In the shadow of the Dragon and the Tiger: Towards a new understanding of production relocation, innovation and industrial decline

By

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Global transformations

We are in the midst of a global reallocation of production activities. Driven by the surge of NIC economies, political trade liberalizations, and decreasing transportation and communication costs, still more production activities are shifting from high- to low wage countries. Annual world wide spending on sourcing was estimated to reach 5.1 trillion US$ in 2003 – up from 3.7 trillion in 2001 (Clott, 2003). China is becoming the world's leading sourcing hub, while India is seen as the key recipient of development activities from Western Europe – particularly relating to information and communication technology (McKinsey Quarterly, 2003).

For most governments and managers this development should not come as a great surprise, since the advent of such changes has been heralded for some time (see for instance Reich & Mankin, 1986; Hamel & Prahalad, 1994). What may be surprising for politicians and companies alike are the speed by which companies in China and India are catching up technologically, hence positioning themselves as potential competitors to producers in Western Europe and in the USA (The Economist, 2003, Zeng & Williamson, 2003).

The vitality of the Chinese "Dragon" and the Indian "Tiger economy" has given raise to some concerns. A number of political commentators as well as industrialists and researchers foresee a

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situation, where – driven by the realities of competition - virtually all production competencies will disappear from developed countries and be taken on by eager producers in China and India. Some claim that research activities will follow, since the development of new knowledge is strongly intertwined with production activities (Cohen & Zysman, 1987). Co-location of production and technology development determines the ability to learn and hence further the ability to innovate by reducing cognitive distance (Nooteboom, 1999; Lundvall, 2003) and competitive learning possibilities (Maskell, 2001). Much like what allegedly happened to a number of industries in the US in the 1980s, images are born in which companies will be "hollowed out" and the competences necessary for inducing technology development will gradually shift to these countries. Hence, relocation activities, and their consequences to industry competitiveness are looked upon with the greatest suspicion (Bettis, Bradley & Hamel, 1992, US Congress Hearing 2004).

The issue to be explored in this contribution is how a massive relocation of production activities to high-growth and low-cost countries such as India and China influences the organisation of innovation activities in Danish regional clusters. Research repeatedly has shown, that in Denmark, regional clusters are the front-runners in terms of export market shares, turnover growth and entrepreneurship (National Agency for Enterprise and Construction, 2002 & 2003). Also internationally, the role of clusters as drivers of national competitiveness has attracted attention from designers of industrial policy (OECD, 2001, European Commission, 2002). Hence, the impact of increased relocation of industrial activities on the future competitiveness of these regions is an important matter that calls for further investigation.

It is claimed here, that globalisation in its present form is strongly driven by the recent advances of information technology, and that new perspectives are called for in order to understand the ongoing relocation patterns. Rather than addressing relocation impacts in singular, a more faceted view is needed, which takes into account the interplay and variety of technological and institutional settings across industrial regions. A framework for understanding the underlying logic of relocation activities and their possible impacts on cluster innovativeness and competitiveness, based on is developed and explored, using case studies from three representative industrial clusters, reflecting the underlying dynamics of these regional economies.

The paper is structured as follows: First, our conceptual framework for addressing activity relocation and for addressing different forms of activity relocation in manufacturing is clarified. Next, a review of the relevant literature is presented and some propositions are derived. In the empirical part of the paper, findings from case studies in four Danish clusters are presented and analyzed, using the theoretical framework. Finally, implications for research as well as management and policy implications are discussed.

Industry Clusters and Activity relocation: clarification of concepts

In order to clarify our focus of investigation, some clarification of the concepts of production activities, clusters and sourcing used is in place. Since we seek to address the consequences of sourcing to local actors' competitiveness our perspective is the industrial cluster within the nation state. The concept of a cluster is preferred to than of an industry, since it is less rigorous regarding the demarcation of industry activities, as compared to the conventional industry concept and includes the notion of locality in understanding the organisation of commercial activities.

Following Porter (1998), a cluster may defined as a geographic concentration of interconnected companies, specialized suppliers, service providers, firms in related industries and associated institutions in a particular field linked by commonalities and complementarities. According to research, clusters provide a range of benefits for those actors belonging to them, including privileged information access, trust and reduced coordination costs (Maskell, 2001). Moreover, through the complementarities of actors across production steps and iterated interactions, co-specialization evolve inducing the innovation abilities of actors, supported by the development of shared norms and mutual trust through physically proximate and repetitive interactions, leading to social bonding, trust-building and commitment. Social interaction among business actors spur competitive as well as collaborative learning through the ongoing processes of monitoring, comparison and imitation. This is the notion of the particular "air" of regional economies, characterized by Marshall (1890).

The special abilities of regional clusters frequently lead to the development of world-class competencies. A recent study of regional clusters in Europe revealed more than 80 examples of internationally competitive clusters, including the Welsh Opto-electronics cluster in the UK and the Wallon Aeronautic cluster situated Belgium and France along the Wallon East-West Axis (NAEC, 2002). Similar studies in the US and in Italy links regions with the development of international competitiveness based on local clusters (Porter, 1998, Storper & Salais, 1997)

Hence, the activities performed by actors located within the cluster have a system-like character, in the sense that they form a loosely coupled system of semi-dependent actors controlling mutually adjusted production organisations. Consequently, a region may be described as a production system, configuring and governing a local system of input-output relations, with a widespread and complementary division of tasks. The input-output system is the functional core of the economy (Storper & Harrison, 1991). It is the collection of activities leading up to the production of a marketable output.. The governing structure has labelled the production system by Storper & Harrison (op cit). It is the managerial superstructure to bridge, coordinate and govern activities. In most cases, the control of the production is distributed among several actors, suggesting fine-grained division of labour among the economic actors in the cluster. A cluster thus resembles a production system, which in its turn reflects the control held over the input-output system, i.e. the particular activities performed within the local area of the cluster.

In order to address the concerns raised regarding the ongoing reallocation of production activities, a conceptual model is proposed for furthering our study of the linkages between relocation of activities in clusters and the innovative abilities of these clusters (Andersen & Christensen, 2005). In this model we distinguish between production facilitating and production processing tasks, and between production processing and production follow-up tasks. We identify that there is an interface between these activities and that they may be more or less interdependent of each other, meaning that decisions relating to production facilitating decisions (such as design) and decisions relating to follow-up tasks (such as logistics) may be more or less interdependent on decisions relating to production processing (such manufacturing).

