMP firms, with 12 firms (26.7%) citing it as a significant element of their competitiveness.

The orientation towards customized and complex products has developed specific relationship structures in the industry. The IMP industry traditionally consisted of firms specializing in either discrete orders of small volume or high volume orders. With the decline of high volume demand firms have developed a greater mix of order types, which has resulted in a more varied order structure. There are three primary types of product order;

- *Discrete* – independent orders for a fixed quantity at a set price in a single transaction over short time periods,
- *Batch* – independent orders for a specific quantity over an extended, yet still short, time period and,
- *Schedule* – long term agreements, which can be over a designated time period, such as 3-5 years, or open-ended, with stable monthly volumes (initially, quantities and timescales are generally not fixed, although prices are).

The order structure is a reflection of market and product types. Schedule orders remain for complex components of products still mass produced elsewhere and discrete and batch orders reflect the more bespoke and development elements of component manufacture. Those firms with a specific market dependency, such as the automotive industry, may have a greater proportion of a specific order type, such as schedule.

The recession has played a significant part in the restructuring of the current order structures of IMP firms. IMP markets suffered dramatic decline (average 38.4%) over very short time periods and IMP firms became more reliant on existing customers. The order type has changed affecting the relative dependency between customer-supplier. Schedule orders declined, and often stopped altogether, as volumes reduced. Instead, customers who traditionally depended on schedule orders began to order smaller batches or discrete low volumes to match reduced and infrequent customer demand. In turn, this increased their reliance on British IMP firms as components were required quickly and intermittently, thereby reducing the customer's ability to purchase from high volume suppliers in low cost locations.

4.2 Relationship of price to cost in the firm unit

IMP firms have three distinct factor costs: labor, metal and energy. These inputs are characterized by specific geographical influences on the formation of price, rates of change, availability and purchasing patterns. The first cost, labor, is a distinctly local component of cost, influenced by the availability of skills and employment opportunities in the local area (Clark 1985). Despite the historical reduction in employment in the IMP industries, there remains a shortage of certain skills, particularly moulders and tool makers. A prominence of internal career progression into management and a decline in the number of training providers has created a relatively older workforce. Firms typically use permanent employment contracts which have generated a long standing and stable labor force.

The second production input, metal, accounts on average for 45.5% of the selling price. Metal prices have two distinct pricing structures. The first is for the purchase of alloys, and increasingly steel, through global market structures (Cockerill 2003). These pricing structures not only reflect supply and demand for manufacture but also spot trading which can distort price structures. As a result, alloy prices are characterized by significant fluctuations (UK Steel 2010). In contrast, significant transportation costs means that the price of scrap metal is determined by localized supply and demand. The price is highly volatile as there is a captive supply and demand market. The demand for scrap metal by larger producers, such as Corus[19], has a monopolistic effect on the price structure, further increasing short term price volatility. The decline in demand volume from IMP customers has resulted in smaller

[19] Corus, owned by Tata Steel Europe, is a transnational producer of steel for direct sale to manufacturing firms. Most of its steel making facilities are located in the UK.

volumes being purchased at more frequent intervals and with more specific grades of material (essential for higher value products). Key metal producers have responded to this by restructuring their distribution systems. Instead of locating mills in consumer markets, large metal suppliers have established service centers in local markets, served by mills located elsewhere (Cockerill 2003). Metal is usually purchased through these service centers or local stockholders, both local subsidiaries of multinational producers and independent enterprises (Ahlbrandt *et al.* 1996). This localized restructuring of metal suppliers in the UK, and in the US, generates a price premium for stock management and purchase of specific material in addition to the international market price.

The third major cost is energy, which represents 8.6% of the average cost base (ranging between 2.5-20%). Energy has a more complex price structure that is influenced by geographical location *and* firm purchasing practices. Energy prices are structured through multiple spatial scales of influence, which results in more localized prices with no standard global price (Stern, 2002: 148). International political and economic stability is influential in the security of energy supplies (Rutledge 2007; Jones 2010). National market structures and legislation differ, influencing the regulation of retail prices (EC 2007), additional tax elements (specifically the carbon cost) (London Economics 2007) and price subsidies (Haley and Haley 2008). The average industrial price can vary significantly between countries (for example, German gas was 72% and electricity 31% more expensive than the UK during S12010) (Eurostat 2011c). The spatial differences in unit prices between countries are only an indication of price differences as tariffs for individual buyers (firms) vary considerably according to purchasing power and contract type. Sub-national differences in energy prices can be found in some countries, such as the U.S., where state level markets operate (Hess 2011). However, retail energy markets are largely nationally based in both regulated and deregulated markets, such as the UK, where price differences are related to competitive differences between retail providers, not explicitly spatially based.

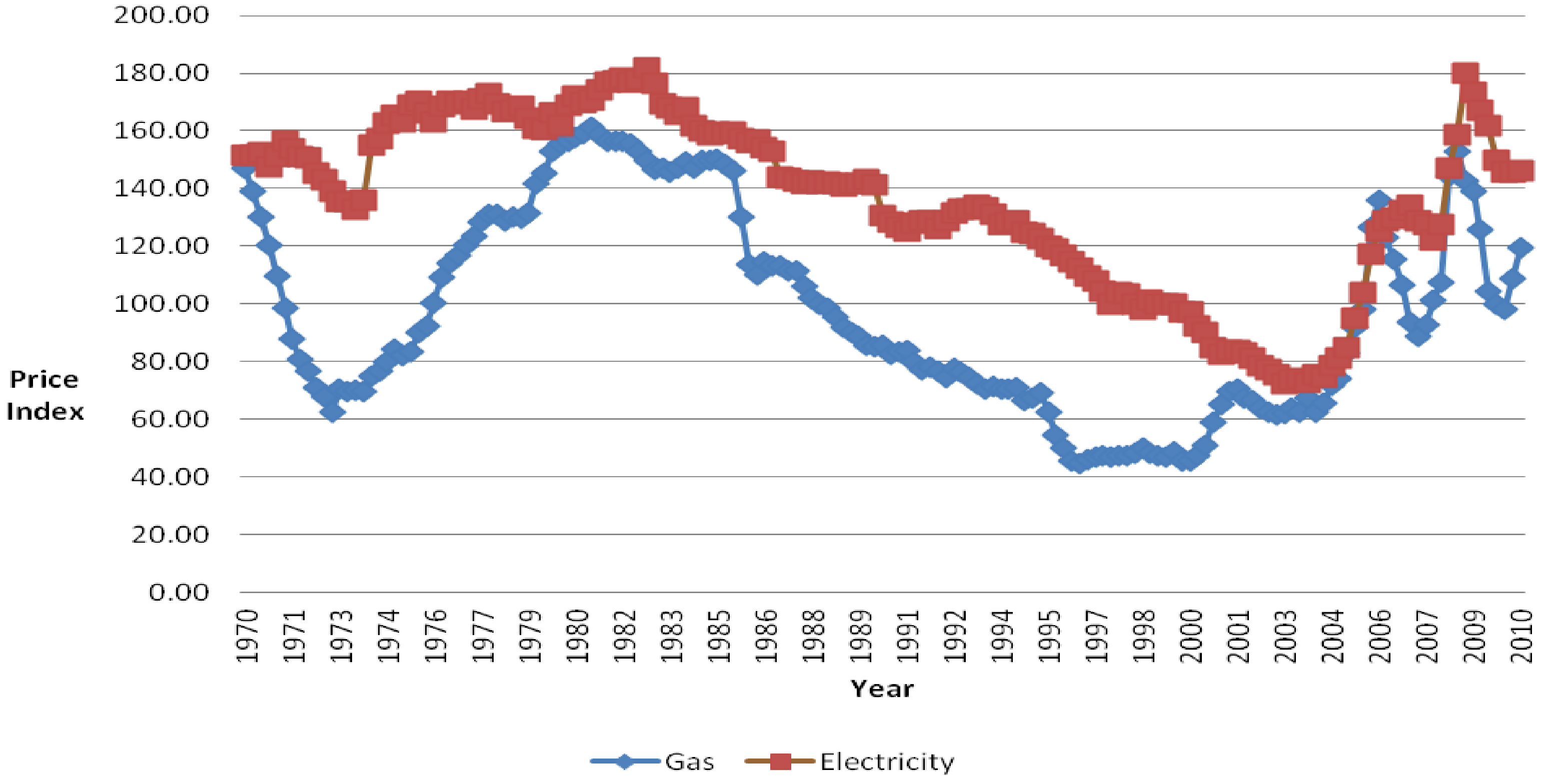
The UK has benefited from some of the lowest gas prices and an EU average electricity rate in Europe over recent years (EC 2011; HC 2011). Prices are rising and forecast to continue to do so, particularly for large industrial consumers (DECC 2011) and small enterprises will be negatively affected by price increases because of the present contract purchasing methods in the UK market (HC 2011). Industrial high energy consumers have been targeted for additional energy taxes (specifically the Climate Change Levy[20]). Although the Climate Change Levy (CCL) adds only 3.5% and 3.6% on electricity and gas respectively to industrial energy bills (according to Q2 2010 prices) (DECC 2010), it remains an additional cost to UK based firms through energy purchasing contracts (London Economics 2007; Bassi *et al.* 2009; HC 2011).

UK energy prices have always been volatile due to the influence of local and global political and economic changes on the availability and price of energy resources, particularly global oil price (Rutledge 2007; Jones 2010), but they are becoming increasingly more volatile (Figure 1). They UK energy is managed through a network of interconnections with other countries, where demand and supply between

[20] The Climate Change Levy is a tax imposed on energy use at the time of supply for specific groups of industrial and commercial users operating in the UK, based on quantity of fuel supplied. It was introduced in 2001 as part of the UK's strategy to meet Kyoto's agreements carbon emission reduction targets (Pocklington 2001).

countries is managed through price signals (DECC 2011). The UK's reliance on non-domestic sources of supply is threatening the security of supply and consequently increasing the UK's exposure to global price vulnerability. The mid-1970s oil price hikes (1973-1982) created a period of high UK energy prices (Figure 1). Although prices are of a similar level currently (2004-2009), they are considerably more volatile. The volatility has been measured by the rate of change in price between consecutive pricing periods, which in the UK are four times per year (every three month period, know as a 'quarter'). It is considered that a rate of change greater than +/-5% between consecutive quarters is high and if this continues to occur it illustrates volatility in prices. Over the current period (2004-2009) 84% (21/25) of price periods (quarter-to-quarter) had a high magnitude of change in retail energy price. In comparison, during the oil price hikes (1973-1982) only 20% (8/40) had such a magnitude of change (DECC, 2010). This illustrates that large price fluctuations are more common during the current period. This level of price volatility has the potential to destroy IMP firms working with relatively low profit margins, potentially converting profitable contracts into unprofitable transactions.