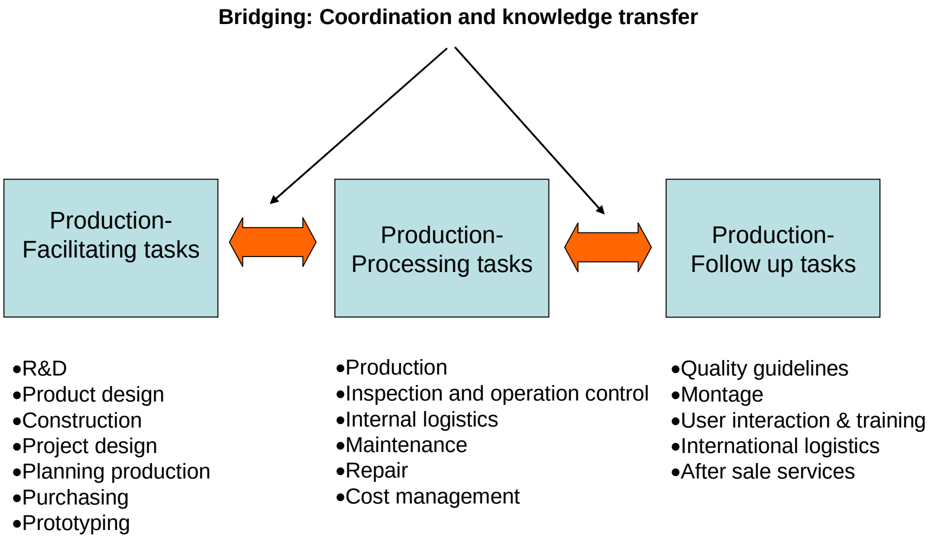

Figure 1: Manufacturing activities: A basic input-output system

Production facilitating tasks concern the bundle of tasks related to developing and preparing for manufacturing of particular products and components. This include Research & Development, product design and construction activities, but also the capabilities related to production ramp-up, such as prototyping, planning of purchasing, etc.. These are all knowledge-intensive tasks to some extent and they all rely on the processing of symbols. Moreover, these activities are upstream, in the sense that they are performed prior to production and are sequentially linked to the carrying out of physical production.

Production processing tasks includes the physical carrying out of manufacturing, surveillance, operation of internal logistics, the management of maintenance and repair, etc.. These activities are industrial in nature, involving the mastery of production technology, machining, etc.. These activities call for some form of production infrastructure consisting of dedicated machinery and specialized labour, able to physically manipulate materials as well as onsite production maintenance, inspection, repair services, etc.. Taken together, these activities are all technology-intensive, in the sense that they typically call for dedicated production equipment.

Finally, production follow-up tasks are downstream in nature, relating to the further distribution and/or consumption of the product. Production-follow-up may include marketing activities as well as various forms of quality control and montage, interaction with users, after sales services, as well as logistics. Like production facilitating tasks, these activities involve manipulation of symbols rather than physical processing of materials. These activities are knowledge intensive, and often call for interaction with users and/or resellers of the output.

The arrows linking the production activities signify the tasks carried out by the production system. These are the activities assuring, that coordination, governance and knowledge transfer takes place. As pointed out by Dicken (2003) an increasingly important challenge for achieving entrepreneurial benefits for any operator in the global production network, is the ability to govern inter-organisational relationships, i.e. to master the process of configuring, linking and coordinating these activities with the wider global production network. This is elsewhere referred to as bridging activities, i.e. those coordinating activities and corresponding transfer of knowledge among actors that link together transformation processes in production activities carried out in global networks (Andersen & Christensen, 2004). For the understanding the impact of relocation of production processing as well as on facilitating and follow-up activities on the region, the crucial question raised here, is whether the linkages between the production processing activities and the production facilitating and follow-up tasks are important for maintaining the innovative capabilities of and if so, whether these linkages function more significantly efficiently within the region than among globally dispersed actors. In other words: Do global segregation and relocation of these activities have any effect on regional innovativeness and competitiveness?

Forms of activity relocation

In order to address the question on how relocation impacts on the innovative abilities of regional clusters more precisely a vocabulary, which is able to address the various forms of activity relocation, is needed (Zysman, 2004). In the debate on the transfer of manufacturing activities to countries with more beneficial factor endowments, global sourcing, outsourcing and offshoring are concepts frequently used. Often however, these concepts are used interchangeably although they apply to different phenomena and differ radically with respect to the spatial relocation of activities and to what degree ownership is involved. In the present context, relocation refers to the pattern of changing the current location or governance form of activities. Relocation of activities concerns the dominant strategies and patterns regarding the overall location of activities and the procurement patterns of any given domestic cluster. This includes outsourcing as well as manufacturing, domestically or in other countries. The different forms are illustrated in figure 2 below, distinguishing various forms based on spatial and ownership dimensions.

The spatial distinction between regional and global refers to the geographical location of activities. The notion “regional” is not an absolute and metric measure. Rather, it is determined by the boundaries of the cluster. In practice, all experience shows that defining the precise demarcation line empirically may be difficult, although most actors may have a clear, but subjective notion on who they believe to be in- an outside any regional boundary. Ownership relocation refers to changes in the legal entitlement of the organising body issuing the specific relocation activity. Ownership is divided into region-based and foreign ownership. By this we refer to where the majority of the owners’ assets is located and controlled from.

Figure 2: The forms of spatial and ownership relocation from a regional perspective

		Ownership relocation of activities	
		Region-based ownership	**Foreign ownership**
Spatial relocation of activities	**Regional**	Local activity expansion and re-organisation	Global tapping
	Global	Offshoring	Global sourcing and outsourcing

Local relocation refers to the ongoing rearrangement of production activities within the region. Reorganisation of activities among actors caused by a more or less intensified externalisation of activities among regional actors will not be further discussed here, as it does not relate to our main purpose. Foreign actors’ investment into manufacturing and technology development activities in the local area is here referred to as the process of global tapping. For instance, multinational companies may establish local listening posts, in order to gain access to locally embedded technologies (Andersen & Christensen, 2002).

Turning to global relocation of activities, Global sourcing and outsourcing refers to transferring parts of or the entire responsibility for manufacturing a service or a good to global suppliers external to the cluster, which previously were manufactured or taken care of within the cluster. This may include facilitating as well as processing or follow-up tasks. The distinction between sourcing and outsourcing in the lower left quadrant of figure 2 may seem artificial. However, in terms of keeping or retaining the mastery of production skills within the cluster, the distinction between these two forms is significant, as sourcing describes the purchase of an additional activity which previously were not performed by the organisation. Outsourcing on the other hand concerns reducing or terminating an in-house activity and procuring this activity instead.

Finally, industry actors may engage in direct investment activities as part of their activity location strategy and move production activities abroad while maintaining ownership control of the operations – either as wholly-owned operations or in a joint venture with local partners, where a significant share of the assets are controlled by the company. In these cases, the cluster may be expanding its activities or linking with other clusters through ownership linkages. We refer to this process as offshoring, as parts of an activity or an entire activity relocate in another context, but maintain operational linkages with the local cluster through supply linkages.

Re-organisation of production and re-location of industrial activities: the road to serfdom?

Most researchers agree that the ongoing reorganisation of production following from extended outsourcing, offshoring and internationalisation of sourcing are signs that new organisational patterns are replacing existing forms (Dicken, 2003). We are entering a world economy, which increasingly has a regional architecture (Zysman, Doherty & Schwartz, 1997). Drucker (1998) characterizes it as one of the greatest organizational and industry structure shifts of the century. Other sees this as the drift away from the M-shaped MNC towards an industrial form defined by extended vertical specialisation (Ernst & Kim, 2002). Still others herald the advent as the coming of new 21st century organisational forms, where virtual organising and networking comes to the fore (Miles et al, 1997).

The relocation of industrial activities from a national context to countries such as China and India is by most orthodox economists seen as an inevitable result of the liberalisation of international trade and investment policies, combined with decreasing transportation and communication costs. First, in order to stay at par with an increasingly global competition companies within the cluster must seize the opportunities of reducing their manufacturing and development costs, thus offsetting the any competitive advantages that global competition may accrue (Bryce & Useem, 1998). Secondly, reduction of manufacturing and development costs may increase performance in terms of increased productivity and profitability (at least in the short run) and hereby satisfy investors and company shareholders (Prahalad & Hamel, 1994). In these new realities, the strategic importance of mastering manufacturing seemingly is decreasing. Manufacturing matters only to a limited extent and “that’s a good thing” (Ramaswamy & Rowthorn, 2000).