Figure 1 UK Quarterly Industrial Energy Prices (inc Climate Change Levy). Seasonally adjusted. Fuel price index numbers relative to the GDP deflator (2005=100)



Source: DECC (2010)

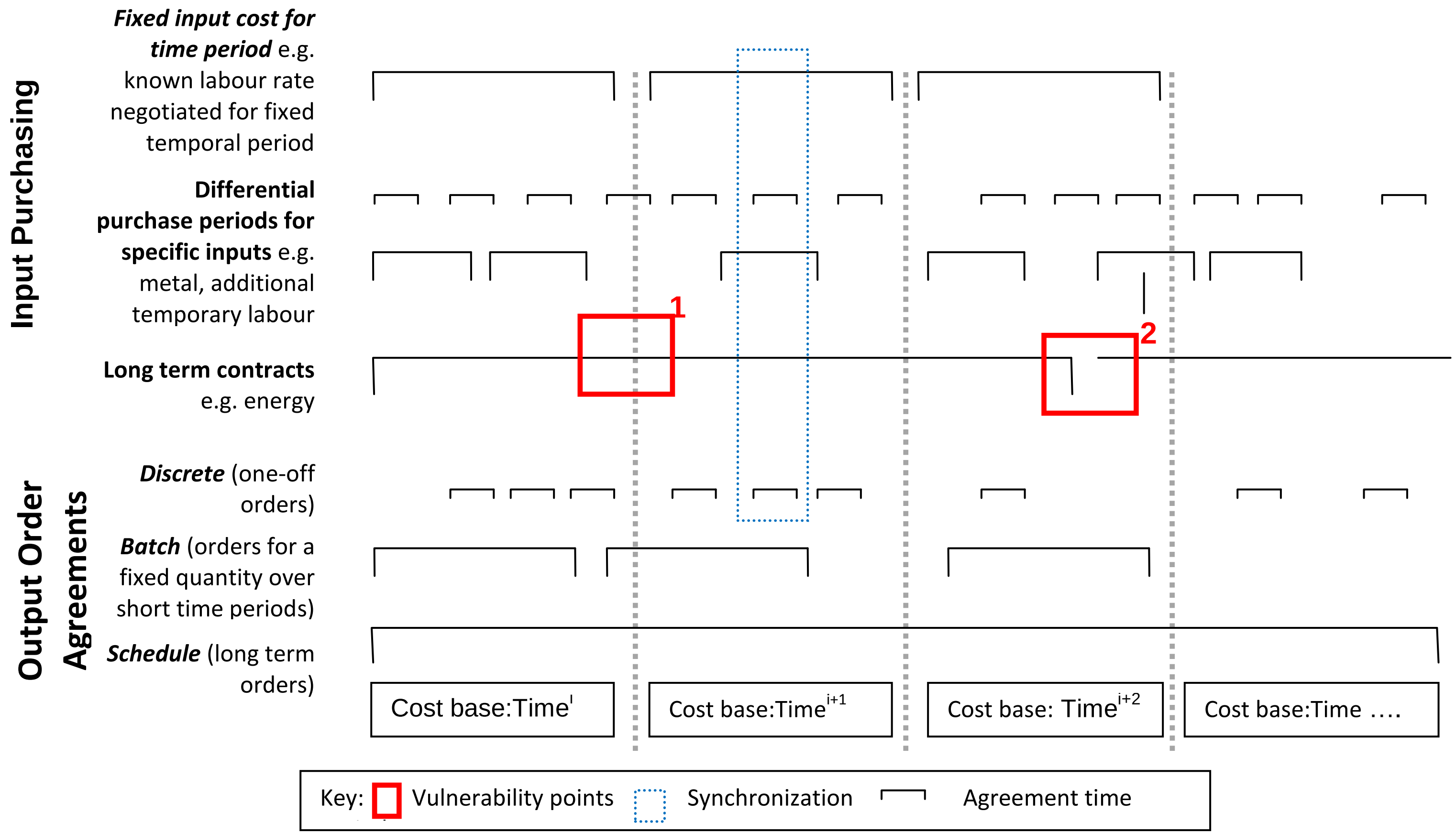
The purchasing activity of firms can play a significant role in generating competitive vulnerability. The denationalization of the UK energy market from 1990 generated more complex purchasing patterns that allowed differential prices, contracts and timing of purchasing, thereby introducing competitive (dis)advantage into energy input purchases (The Manufacturer 2010; The Manufacturer 2011). Inter-firm differences in the ability to engage in certain markets (wholesale as opposed to retail) and negotiate cheaper contracts based on energy spend or ability to access or use external expertise produces competitive differences between firms. Increased volatility in prices over the last decade has generated more complicated energy purchasing strategies. Flexible contracts, which allow staggered purchasing of energy blocks, direct trading on the wholesale market or a combination of methods, have developed and increased in popularity as they provide a means of managing price volatility. Spot buying has increased as an in-between-contract method allowing firms to optimize low price points by timing contract purchasing. The increasingly complex energy market requires significantly more management time and knowledge. As a result, the use of third party brokers to try to optimize cost savings is growing.

Under these new methods firms actively take on additional risks, which were previously managed by the energy supplier through a price premium in fixed price contracts, to reduce costs through staggered and complicated purchasing strategies (The Manufacturer 2010). IMP firms have made a transition towards more flexible purchasing methods; flexible contracts were used by five firms, spot trading between contracts by three firms and one firm engaged with direct purchase from wholesale markets. Fixed price contracts remain the most widespread contract form (18 firms, 40%). The use of brokers, for both types of contracts, is fairly common in the study with 10 firms (22%) using external knowledge sources to optimize purchasing activities. This pattern indicates the transition towards more complex purchasing and the increased risks taken by IMP firms to obtain the best market prices for energy inputs.

4.3 The firm as a set of contracts

The different times in which factors are purchased and product agreements determined generates an inherent risk for IMP firms (Figure 2). The range of input agreements (labor, raw materials, energy) spans various timescales, but a firm has to calculate a production cost or sales price at a specific point in time for a given temporal period (for example, Cost Period 1 in Figure 2). The selling price has within it a collection of different input costs and the cost of each input can be negotiated at a different time and for a different length of time. The selling price reflects many different costs controlled or regulated by different terms and conditions and contractual agreements. Shorter product agreements, such as discrete and batch orders, allow a firm to reflect the present cost base more accurately, or only risk incorrect costing for a short time period. In the synchronization in Figure 2 the discrete output agreement is costed on fixed energy, raw material and labor costs (the contracts of the inputs required for this order span the length of the order and therefore do not pose a cost risk). The interaction of longer factor and product agreements can generate a series of competitive advantages or disadvantages from the interplay of temporal and relationship characteristics. The change of a cost base (Vulnerability Point 1 in Figure 2), say for an annual review of labor rates, can generate a competitive advantage for schedule orders if existing long term factor agreements, such as energy, remain inline or better than the current market price. Conversely, if the contract price is higher than the present market price then the new cost base, from which product prices are quoted, will be out of line with competitors (assuming their contract structure allows them to access the market price). In addition, a change of long term factor agreements during a cost base (Vulnerability Point 2 in Figure 2) can generate the same competitive vulnerability or potential advantage. The renewal of the energy contract can be above or below the price on which ongoing orders have been costed. Therefore, a potential shortfall in profit from the sale may result.

Figure 2 Firm Contract and Cost Structure



The composition of order structure and purchases changes over time and between firms, thereby potentially generating price competitive differentials between firms. The synchronization of these agreements in the firm is important as it allows transactional partners to transfer risk between them. By synchronizing factor price increases with output orders the relative increase can be incorporated into the product price and transferred to customers (assuming the product price stays in line with market competition). This allows firms to maintain profitability and long term viability. Conventions have been established to transfer metal price volatility to customers through a surcharge[21] or annual price review mechanism. The relative stability of energy prices over the past few decades has resulted in the industry perceiving energy costs to be the domain of the supplier. As one firm explained:

> *Our customer base generally accepts that steel is totally beyond our control and therefore is more agreeable to accept the steel clauses [surcharges] … the steel side has been like that for many years … Energy, up until probably six, seven years ago maybe, eight years ago, not so much of a cost for consideration in that respect … and therefore, it has not got that embedded understanding within the customer base that there is going to be a price premium to pay for energy (Interviewee 1, Forge SME 4).*

Metal prices have been extremely variable (UK Steel 2010) and industry practices have developed to manage the additional risks to supplier firms by transferring price changes to customers through product agreements, partially matching input-output agreements. The IMP industry has yet to establish any such conventions for energy price volatility and as a result, the decentralized nature of energy agreements draws risk to supplier firms without any means to transfer it to customers.

[21] A surcharge is an additional payment to the base price and can be used for positive or negative movements.

The adjustment processes already underway within IMP firms towards more complex manufacturing and lower volumes has significant implications in terms of the contractual, or input-output, structure of firms. The increased mix of product order types has given IMP firms wider scope to manage the synchronization of agreements. Firms have actively tried to increase this mix to reduce their vulnerability to risks associated with price volatility. Energy, as a long term purchase and an increasingly significant cost to firms, represents a potential risk because of the rate of change in prices. The management of this risk, and the attempt of IMP firms to transfer the risk outside of the firm, will be discussed in detail in the following section.

5. Energy, adaptation, relationships and the IMP industry

Energy costs have always been a cost consideration in the IMP industry as production processes are energy intensive. IMP firms have attempted to reduce energy costs through ongoing process improvements and cost reduction strategies to reduce the overall production cost. The study has identified a threshold point at which individual cost components, in this case energy costs, become significant enough to require additional and specific management of their own, as the interviewee below explains;

> *I mean the energy bill on this site was a million pounds five years ago. It's now more like four million pound. But, it's still less than 10% of our operating costs so we have to make our own judgments and do our own hedge on energy markets. … it's a four million pound bill so it deserves a bit more process around it (Interviewee 1, Forge Large 3).*

The threshold point is dependent on the overall composition of costs and the resources available to the firm to manage it. As a result, the threshold may vary between individual firms but as a guide the study has illustrated this point to be when energy represents greater than 6% of product costs (interview data). The average energy component cost during the study period was 8.6% (range 2.5-20%).

The principal forms of energy used in the IMP industry are gas and electricity, which represent 74.3% of basic metal production and 93.8% of fabricated metal production energy use (ONS 2010). Since 1990, IMP energy use has reduced significantly driven by reductions in production volumes and technological advances, particularly the transition to electric power induction heating, which has resulted in a far greater reduction in gas use than electricity (ONS 2010). This fuel switching is dependent on significant investment by firms as many of the low cost adaptations have already been made (Bassi *et al.* 2009). Low profit margins means that firms have to rely on accessing credit for capital investments. At the time of study the UK was in recession (2009-10). The considerable reduction in credit availability during this period, particularly to manufacturing firms, constrained investment by IMP firms. The availability of government interest free loans from the Carbon Trust[22] encouraged investment in efficiency technology (10 firms in the sample utilized this scheme); however firms were reluctant to invest in new technology because of sunk costs in existing production methods and investment was only made when equipment needed replacing.