The question posed to the strong growth of new sourcing hubs in China and India at the expense of local production is whether things are moving too fast? Is the rapid development potentially harmful for the high-wage country’s ability to maintain its competitive abilities and should political actions be taken in order to mitigate or at least readjust for this shock (Ansberry, 2003). Several voices are raised in concern during these times of change, which together can be labelled proponents of the “hollowing out/learning decline” hypothesis. The argument put forward by these politicians and commentators, is that although the development is inevitable it may be delayed politically in order to give the work force more time to readjust and re-skill their workers to meet the changing conditions.

Production relocation and industrial decline from a hollowing-out viewpoint

First, representatives of local labour unions as well as politicians in several high-wage countries follow the development with great anxiety and protective political measures have been suggested by for instance US politicians and have been a recurrent theme in the latest US presidency election campaign (Reich, 2003). Moreover, the US senate is working on bills to restrict government contractors from outsourcing work overseas (Business Week, 2004).

They argue, that increased relocation – particularly outsourcing, international sourcing and global tapping eventually is a process of knowledge codification, where knowledge becomes increasingly ripe for imitation by potential competitors in China and India. This will give these countries a head start in the competition while the competences located in the clusters of high-wage countries gradually will erode, as barriers to cross-functional learning will develop. Transfer of activities from a domestic to a global context will lead to the build-up of potential competitors’ knowledge, and shift the power balance in the production system, giving suppliers in these countries the upper hand (Gereffi, 2001). Hamel (1991) has described the hollowing-out process of US industry through the reallocation of activities and corresponding loss of skills and competitiveness by US firms. Through strategic collaboration among companies from the US and Japan, branch after branch particularly in the electronics industry in the 1980s lost control over critical skills, leaving the development initiative to eager Japanese and Korean competitors. The dynamics of outsourcing leading to the deskilling of industries are described in detail by Bettis, Bradley & Hamel (1992). According to them, particularly ownership proximity of manufacturing to innovation activities is crucial for companies to maintain their zest for development. However, short-term strategic horizons may mislead companies to "be tempted by the dark side" and take a shortcut to achieving short-term competitiveness (Hamel, 1991). This, however, is on the expense of developing the people-embodied skills needed for long-term product leadership (Prahalad & Hamel, 1990). Hence, the notion that companies may outsource manufacturing and focus on customer relationships and product design, leaving out manufacturing activities is believed to be faulty, since the ability to develop new products and link market needs with evolving technological possibilities calls for activity co-location and control (Berggren & Bengtsson, 2004). Separation of ownership between manufacturing and design are believed to reduce coordination capabilities, add substantially to product development lead times and inhibit skill accumulation. Moreover, a separation of manufacturing from customer knowledge is not achievable, simply because customer inputs usually is necessary in customized production (Bettis, Bradley & Hamel, 1992).

Production relocation and industrial decline from a regionalist viewpoint

Although the debate is accentuated by these concerns, a different tenor can be heard from other critics of the ongoing relocation of activities. Rather than looking at the global relocation of activities as a short-term phenomenon they criticize global re-location to be ineffective from a more long term and strategic viewpoint, as the hidden operating and strategic costs of outsourcing is not clear to the actors involved and in the end may raise barriers to their future technological leadership abilities (Clott, 2004; Hendry, 1995). A parallel viewpoint can be found in the regional economics literature on innovation, learning and regional development (Storper & Harrison, 1991; Saxenian, 1994). Here, focus is primary on the spatial dimension of industrial activities, whereas ownership plays a less important (although not insignificant) role in understanding innovative dynamics of a cluster. Fundamentally, geographical proximity is expected to reduce costs associated with knowledge development. For instance, Storper (1995) points to the importance of regional location for innovation activities. Since innovation is of an evolving and uncertain nature, personnel with various skills must be able to interact spontaneously. Proximity provides a number of benefits for this interaction to occur: it reduces cognitive distance, since actors have a common reference frame or a shared technical code (Nooteboom, 1999). Moreover, it enhances openness in communication, since localness favours sanction mechanisms enhancing trust-building and discouraging opportunistic behaviour (Dei Ottati, 1994). Also, co-location gives way to learning, as local surroundings reduces the costs of ongoing monitoring, imitation and comparison of identified superior solutions, thus providing the most fertile ground for variation and technological evolution (Maskell, 2001). Thus following this view, not only global sourcing and outsourcing, but also activity relocation through global offshoring is seen as detrimental to the learning ability and – in its turn the innovativeness of local clusters. The process of global tapping, on the other hand is seen as less problematic and some researchers even see it as beneficial to the local development of industries. For instance, it is an explicit development policy to develop incentive schemes so as to attract foreign multinational in order to vitalise local industry. Such policies are rather global in scope and are found for instance in diverse areas such as Xuhing in China and Wales in the UK.

In particular, since the ability to acquire and utilize new knowledge is becoming the dominant competitive factor, physical relocation of activities important to competence maintenance and renewal are critical. Competitive advantages relating to production knowledge becomes less sustainable, as access to global production and supply networks become a ubiquity – available to all actors in the industry, and even opening up for low cost entry of skilled entrepreneurs. In its turn the loss of local production competencies therefore eventually will lead to a process of competence erosion, as industry after industry will loose control and knowledge of crucial production capabilities necessary to develop products and enhance further business potential (Hitt, 2004; Heywood, 2001).

Challenges to the received view: Towards a new understanding of product relocation, innovativeness and industrial decline?

The received views are important for understanding the impact of globalization on the regional economies and their ability to remain competitive as predominantly production processing activities but to a growing extent also production facilitating tasks (such as programming, computer drawings, manuscript preparations) and production follow-up tasks (such as service organisations and call centres) move abroad. Relocation of production activities has been an opportunity for some time now. What seems to be new is that not only what has been characterized as “simple” or “standard” production activities in terms of physical manipulation of materials into components and final goods is moving, but also knowledge intensive work, demanding symbol processing skills may be de-contextualised and relocated. From this perspective, the growing concerns may be understandable. It is however important to understand, that the implicit premises and axioms upon which the viewpoints of the received views rest are those of the mass-producing rather than the digital era. This has ramification for both the nature of international trade and for the organisation of business activities. According to Gereffi (2001), we are facing the era of digital globalization, which has replaced the era of trade based-globalisation. Where the trade-based globalisation phase was strongly contingent on and driven by the rapid and diversified industrialisation of a number of developing countries, the digital era is characterized by functionally integration of physically dispersed activities. It is revolutionary in the sense that the importance of space and co-location of activities in order to glue together production activities are changing and that the rate of global diffusion of the Internet technology is far faster than of any previous technology. The political, economic and technological forces of the digital era promoting companies' ability to transfer production activities to low cost countries, also transform the organization of industry, making it increasingly possible to partition and modularize production chains and bridge large geographical distances: research suggest that the increased modularity of manufacturing and development resources creates new norms for activity coordination and co-alignment, which spurs global activity coordination and configuration (Gereffi, 2001; Tapscott & Ticoll, 2003). Hence, rather than outlining a unison picture of globalisation's effect on industrial localisation and national competitiveness, the fact that transferability of production activities is a two-way street and how this may affect the ability of an technological cluster to connect and act in an increasingly globalized economy should be taken into account (Castells, 2000, Amin, 1998). Likewise, Several have pointed out that the organizing possibilities emanating from the digital revolution are challenging the organisational forms of the industrial age. New business models, which focus on knowledge rather than technology management, are appearing, with an explicit focus on the development of network positions, knowledge management and global configuration of activities (Venkatraman & Henderson, 1998; Drucker, 1993, Malone, 2002, Hagel & Singer, 1999).