Despite the overall reduction in energy use since 1990, the foundry subgroup of the IMP industry has actually increased the energy intensity of its production (energy use

[22] The scheme was part of the Climate Change Levy (2001). The levy was recycled, through a reduction in National Insurance Contributions and by a funding scheme intended to increase energy efficiency in SMEs (Pocklington 2001). The Carbon Trust was established to run this scheme by providing advice, audits and funding for research and development into energy efficiency. The scheme provides an interest free loan for investments from approved technology providers that meet government guidelines for energy efficiency.

per ton of casting) between 2002-10 (CTI 2010). This has been driven by a shift towards the production of more intricate cast components with high grade properties (e.g. strength), particularly for lightweight materials required for the aerospace industry, which require higher temperatures and additional treatments to produce the desired properties. In addition to this, production volumes have reduced and therefore the energy efficiency of the process has reduced. The forging industry however, has seen a significant reduction in energy intensity (CBM 2010). Investment in new technology for energy efficiency specifically, measured by use of the Carbon Trust scheme, was considerably higher in the castings industry (60% of firms in sample who used scheme) compared to the forging industry (30%). The forging industry enhanced energy efficiency by introducing wider process efficiency measures. Investment in process technology to reduce labor and production time created energy efficiencies. One firm:

> *. . . had a complete look at our business and decided we were either going to continue or decide not to continue . . . We put a massive amount of automation in … So we halved our labor costs, 50% of our energy costs and it also freed up the rest of the buildings so making management easier (Interviewee 1, Forge SME 10).*

The three forging firms which used the Carbon Trust scheme combined the scheme with an investment program to increase automation, but only one casting firm introduced automation. The following section examines in more detail the impact of the changing UK energy market and economic landscape on the IMP industry and the specific ways firms are adapting to it.

5.1 Adaptation to the energy challenge

IMP firms are experiencing an energy crisis with two elements; price increase and price volatility and firms have responded by developing adaptation strategies. In this section we explore four broad strategic approaches for managing energy price risk that IMP firms have developed: ostrich, protectionist, reassert competitive advantage and exploitative (Table 2). Different approaches have been adopted using different timescales and in conjunction with one another.

Table 2 Approaches to Energy Price Changes within the IMP Industries

Firm Approach		**Ostrich**	**Protection**	**Re-assert Competitive Advantage**	**Exploitative**
Strategic tools		(1) Absorb additional cost from profit margin, cash reserves or short term credit facilities	(1) Fix costs through contractual agreements (2) Transfer price increases forward in supply chain	(1) Investment in efficiency measures to regain profit margin (2) Restructuring to take advantage of cheaper tariffs (3) Buying consortium to generate economies of scale when purchasing	(1) Actively manage energy markets through wholesale or flexible purchasing strategies to eliminate retailer premium and benefit from low price points (2) Actively manage pricing structure of segments of the customer base to achieve additional profit during energy price low points
Number of firms using strategy		**3**	**3** (1) 0 (2) 3	**8** (1) 7 (2) 3 (3) 2	**0**
Firm characteristics	*Firm size*	Small	Multiple sites, group purchasing activity	Varied size	
	Product type	Some IPR ownership		Bespoke manufacturers, small volume	
	Order structure	Subcontract order	Prominence of schedule order	Prominence of discrete orders	
	Dependency	High number of markets, stock management for customers	Stock management for customers, additional risk taken on during recession	Market dependency	
	Investment			Government finance schemes	

Table 2 Continued

Firm Approach		**Ostrich**	**Protection**	**Re-assert competitive advantage**	**Exploitative**
Number of firms using as partial strategy		**17**	**19** (1) 10 (2) 12	**11** (1) 6 (2) 8 (3) 2	**4** (1) 1 (2) 3
Firm characteristics	*Product type*	Bespoke manufacture	Bespoke manufacture	Bespoke manufacturers, high export level	Bespoke manufacturers, value added components
	Dependency	High market dependency	High market dependency, additional risk taken on during recession	Market dependency, lower drop of orders in recession, no additional risk during recession	Market dependence, additional risk during recession
	Order structure	Prominence of discrete orders (mix with schedule orders), high number of formal agreements with main customers	Schedule order books (mix with discrete orders)		Mix of order types, use of formal agreements
	Investment			Continual investment	Little investment
	Finance structure	Overdraft	Invoice discounting	High cash reserves or credit available: credit (7), cash reserves(6), grants (5)	Financial stability: no borrowings, cash reserves and high profit levels

5.1.1 Ostrich approach

Under the ostrich approach firms take on the responsibility for price increases internally by absorbing alterations in prices by reducing profit margins on a contract-by-contract basis. Price increases can be substantial enough to eliminate profit margins; products are sold at a loss and are subsidized from cash reserves or by short term borrowing. This was the initial response to energy price escalation by all firms. This short term solution is limited by the profit margin a firm can achieve, which has been continually eroded through competition with lower cost producers, and the availability of cash reserves or short term credit facilities.

The ostrich approach most commonly forms a partial solution to energy price increases and fluctuations (17, 38%), with only three firms using this strategy in isolation. The IMP industry consists of subcontract manufacturers for semi-finished components. The three firms using the ostrich approach in isolation had an order structure dominated by transactions with subcontractors that do not undertake further manufacture of the product and have pre-agreed deadlines, costings and specifications from their end customers. This type of contractual agreement impacted on the cost base of firms as:

> *A lot of people we deal with have catalogues. Catalogue prices are settled at the beginning of the year, you can't change … We're getting people pricing steel at the moment and they'll hold their quotes for 2 days. . . We go back to the catalogue price. We go back to things that we've made for 13, 14 years at that set price, that are sold at that set price (Interviewee 1, Foundry SME 19 - Fabricator).*

By fixing a price further up the supply chain, often through catalogue pricing, the IMP firm is unable to negotiate price increases after a quotation is made. As a result, the firm is forced to absorb increases in inputs and at best share this absorption with subcontractors. These firms were small, acting in a range of markets without strong relationships with particular customers and order values were relatively low and infrequent (Table 2). This lack of interdependence between transaction partners reduces the relative power the IMP firm has within the supplier-customer relationship as assets specific to meet the requirement of particular customers have not been created (Sturgeon and Lee 2001).