The emerging realities of the informalisation of the world economy leads to interesting paradoxes related to the received theoretical perspectives on the hollowing-out phenomenon. For instance, after having suffered what was believed to be devastating blows to American-owned companies within the electronics industries throughout the 1970s and 1980s, American companies succeeded in regaining market shares through innovative new products in the areas such as new consumer electronics. An entirely new competitive model, based on global production networks, international standards and the ability to capitalize on innovative abilities within marketing knowledge, software development and product architecture was suddenly more critical than mastering electro-mechanical skills. This has been labelled Wintelism, describing a development where formerly critical skills becomes commodities, available from contract producers, and where the ability to connect electronic components and find commercial use for the possibilities offered has become the new key success factors (Borrus & Zysman, 1997; Hart & Kim, 2002). The return of the US entertainment electronics industry came as a surprise to most commentators on international competitiveness (Hart & Kim, 2002). Likewise, as a consequence of the new economic realities of the digital economies, industries which usually were dominated by vertically integrated companies, ensuring a high degree of ownership control over production facilitating as well as processing activities are now dominated by firms which holds control over a single component or activity in the entire system of value adding activities leading up to the manufacturing of a product. This has been known as the deconstruction model, where companies control entire industries based on separating the information-rich part from the commodity parts of the value chain (Sammut-Bonnici & McGee, 2002; Ewans & Wurster, 2000). One case in point is the emergence of a Danish cluster of companies within the production of home cinema solutions with flat screen displays as their core. Even though these companies have no technical mastery with respect to the physical production of displays, they control the knowledge necessary to develop the proprietary software which, when loaded on the chip set enable superior product performance and provides them with a stronghold in terms of production facilitating competencies untied to production processing skills.

This suggests that the predictions of the hollowing out theory proponents and the regionalists may be less general in scope than originally assumed. In order to better understand the apparent paradoxes, the cross-sectoral divergences of interlinkages between innovation and the relocation of activities need to be addressed more systematically. These and other findings suggests, that the growth of global sourcing and off-shoring holds no general ramifications for all companies, but that impacts are shaped by the characteristics of manufacturing industries in those sectors (Zysman, 2002). As a consequence, radically different sourcing and relocation dynamics fuelled by different strategic priorities and competitive dynamics are at play. The challenge is to gain a clear perspective on how these different forces act in shaping the future competitiveness of local competences.

Perspectives, which challenge the implicit assumptions of manufacturing as the key to learning and innovative performance, found the received views are called for. Several contributions have pointed to the importance of new information technology as an enabling technology, which – in combination with existing technological trajectories and sector-specific institutional designs – may lead to radically different strategic priorities and corresponding sourcing and relocation strategies in different manufacturing sectors.

Given very different industrial contexts, the response of the Western industry to the ongoing globalisation and the rise of India and China as possible sourcing bins may hold strong variations. As pointed out by Storper and Salais (1997), because regions are formed by actors and institutions through complex socio-cultural processes they represent different socio-economic identities, fuelled by diverging conventions for configuring and coordinating economic activity. An important factor accounting for these apparent variations and the lack of explanatory power of the received perspectives is the advent of the technological paradigm shift fuelled by the information and communication technology (Castells, 2000). What seems to be the critical question in some of the industries, which have been transformed, or which are now emerging from this industry is the status of production competencies as a strategic weapon or as a commodity (Zysman, 2002). Assessing the relocation impact on regional industries and its possible consequences to innovation is contingent on the stature of production competence as a scarce resource with strong rent-generating possibilities or a commodity available to a broad range of actors, who can configure and dismantle production activities at will (Zysman, 2002). In situations, where production capabilities are scarce, access to these capabilities creates a potent strategic weapon, leading to positional advantages vis a vis competitors. However, in situations where production capabilities have a commodity-like character and may be assessed with few or no entry costs from a broad range of suppliers, other competences gain in comparative merit as levers for strategic achievements.

Hence, explanations which takes the new competitive realities of an economy, where the penetration of information and communication network technologies both enables new forms of information-based products or are information processes themselves, is frequently heralded as the main engine in a technological revolution centred around the creation and dispersion of knowledge and information, embodied in symbol processing operations and new product capabilities (Drucker, 2001, Dell, 1998, Quinn, Anderson & Finkelstein, 1998).

For this purpose we draw on two important research streams which both address the core design aspects of manufacturing organisation and the role played by information and coordination costs, which both have the potential for contributing with novel insights for understanding the underlying aspects of economic organisation and governance of manufacturing industries, impacting on the mobility of production activities: the modularization and the digitalization approach, but which has not been given much consideration in the current debate on the consequences of global outsourcing for regional innovativeness and competitive abilities. These research streams include research on digital or knowledge production and on the development of modular product architectures. Both research streams provide useful insights into the debate as they both take in to consideration the changes to the organisation and management of manufacturing activities fuelled by an increasingly information-based economy and address the mobility of manufacturing activities from this perspective. The ongoing discussions within these two fields are interdependent, and both points to powerful forces fuelling production relocation processes. However, they are distinct in the sense that, modularisation focuses on the relationship between standardisation and costs of coordination, whereas the underlying relocalisation driver of digitalisation relates to the relationship between knowledge codification and the possible de-contextualisation of activities. However, their emphasis on the consequences of the process differs as well. Whereas the modularisation perspective mainly focus on the rise of standards as a consequence of globalisation and their effect of coordination costs – and in its turn – location costs – the digitalisation perspective discuss the physical versus digital character of the value adding activities leading up to the manufacture of a product. In the following we will briefly outline these viewpoints and the underlying streams of research, in order to develop a framework that may help us to address more fully the apparent divergences in how industrial sectors respond to these new possibilities for global relocation and how such pursuing such strategies impact on the innovativeness and competitiveness of the industrial sectors.

The digitalization approach

The new information technology has changed the competitive realities in a number of industrial sectors. Industries strongly reliant on the collection, processing and distribution of information such as the music industry, travel agencies and a number of other information processing service industries are undergoing massive changes these years. A basic and relevant feature for addressing the physical mobility of activities is linked to the digital content of the activities performed to create a specific output. By value adding physical activities are here meant manipulation of physical matter to enhance market value of a processed good, while digital activities concerns the manipulation of symbols with a similar purpose. In the contemporary world, the value adding activities leading up to the fabrication of a typical final output is neither purely physical nor purely digital in nature. However, the bundle of activities necessary in order to produce a specific output may be either predominantly physical or predominantly digital. At one extreme, some products are entirely digital in their functionality and can be delivered as a set of code. The conversion of products from physical to digital, such as for instance encyclopaedias is one extreme example. As powerfully pointed out by Hagel & Singer (1999) in a study of the demise of the British Encyclopaedia struggling with the Microsoft Encarta: every business is to some extent an information business, and those who do not understand that digitalization will impact on their current revenue streams are facing serious challenges. However, the waves of changes are certainly not restricted to these cases. Digital processes adds value to a range of products and complement, convert or replace physical activities in a wide range of value added activities leading to end products. A wide number of the value adding activities leading to the assembly of a car or a camera have changed from physical to digital or digital activities have been added to the existing physical activities so as to add value to the product (Zysman, 2004). This does not only relate to the nature of the product but on their business models in their entirety. As the share of the total value added leading up to the manufacture of a specific product are increasingly digital in nature, the importance of interlinking production activities through ownership and/or physical location becomes less obvious (Hagel & Singer, 1999)

However, less often mentioned in this discussion is that even though digitalization impacts on almost all industries, they do so with great variety. Most regional outputs find themselves in between the ends of a spectrum, where digital or physical activities respectively have the upper hand (Christensen & Raynor, 2003). Whereas the established music industry is experiencing a global shakeout and the entry of new actors, other industries, such as for instance producers of apparel goods may experience some changes in terms of digitalized activities and processes, but also that the activities involving physical manipulation of goods still play a major role in coordinating activities and in deciding the structure and location of the value chain in its entirety. It is here suggested that digitalisation of activities is an important underlying force for understanding the location and configuration of value added chains.