As energy price changes have become more consistent many firms have developed other strategic approaches. The approach is most commonly used as a temporary measure for short term and low price fluctuations and as a last resort for customers who will not accept price increases or as a partial response to customers when price negotiations occur. Price fluctuations of low magnitude (below 5%) are difficult and time consuming to pass on to customers. Small price increases are far harder to deal with and are usually absorbed by IMP firms. Thus, for:

> *5% price increases customers expect us to soak it up. When it's massive the whole world just passes it on. So if … prices are going to go up, going up by a lot once is an easier thing to manage than say smaller increases (Interviewee 1, Forge Large 2 - Fabricator).*

The lack of transparency of energy prices and their use in IMP firms creates difficulties in transferring additional costs to customers. The general perception of the customer base is that the risk from price changes lies with IMP firms and this embedded understanding generates institutional practices, or conventions (Storper 1997), which limits adjustment practices (Dorry 2008).

Over time, the absorption of relatively small price rises can have a significant detrimental effect on the financial stability of firms as it erodes cash reserves and profitability (Markusen and Teitz 1985). Working capital is declining, reducing the ability to invest in product and process innovations. Firms adopting this approach predominately do so to deal with the discrete order segment of their customer base. A sale price is set for current factor prices, which is stable for the duration of the order because it only covers a short time period. As such, any miscalculations of factor price adjustments during this period will hopefully be small and IMP firms are forced to absorb these adjustments. Consequently, the use of overdraft facilities is common amongst these firms as a mechanism to cope with price changes. Restrictions on credit availability undermine this strategy; the mainstream banks are reluctant to lend to cover cash flow or working capital problems as these loans are considered to be relatively high risk.

5.1.2 Protection approach

The protectionist approach attempts to retain profit margins on sales by ensuring output prices reflect input costs. Two principal methods are used: stabilizing energy price fluctuations and price increases during a given period through purchasing strategies and by transferring price increases to customers by price increase notifications or surcharge mechanisms.

Firms which used only this approach were involved in transferring price changes forward to their customers by surcharge mechanisms incorporated into schedule orders. In addition, IMP firms often took on additional responsibilities and risks for customers, particularly during the recession. This indicates a level of interdependence between customers and suppliers which enhances the ability of the IMP firm to transfer input price increases to customers; both firms invested in the relationship and therefore benefited from its continuation (Sturgeon 2002; Gereffi *et al.* 2005). Firms which were able to transfer the risk of energy price fluctuations were relatively powerful given their size (two were part of larger groups) and capabilities (one firm was the industry leader in a production process).

Firms deploying this approach in combination with other approaches did so by transferring the risk of price fluctuation to customers and by the strategic purchasing of fixed price energy contracts. Firms with a strong schedule ordering relationship with customers included regular price review points in contracts and a surcharge mechanism. A large forge noted that:

> *The easiest way of doing it [passing costs forward] is to have regular review points against perhaps universally agreed indices or some other recognizable benchmark. For example, aluminum prices can be controlled by the LME [London Metal Exchange]. Some contracts have an agreement at intervals to measure what the LME was at the start of the contract and what it is at the rate point and if it's gone up pass an increase, if it's gone down pass the reduction through (Interviewee 1, Forge Large 3).*

IMP firms which were able to formalize the transfer of risk associated with price volatility had distinct capabilities which enhanced customer's dependency. All these firms had invested in technology and capabilities such as early stage manufacture and prototyping. Customer-supplier relationships had moved beyond the manufacture of one particular product under a schedule order, towards higher value customized products. IMP suppliers used the dependence on their technical capability to improve the pricing structure on higher volume orders. The capabilities of suppliers increased their relative powerfulness in customer-supplier relationships (Gereffi *et al.* 2005), although there are also other influences. Several firms (3) were the sole manufacturer of products, which created considerable client dependency, and one firm was engaged in ‘helping out’ the customer when it was experiencing a production crisis, which evoked a form of benevolence in the relationship (Sako 1992) increasing supplier power. Not all these firms were large (50% SME) and this highlights the complexity of the power asymmetries in the relationship, which extend beyond the capabilities of supplier firms and asset specificity.

The most common purchasing method (18 firms, 40%) was to fix energy prices over a given period, usually 2-3 years, in an attempt to limit potential price volatility risk by matching factor and product agreement timescales. An interviewee from a large foundry supplying aerospace components highlighted the difficulty of managing long term agreements with principal customers by using utility input supply contracts:

> *I mean we’ve tried contracts, [but the Aerospace customer] won’t do anything less than 5 years. We struggle a bit because we can’t get any more than 3 years, on particularly our utility costs, electric and gas. So we’ve managed to tie ourselves down for 3 of the 5 … So worse case, if everything went up we’d be at risk but that’s one of the problems we’ve got (Interviewee 1, Foundry SME 2 (PLC group subsidiary))*

Firms taking this approach were characterized by having large proportions of schedule orders, which increases their vulnerability to temporal changes in factor prices. The use of invoice discount financing[23] was common for such firms,

[23] Invoice discounting is a financial facility used to improve cash flow. Bank creditors loan a percentage of outstanding invoices to the firm (usually 60-80%), providing them with working capital. When the outstanding payment is made to the firm, the firm is able to access the remaining funds attached to the invoice.

highlighting a reliance on external credit for cash flow. Discount financing or factoring also reduces the firm's margins as there is an associated financing cost (interest charge). This implies the need to fix input costs as there is limited working capital to fund price fluctuations.

5.1.3 Re-assert competitive advantage approach

This approach attempts to generate efficiencies in production processes and purchasing activities to retain or improve the profitability of firms under existing product and factor prices. Firms internalize risks and manage it through offsetting price increases with a reduction in production costs. This reduces the firm's vulnerability to price volatility as energy accounts for a lower proportion of the firm's cost base. This approach is a long term strategy aimed at retaining and improving price competitiveness by maintaining a cost base in line with competitors and generating suitable profit margins. Firms using this strategy invest in energy efficiency measures, restructuring production processes to utilize utility cost advantages and through sophisticated purchasing methods including energy brokers, consultants and buying consortiums.

The protectionist strategy is the most popular single approach (8 firms, 18%) and was predominately used by independent SMEs (7/8 firms). This highlights a significant power asymmetry between transaction partners based on the relative size of enterprises (Zabin 1997; Christopherson and Clark 2007). Independent SMEs cannot generate relative powerfulness from wider group ownership and as a result, the significant size and purchasing power of larger customers constrains the IMP firm's ability to transfer energy cost risk forward in the supply chain. Consequently, firms are forced to internalize the risk of energy price changes and make alternative adjustments, such as utilization of funding scheme for energy efficiency (5 firms used the Carbon Trust scheme).

Firms using multiple strategies, of which re-asserting competitive advantage was one, were characterized by significant continuous levels of investment throughout the production system. The ability to invest is critical to this approach. Firms using this strategy had a high level of available funds, either through cash reserves (6 firms), credit availability (7 firms) or grants (5 firms) and management teams interested in innovation combined with cost control. This group also had a high level of export based turnover. During the recession credit availability, primarily through invoice discounting or overdraft facilities, was favorable to exporting firms. The institutional context enabled exporting firms to make efficacy investments (Dorry 2008). Government schemes intended to increase efficiency in industry were critical for SMEs in the sample. Such schemes were used to reduce energy use and ultimately improved profitability as firms were able to re-balance their cost structure (Bassi *et al.* 2009). Larger IMP firms were less active in making direct energy efficiency investments, partly because they had previously made significant investments that would make any further investment less effective. Larger firms had higher levels of asset specificity, in both equipment and knowledge, which generated a degree of interdependence, power in client relationship and consequently were more successful in transferring energy price risk to customers (Gereffi *et al.* 2005).

5.1.4 Exploitative approach

The final approach to energy price changes is far more embryonic and of a much smaller scale (used by four firms). Under this approach IMP firms actively manipulate the pricing structure of their customer base to generate additional profit by exploiting price volatility. Dependent or less powerful customers are used to offset IMP firm's inability to transfer price volatility to less dependent and more powerful customers, where they may incur losses. Time is especially important in contractual relationships. During the early years of a five year contract, profit margins may be acceptable, but may be eroded towards the end of the contract. Firms try to transfer costs to clients, or make up any shortfall from reserves or from other contracts. Further research is urgently required to explore the relationship between time, contract and relationships between firms. In the case of Foundry SME 18, a jobbing[24] foundry, the firm was able to pass on energy price increases to smaller customers but, importantly, this firm does not adjust prices when energy costs fall. This allows the firm to generate additional income from a small proportion of its less powerful customers. This firm argued that they:

> *. . .benefited from [surcharges from] my smaller customers, I just put prices up. Then I put it up again, put it up again, then again. With the bigger boys, when the surcharges come down they benefit. The small ones, they've not benefited at all. Because we've looked around and said well it will cost them more to move and go somewhere else. It's a bit naughty but its well, financial, commercial, you know, you've got to stay with it. (Interviewee 1, Foundry SME 21)*

This firm manipulates surcharges to its advantage but only with customers that are dependent on the firm. This is a form of 'lock-in'. Small jobbing foundries have

[24] Jobbing refers to the structure of product orders. These firms are characterized by discrete, one-off orders from a wide range of customers with non-transaction specific investments.

relative power over some of their clients; it is costly and time consuming to transfer small batch production to another producer as the tooling is located at and tailored to a particular foundry. Consequently, smaller customers are highly dependent on a foundry and the foundry has a much stronger governing relationship (Gereffi *et al.* 2005). Firms which do not provide specialized foundry-specific capacities and manufacture mass produced components are less able to develop and exploit ‘lock-in’ relationships. Larger clients avoid lock-in situations by spreading the production of parts between firms and playing providers off one another.

5.2 Energy adaptation and governance structures of IMP firms

The adaptive approaches developed by IMP firms in response to the ‘energy hot potato’ are entangled with governance influences from both transactional partners and the institutional setting of the IMP firm’s geographical location. As a result, firms have developed and implemented a range of adjustments, which are most commonly used simultaneously to address specific elements of the firm’s transactional relationships and financial stability. IMP firms are engaged with multiple value chains that reflect a mix of products and order types, and have multiple and varied customer-supplier relationships. This is highlighted by the ability of IMP firms to use specific approaches with different segments of their customer base. The ability to manipulate customer relationships to adapt to changing environmental conditions is influenced by power differentials (Fuller and Lewis 2002; Grimshaw and Rubery 2005; Sturgeon *et al.* 2008). In some instances, IMP firms transferred energy price increases forward in the supply chain through price increase notifications or formal surcharge mechanisms.