The product architecture/modularization approach

A second and equally important dimension is linked to the architecture linking the components that forms the marketed goods. By a component we here mean a distinct portion of a product, embodying a core design concept, which can be separated from other components. The interface between the components, or how the components fits together in order to add to the desired output, is referred to as the product (or service) architecture, by Henderson & Clark (1990). This architecture may be more or less unilaterally defined, suggesting at the one extreme a strictly modular architecture comprised of hierarchically layered components fitting each other like (basic) Lego building bricks. This may be seen as opposed to integral product designs, reflecting a complex and integral product architecture, such as the one describing a F16 fighter jet. Here single components cannot be created interdependently of other parts, as their functionality are tightly coupled to the functionality of the other parts. This dimension links directly to the complexity of coordinating and managing interdependencies in the basic input-output system and in a broader perspective of managing activities crossing organisational as well as territorial boundaries. Interfaces exist within a product as well as between stages in the value added chain. The production facilitating., processing and follow-up activities described in the present context may be seen as one way of partitioning the regions' architecture. On a production system level, the equivalent to product architecture is the extent to which coordination is supported by the development and establishment of international standards, which provides the springbed for modularization (Galvin & Morkel, 2001). Here standards provides the basis for an embedded form of coordination that reduces the extent to which management coordination and direct intervention is required for the configuration and execution of globally dispersed production activities.

What is reflected in the received views is the importance of digitalization as an underlying transformative force, shaping how globalization affects the future organisation of business as well as reinforcing the globalization process. However, it is equally important to note, that the conversion from physical to digital activities has not affected all industries equally. Whereas few have been left unaffected by the informalisation of activities, the impact of the transformation is unevenly distributed across business spheres, as technologies, managerial beliefs and institutional rigidities vary. Using the dimensions presented here some insights regarding the role of production relocation and industrial decline may be reached in different business enterprise arenas, each reflecting different competitive situations and corresponding business possibilities and challenges for those firms acting in them. These arenas are displayed in figure 3. Each are represented an ideal type form, which holds distinctive characteristics. Moreover, it is assumed that the characteristics of each arena will impact on the nature and dynamics of relocation and how relocation affects innovativeness.

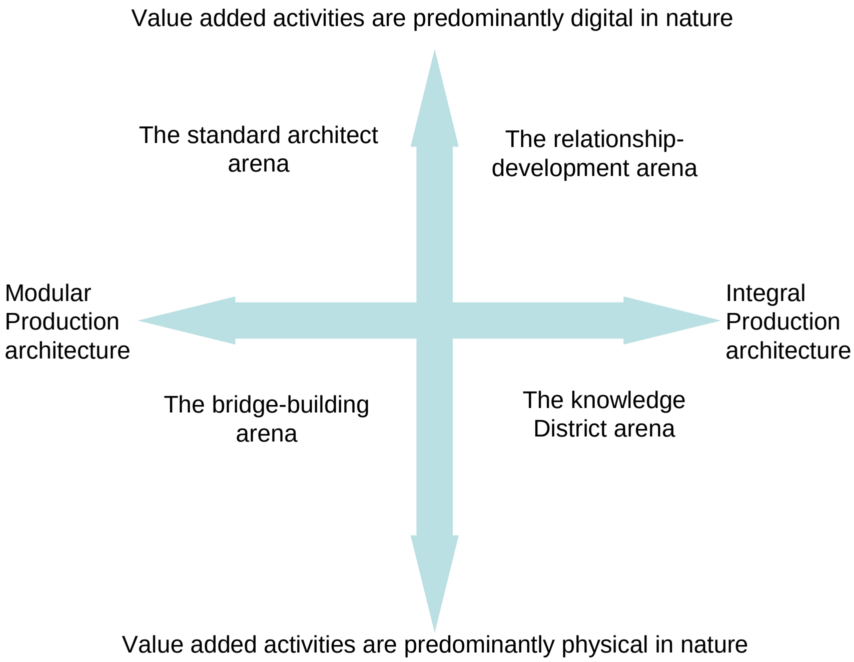

Figure 3: Production Relocation dynamics across regional arenas

The knowledge district arena

The lower right quadrant of figure 3 denotes a situation, where production activities often are territorially bound and here high coordination costs, due to the intricate and complex nature of production activities. Production and innovation are deeply intertwined, as learning is context-bound and contingent on iterative trial-and-error processes. This calls for close interaction and physical proximity of complementary production tasks. This is a situation often said to characterize the traditional Marshallian industrial district (Storper & Harrison, 1991). Here, production and innovation activities are strongly affected by the ability to perform physical activities in close proximity and territorial coordination dynamics in the form of frequent interaction and integral production architectures.

In these cases, production facilitation, product processing and follow-up activities are difficult to separate territorially. In particular global outsourcing but also to some extent global sourcing may lead to the loss of complementary competencies and impair the learning capabilities of the region, parallel to the concerns aired by the regional district hypothesis. Regional decline has been witnessed in industrial areas, where local competencies have been destroyed, as tasks were outsourced from the region leading to the loss of skilled workers and industrial decline. One case in point is the Danish shipyard industry, where a broad range of suppliers in proximity to the large Danish shipyards have closed down their operations, leading to the demise of regional capabilities in shipbuilding.

The bridge-building arena

The lower left quadrant in figure 3 illustrates a situation, where production activities are of a predominantly physical nature, but where the interface between them is well defined, hence following a modular production architecture. Here, the ability to capture economic rents through describing product and/or component interfaces and coordinate activities across vast distances becomes a decisive competitive competence. For instance, the manufacturing of bicycles may illustrate this situation. Modern fabrication of bicycles reflects modular system where interfaces among components may be described reasonably hazzle-free (Suarez & Cusumano, 1995). As a consequence, those able to bridge component suppliers and the retail channel, using qualified insights on supplier performance and combining it with branding excellence are likely to become successful in this market situation. In a Danish context, the outsourcing and offshoring of textile production illustrates this development well. Here, production activities are highly physical, as the major bulk of the production steps leading to the manufacturing of apparel depend on physical manipulation activities. However, modularization makes it possible to distinguish between pilot production and ramp-up activities, which means that production activities may be relocated fairly, once the design and initial production trial runs are in place. Thus, the ability to innovate is less dependent on mastery of production activities. Therefore, outsourcing of production processing activities alone is less likely to affect the competitive abilities of actors operating in this arena. What may be more effective, however is, that once production capacity diminish in importance as a competitive weapon, companies which have built their competitive capacity around their production capabilities are facing serious trouble. However, the ability to master complex and intricate logistical flows and coordinating project-based and entrepreneurial production networks makes room for an entirely new type of company: the relationship builders (the nature and business models of these companies are discussed in detail elsewhere, see Andersen & Christensen, 2004)