Firms able to transfer the energy risk, the hot potato, to some customers did so through two types of power. The first results from the significant size or capability of the IMP firms. This form of structural power allowed firms to exploit the dependence of other firms on the relationship (Zabin 1997; Fields 2006). The second, more complex, power negotiation is illustrated in instances where firms are able to transfer part of the energy risk to some of their customers. In these cases, the relative power of supplier firms is constructed through the types of order and agreements between transaction partners. Formal contractual agreements allowed supplier firms to negotiate a price change mechanism into the contract, however, where the power differential between customer and supplier firm is less clear, IMP firms often attempted to build upon informal relationships. An example from a large foundry illustrates how an informal relationship of trust and reputation can allow firms to manage energy cost increases more successfully than via purely formal contractual agreement:

> *[we] did put a one year delta [surcharge] against the contract based on the electric . . . to be honest that was a pretty big favor on the basis we've got a very good relationship with them all, so the T&C's [terms and conditions] would say no, they don't do that (Interviewee 1, Foundry SME 2 (PLC group subsidiary)).*

The recession amplified power differentials between firms by making firms generally more dependent on customers and therefore reduced the enforceability of formal contracts and power in negotiating informal agreements. With lower volumes and batch orders IMP firms could, in some cases, take advantage of their relative power as customers required smaller orders and were more dependent on rapid, short order runs. Smaller orders meant that some customers had to transfer orders from China back to the UK. The increased dependence on a supplier firm influenced the governance of the relationship in the favor of suppliers (Gereffi *et al.* 2005). Power is a means of governing inter-firm linkages as organizations have differential status in relationships (Grimshaw and Rubery 2005). This heterogeneity of status allows one firm to influence the workings of another, where power is seen as an alternative to trust as a governance mechanism. This dynamic between power and trust as a governance structure is dependent on the context in which the relationship is situated (Rowley *et al.* 2000; Grimshaw and Rubery 2005; Sturgeon *et al.* 2008). Time and timing is important; this was the case for the IMP industry with the onset of recession that was also combined with enhanced energy volatility.

6. Conclusions

IMP firms have developed significant adjustment processes for managing the risks associated with energy price volatility. The ability of IMP firms to transfer energy price risk, the energy hot potato, has been shaped by power asymmetries in customer-supplier agreements, which have been influenced by both transactional and institutional forms of governance. The inability, in many cases, to shift the risk to customers has forced IMP firms to engage in multiple strategic approaches to reduce their vulnerability to energy costs, including technological investments and purchasing strategies. The energy crisis has provided an insight into the development of governance regimes as IMP firms learn to adapt to volatile energy costs.

The current energy crisis has a complex multi-scalar cost structure, influenced by international markets, national market structure and policies, particularly carbon reduction legislation, and the individual firms ability to negotiate contracts or engage in cheaper parts of the supply market (i.e. wholesale). Energy intensive industries, like the IMP, have been amongst the first to experience the energy crisis.

IMP firms have developed multiple strategic approaches to manage energy risk. This is a direct result of the multiple governance structures acting on firms that are part of specific transactional relationships, with their associated power asymmetries, and the institutional constraints and enablers on firm activity. This variety of governance regimes means that a single approach does not reduce the risks associated with alterations in energy prices. Instead, firms are forced to develop strategies which can minimize risk related to energy price changes by adjusting specific governance structures. It is this mix of governance structures which affects the stability and vulnerability of IMP firms. Governance models in the literature focus on the ability of lead firms to transfer costs and risks to their suppliers (Sturgeon and Lee 2001; Gereffi *et al.* 2005; Sturgeon *et al.* 2008), however, our research stresses the importance of the *supplier's* ability to transfer risks to *their* customers through specific transactional relationships; suppliers play different roles depending on the type of customer – from lead to dependent, from a position of power to powerlessness. This draws attention to the complex nature of power differentials in transaction relationships, influenced by order structures, agreement types and the product portfolio of supplier firms. These more complex forms of governance have a significant effect on the adjustment processes of IMP firms and need to be more fully incorporated into conceptualizations of governance structures.

Energy costs are an increasingly important challenge for energy intensive firms (Forfas 2011). With increasing prices energy cost components are set to grow in significance for firms and pose specific challenges for survival. The rate of change for energy prices creates immediate and short-term problems with cash flow and a longer term erosion of profitability and financial stability. As such, a cycle of continued competitive disadvantage founded on a lack of investment and innovation renders firms increasingly vulnerable to competitive pressures, cyclical events and shocks. The best firms focus on the production of innovative products combined with cost control. By itself, cost control eventually undermines the ability of a firm to manage the relationships with customers. Cost advantages can always be matched by some competing firms; price or cost control provides limited advantage in managing a long term customer relationship. IMP firms that compete on technology, process, speed and cost are able to acquire power in the relationship with some of their clients. The same firm will have different degrees of power or powerlessness in their relationship with different clients and that power also varies over the course of a contractual relationship. The interaction of short- and long-term processes of change generates a series of complex adjustment processes which need to be more fully integrated into existing conceptualizations of firm adaptation. With the increasing significance of climate change and the targeting of industrial activities for abatement of green house gasses, adaptation to energy price changes and volatility will play an increasingly significant role in firm strategies, both in factor input and distribution costs. The role of distribution costs is beyond the scope of this analysis but raises important questions regarding the location of production, particularly in conjunction with the transition of the IMP industry towards low volume production of complex products and the shift of some production back to the UK, which was previously sited in low production cost areas, during the recession. These factors rely heavily on closeness to market and relationship structures with key customers. The influence of energy prices on the form of distribution costs is an area which requires further examination to understand how energy prices may promote this transition.

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