The relationship-development arena

In the upper right quadrant of figure 3, we find activities, which are highly digital in nature but where it is difficult to identify standard interfaces among product components, making it possible to separate discrete production activities. Here, activity relocation is easily achieved, due to near-frictionless transportation and adaptation and it is therefore possible for business actors to provide these activities from great distances. However, demand is often highly sophisticated, calling for adaptation of products rather than standard solutions. These adaptations are contingent on dense interaction between users and producers – at least in several important steps of the development of the production/consumption activity. The quality of the services offered by actors finding themselves on this arena are highly dependent on the knowledge generated from previous interactions with these customers – making interaction and relationship building with customers a key strategic concern of the business actors finding themselves in a business context characterized by integral product architectures and predominantly digital activities forming the actual output. These incidents may be found for instance in cases where the bulk of the vale added activities carried out consist of complex software development or other forms of manipulation of symbols, but where frequent and dense interaction among actors in order to make informed decision or develop products based on highly tacit knowledge bases, activities may be strongly depending on proximity in social space.

The standard architect arena

The location in the upper left quadrant of figure 3 means that manufacturing activities are hyper mobile and easily can be relocated in physical space, since coordination costs are low and activity transportation and relocation costs are negligible. This also gives way for a competitive climate characterized by hyper competition and rivalry learning activities (D'Aveni, 1994). Under these circumstances continuous learning and standard development are the main drivers of the competitive game, making way for a highly volatile competitive situations, where no differential advantages can be reaped from holding definitive positions in terms of production facilities (Williams, 1992; Shapiro & Varian, 1999) Hence, production activities will relocate swiftly, in accordance with the whims of the global factor markets, following a footloose and unstable pattern, since activities can be moved and coordinated without experiencing excessive switching costs.

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Data collection and data analysis

The purpose of the empirical investigation is to subject the proposed framework for understanding the different logics of industrial relocation to empirical testing and further development. We suggest here an ‘‘ideal-type’’ typology of four generic arenas for understanding underlying relocation dynamics. By ideal type, we refer to the Weberian notion that complex reality can be ordered according to simplifying models, grasping the essence of the reality studied (Burrell and Morgan, 1979). Hence, the empirical testing does not follow the traditional positivistic canons of deductive hypothesis testing. Rather, the empirical setting is used as a reflective device aimed at illustrating and further extending the modelling efforts by reconstructing the theory (Burawoy, 1991). This is an explorative methodology, which is between inductive and deductive research methodology. Generalising findings into predictions about a population is not the purpose of this approach. Instead, it attempts to ground theory development in empirical observations and to refine it further through the test of reality (Orton, 1997; Strauss and Corbin, 1990; Yin, 1991). In contrast to the traditional procedures of grounded theory (Glaser and Strauss, 1967), which picture a bipolar research world composed of inductive and deductive research, our approach lies between these stances. This is consistent with the methodological position known as iterative grounded theory (Orton, 1997). Iteration occurs when researchers continue to move back and forth between theoretical concepts and field observation, seeking to enhance their understanding of both theory and data during this process.

A multiple context and multiple case study approach has been taken to data collection. According to Yin (1994, p. 23), case studies are empirical inquires that (1) investigate a contemporary phenomenon within its real life context, (2) when the boundaries between the phenomenon and context are not clearly evident and (3) in which multiple sources are used. The purpose of this approach is not to generalise findings into predictions about a population, but to ground theory development in empirical observations and further refine it through the test of reality (Strauss and Corbin, 1990; Yin, 1991). By contrasting cases, purposefully selected based on their divergent characteristics, theory development may be further enhanced. Hence, three regions, which reflect diverging territorial dynamics, have been selected. For each selected region, expert interviews with company representatives have been conducted and representative companies have been identified. Data for this part of the study has been collected from primarily interviews with representative companies and from previous research and background reports. Interview data has been collected through personal interviewing, using a semi-structured interview guide. Interviews were typically of 1-2 hour duration. Interviews have been taped and transcribed. Based on the interviews and background material received from the companies, a case has been developed and submitted to the interviewed companies for approval and validation and follow-up interviews have been made over the telephone. Interviews have been prepared for systematic data analysis, using the Nvivo software package for pattern tracing and categorization.

In order to ensure that the regions studied are sufficiently divergent, representing different territorial logics, the modularisation and digitalisation dimension have been operationalized. The modularisation dimension has been addressed with respect to the dissemination and importance of industry-wide standards for manufacturing outputs within the particular regional cluster. Standardisation may take the character of enacted as well as de facto standards, where de facto standards in terms market-based standards "wars" between powerful competitors and negotiated standards, where industrial players seeks to agree on a common standard (Bonnici & McGee, 2002).

The second dimension addresses the role of digitalisation in the value adding activities leading up to the final produce. This issue is more complex to address, since value added must be understood from the user's point of view. Hence, the dimension is concerned with, whether the specific features of a given product are the outcome of mainly digital or physically informed activities. For instance,

Industry reports as well as presentation material and informal discussions with industry experts has been used in to collect information in order to access whether the value adding activities where dominated by digital processing of information or by physical manipulation of materials. Based on these findings, an overview of the regional clusters are given below in table xx

In order to select the regions to be investigated, we have taken departure in a recent study of industrial regions conducted by the National Agency of Economy and Commerce (2002). During 2001, this study identified 29 national and local regional clusters in Denmark, amounting to 20% of Danish industrial employment and 31% of Danish exports. The identification of these clusters was based on qualitative data. In 2002, this study was followed up by a quantitative study, which, based on a set of measurable criteria. By triangulating these studies a sample of 20 regional clusters anchored in Denmark can be found[2].

	Wind turbines	Telecommunication	Stainless steel
Primary location	Middle and West Jutland, Funen	Northern Jutland	The triangle (Eastern Jutland)
Number of companies	90	45	170
Export value (1999)	500 Million Euro	40 Million Euro	80 Million Euro
Approximate number of full time employees	21,000	4,000	6,000
Product architecture	Integral	Modular	Increasingly modular
Nature of value added	Primarily physical	Primarily digital	Increasingly digital
Nature of value added activities	Primarily linked to manipulation of physical materials	Primarily linked to manipulation of symbols and information processing	Linked to design as well as to production
Relocation of activities	Beginning relocation, primarily as offshoring of production processing and follow-up activities	Intensive relocation of production processing and some relocation of follow-up activities. Primarily as sourcing	Relocation of production processing (outsourcing) offshoring of production follow-up tasks

The wind turbine district

[2] A regional cluster may cross national boundaries. By ”anchored” is here meant that a significant part of the working population belonging to the regional cluster (40% or more) is located in Denmark.

The Danish wind turbine district developed from a modest start in the beginning of the 1970s into an expansive area in the 1980s and 1990s with yearly turnover growth rates toppling 40 and 50%. At the same time the industry has been able to increase employment considerably. From approximately 18.000 in 2000 to 21.000 estimated in 2002 (DWIA, 2003)

Today, Denmark is recognized as the leading knowledge hub for wind turbine production in the world, with a market share of more than 50% measured in installed worldwide MW capacity for wind turbines (DWIA, 2002). The Danish Wind turbine producers continues to hold a strong market position and attract international buyers of wind turbines as well as components, thanks to a fine-grained division of labour among innovative and highly specialized suppliers to this industry. The ability to interact locally with suppliers across various industrial branches is pronounced by several of the company representatives interviewed. For instance, the manager responsible for the offshore Wind Turbine division at Densit, a producer of foundation material and know-how explains:

“Local network is at the essence of our abilities. Using the knowledge and contacts we obtain trough various forms of interactions is shaping our abilities and is transferred from one off shore project to another by us as well as by many others”

As a product design a wind turbine is complex and integral in nature. In order to resist the extreme working conditions for wind turbines, wind turbines are carefully designed and subsystems are strongly interrelated. Moreover. Wind turbine producers constantly seek to improve on existing wind turbine designs, in order to increase the energy efficiency of the turbines. This calls for constant improvement of materials, components and product designs. For these reasons, industry-wide component standards defining the interface between the various components have not emerged.

Although the wind turbine production driven by supply side learning pressures, calling for the constant development of new knowledge, value adding activities are strongly bound to the trial-and-error processes and adjustments taking place. Some larger producers such as Vestas, the largest manufacturer of wind turbines located in Denmark and LM Glasfiber, the leading producer of blades for wind turbines have off shored production activities to Bangalore, India. The leading motives for off shoring, however has not primarily been to take advantage of local factor endowments such as production costs. Rather, outsourcing is driven by transportation costs, since wind turbine components constantly increase in size, and the transportation of some components (wind mill blades in particular) is becoming prohibitively expensive. Interestingly, together with LM Glasfiber, three of their Danish suppliers (ECM, Brd. Jensen and Rool) have chose to offshore and co-locate in near physical proximity with them, establishing their production activities in India, using supplier contracts with LM Glasfiber as a bridgehead in their relocation process. So far, this outsourcing process of production has not affected the location of production facilitation or following-up from the region. Moreover, outgoing relocation activities are rather limited. More outspoken seems to be ingoing relocation activities, as a growing number of national as well as international actors establish companies in the regional cluster hiring in personnel with professional linkages to the cluster, or take over already established firms. Producers such as Suzhlon (India) and Siemens (Germany) have recently entered the region trough take-overs or green field investments.

The Telecommunication district

Most of the companies in the sector today are specializing in technology development, and the number of companies involved and personnel employed in manufacturing activities are decreasing. Thus, the number of employees has decreased with almost 1000 persons since 2003, due to closures of manufacturing activities. Today, approximately 50 firms are found in the district. Most of them (two thirds) are small companies with less than 50 employees. Some of them are specialized development units owned by multinational companies. Today, foreign investors or foreign firms own approximately half of the companies. In total the companies in the cluster are employing approximately 3200 persons. Of these, about 2000 persons (primarily engineers) are working with technology development (BNY, 2004).

Historically, the telecommunications industry in Northern Jutland is a spin-off of the many radio and television producers who were established in the late 1940s and early 1950s, thriving on the huge private demand for television sets and audio equipment in the wake of the mass media investments. In the 1960s as the local demand for radios and television sets began stagnate and domestic as well as foreign competition grew increasingly fierce, producers began to look for new possibilities for exploiting their current skills. A small number of local companies started to manufacture professional maritime telecommunication equipment, caused by the demand from the local fleet of small fishing vessels in Northern Jutland (Dalum, 1995).

The emergence and continued importance of telecommunication standards has given rise to extensive product modularisation among telecommunication producers. Moreover, valued added activities are strongly digital in nature and for producers of telecommunication goods production capacity resembles more a commodity that a strategic weapon in the terms of Zysman (2004). This means that most location and coordination costs are increasingly neglectable giving rise for a prominent relocation of production activities to global specialists such as Solectron and Flextronics. As a consequence, low skilled jobs are leaving the district, causing overall employment to decrease drastically. For instance a branch of Flextronics recently closed down, calling for a lay-off of more than 1000 employees. However, although relocation of production processes are strongly affecting local employment and has dire consequences for the Northern Jutland region in general, this seems to have only limited effect on the innovative ability and competitiveness of the remaining companies in the area. The number of companies engaged in developing products based on existing standards or on further improving these standards (or giving way to hybrid standards aiming at breaching or undercutting the collaborative decisions made by powerful players in the industry) remain unaffected. One case in point is RTX Telecom. The company develops and sells advanced wireless development projects and products, including cordless telephones, Bluetooth headsets and mobile phones. RTX provides customers with complete individually tailored turnkey solutions that transform initial specifications into fully tested, ready-for-market products, in the shortest possible time. The company is established in 1993 and has gradually extended its activities to cover the development of communication solutions within a wide range of wireless and mobile communication standards. These include RF, HW, SW, Silicon IP and project management within the wireless technologies field, including in particular the standards DECT, 2.4GHz, Bluetooth, GSM/GPRS, VoIP, TD-SCDMA and 802.11a/b/g. The resources of the company are within product development. It controls no production activities, but relies on an extensive and international network including contract manufacturers, suppliers and development partners and has never owned production facilities. Still, the group covers several business links within the telecom industry’s value chain. RTX takes total or partial responsibility for product design and development, testing, approvals, production ramp and ODM production.

From the beginning of its existence, RTX has relied on sourcing production competencies externally. Although the company also have worked with local suppliers of production capacity, it has never been dependent on these and has in general sourced more from contract manufacturers outside Europe. In general, the company considers the presence of production capabilities within the region or within the auspices of ownership irrelevant. This does not mean that distance does not matter in relation to development activities, but rather that production facilitation and to some extent also follow-up activities are independent of production processing.

The stainless steel district

The stainless steel district in the triangle area comprises producers specialised in producing process equipment for the production of food (in particular fluids, such as dairy products). Production equipment are modular products, but calls for much adaptation to individual customer requirements. Hence, sales are much driven by projects. The region consists of a large number of small- and medium-sized subcontractors specialized in steel processing and component development as well as three large international manufacturers of food processing equipment. Including Alfa-Laval, GEA and APV Baker, who dominate the world market for process equipment (Christensen & Philipsen, 1998). There is a fine-grained division of work among the subcontractors, which up till recently have been strongly focusing on production processing. Innovation activities are strongly reliant on trial and error processes among suppliers and producers, but is clearly dominated by the user initiative. In other words, the large producers of process equipment are in control of product development activities, and the know-how and input from suppliers are important, but mainly in the latter stages of product development and installation activities. However, as their large customers increasingly outsource work from the region to low cost areas, there is an increasing pressure on the subcontractors. These producers are outsourcing work for a number of reasons, where labour costs and the emergence of new market possibilities in countries such as India and China are among the most prominent. Recently, for instance Alfa Laval moved a significant part of its activities from the triangle area to India. In general, subcontractors in the Triangle area are well aware of the ongoing transformation and follow a diverse range of strategies in order to accommodate strategically with these challenges and retain customer relationships. The common characteristic of these strategies seems to be to retain facilitation activities within the region, and to maintain some control over production processing competencies as well by partitioning and maintaining ownership control of critical or core production activities, leaving more standard work to suppliers outside the region. One strategy is to seek to meet the cost of their Asian counterparts, taking over the strategies of their customers. In these cases, subcontractors become bridge-builders to competitive factor cost markets. They outsource activities to suppliers directly or through sourcing agencies located in the sourcing markets. One case in point is Ribe Maskinfabrik, who is increasingly replacing its production processing skills with its ability to control production facilitation activities (such as concurrent product design) and production follow-up activities in terms of servicing customers' logistical needs worldwide. Another sourcing strategy involves following customers abroad, using offshoring as a main vehicle for coping with the global transformation pressure. This strategy has been followed by steel partner, which have developed relationships with domestically located global contractors, and followed these to India, using the relationships developed locally in doing so. Here offshoring becomes an important part of managing this process.

Interestingly, the internal organisation of these companies is strongly affected, as the skills relating to physical production processing diminish and qualifications in the area of production facilitating or follow-up becomes increasingly prominent. One obvious change vector relates to the increasing importance of industry-wide systems for component tracking and handling of logistics. Here, inventory clearly is replaced by information, increasing the digital content in value adding activities. Hence, business models emerge, where production processing is at the periphery, rather than at the core of the activities carried out within the region and where the ability to master logistical flows and orchestrate inputs from a range of suppliers, meeting customer expectations, and co-aligning with the logistical flows of their customers' construction projects are becoming the distinctive skills of these producers. Hence, relationship management and coordination control and in association with this knowledge regarding production activities and skills necessary to monitor such activities are key requirements in order to maintain initiative in competition with skilled suppliers from Asia and China.

Case analysis and discussion

These cases presented demonstrate the divergence regarding how globalisation and relocation affects the competitiveness of regions. Clearly, in order to understand the impact of globalisation on competitiveness, these issues must be taken into account. What seems to be a common characteristic in all cases, is that in the struggle for achieving control of the key success requirements within each line of business, sourcing and relocation plays very different roles and that these roles meaningfully can be addressed based on the arenas developed. In the cases discussed it was possible to link relocation dynamics with the digitalisation and modularisation dimensions. The regions and how they are located in the suggested framework is provided in table 1 below. Moreover in the table, the effect on production activities and how this effect innovation abilities are presented as well.

	The Telecommunication district	**The wind turbine district**	**The stainless steel district**
Relocation Dynamics	Standard Architect	Knowledge district	Bridge-building
The importance of physical relocation for regional competitiveness	Territorial proximity of activities not important for innovation. Physical relocation of production processing and/or follow-up activities do not affect innovative ability of production facilitating activities or lead to industrial decline	Territorial proximity important for innovativeness both in terms of linking product processing with facilitating and follow up-tasks. Territorial relocation of production activities is expected to infer negatively with innovation ability and may threaten competitiveness	Territorial proximity of production follow-up activities somewhat important in terms of developing competitive production facilitating tasks, serving customers or suppliers efficiently
The importance of ownership relocation for regional competitiveness	Ownership proximity of production processing or follow-up activities not important for regional competitiveness. Ownership of production facilitating activities somewhat important	Ownership proximity of all activities equally important	Ownership proximity of production processing and production facilitating activities not important. Ownership of production follow-up activities

What the studies of the regional districts shows, is that there obviously are different relocation dynamics at play and that the territorial as well as the ownership-based relocation of production processing activities impacts rather differently on the innovative ability of the regional districts. As expected, in regions where production processing capabilities increasingly are becoming commodities available in the world market due to emerging standards and modularity and where an important bulk of the value added activities are becoming digital, reducing the global activity configuration and distribution costs, having proximate access to full scale production processing capabilities matters less. In these cases, as demonstrated for instance in the stainless steel case, production processing capabilities becomes a part of the production facilitating or follow-up capabilities, which may serve as a skill-containing device, ensuring that the company maintains some abilities to govern production processing abilities at a distance or ensure that ramp-up capabilities are ensured. Much like the apparel industry, where the ability to make pilot production in apparel and use these as flying prototypes, that can be transferred around the globe as exemplars for visual inspection by suppliers, it is important to maintain some production processing skills in for instance the stainless steel district. However, in the stainless steel district, which shares many similarities with the bridge-building arena knowledge-building processes are less tightly knit to the iterative trial and error production processes than elsewhere believed.

In the wind turbine industrial district on the other hand, production facilitating, processing and follow-up activities seem to be closely linked to innovativeness. Here, there is strong interdependence across the component interfaces and the product architecture is integral rather than modular in nature. As a consequence, proximate iterations, frequent and informal exchange of know-how and physical meetings among co-specialized users and producers and exchange of skilled personnel among component suppliers, producers and even users of wind energy seems to be crucial for the further development of wind turbines and wind power facilities. Physical relocation of production processing activities will most certainly affect this innovation dynamic negatively. It is less likely that the innovative ability of the wind turbine district will be affected by ownership relocation. At least in the case of the Danish wind turbine industry, a massive inflow of foreign capital throughout the 1990s and continuing in the 2000s seems not to have affected the abilities of the wind turbine district significantly.

The innovative ability of producers in the telecommunication district in Northern Jutland seems to be unaffected by the relocation of production processing skills. In the case of telecommunication, global contract producers provide a dense and much available network of production capabilities. Digitalised value adding activities seems to be increasingly important as compared to physical activities. Moreover interfaces with suppliers of production processing capabilities are highly modularized, and thus can be controlled over vast distances. Moreover, modularization affects all activities involved in the design, production and distribution of electronic equipment for telecommunication. A growing number of the production facilitating tasks, such as programming and even design of user interfaces may be left to suppliers with whom the developers of telecommunication equipment share little or no physical proximity. What seems to be the case here, is to define what are the critical development capability and rely on knowledge suppliers as well as suppliers of production capabilities and specialized distributors. In these cases, entry and exist costs to the value added chain are negible and producers operating here may design customized value chains that can fulfil specific customer orders, and simply dismantle them after use, as competencies, much like LEGO building bricks can be reused and regrouped with little or no cost. Hence, relocation dynamics of the telecommunication district resembles what here has been labelled the standard architect.

Managerial and academic implications

No doubt important and competitive economies such as China and India will make inroads to the European and US markets in the years to come. However, if the experience of such diverse industries such as textile and telecommunications is to be as lead exponents of the coming development, the future is not quite as bleak as suggested by the received view.

Although the conceptual work is preliminary, several interesting points and implications for both managers and for academia can be found. No doubt important and competitive economies such as China and India will make inroads to the European and US markets in the years to come. However, if the experience of such diverse industries such as textile and telecommunications is to be as lead exponents of the coming development, the future is not quite as bleak as some pessimists and politicians would let us believe. The political, economic and technological forces promoting companies' ability to transfer production activities to low cost countries, also transform the organization of industry, making it increasingly possible to partition and modularize production chains and bridge large geographical distances: Our research suggest that the increased modularity of manufacturing and development resources creates new norms for activity coordination and co-alignment, which spurs global activity coordination and configuration. Hence, rather than outlining a unison picture of globalisation's effect on industrial localisation and national competitiveness, the transferability of production activities and how they affect the ability of an technological cluster such as the telecommunication cluster in Northern Jutland to connect and act in an increasingly globalized economy should be taken into account. Given very different industrial contexts, the response of the Western industry to the ongoing globalisation and the rise of India and China as possible sourcing bins may hold strong variations. What seems to be an important lesson for policy makers in the West is to understand the forces shaping this development and realize what new possibilities this development has to offer for industries in these countries and what political means are necessary in order to help their companies embrace these possibilities. What is important for academia is to study these processes and extent our understanding and vocabulary with respect to sourcing and relocation dynamics. We must avoid being caught in the logical of the industrial economy when trying to understand the drivers of and motives behind global sourcing. This paper suggests a tentative framework for enhancing our understanding of the diverging logics behind global relocation. Much more work is needed in order to develop and improve these ideas, and ground this more soundly in empirical work than what has been attempted here.

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