The organisational decomposition of innovation and global distribution of innovative activities: insights and research agenda

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Abstract: The starting point for this paper is a fundamental change currently occurring in the way innovation is organised in developed countries: it tended to be centralised at or near headquarters, but is now much more decentralised within the company. Equally if not more significant, innovation activities that used to be carried out in-house by innovating firms themselves are carried out by independent suppliers of knowledge-intensive business services or are transferred to key suppliers. The question driving this paper is how this 'organisational decomposition of the innovation process' changes the global distribution of innovation of activities. Does it contribute to their global dispersal to the developing world or does it strengthen the existing concentration? Since this is uncharted territory, the paper seeks guidance from theory and draws out the insights which can be gained from the innovation systems and Global Value Chain (GVC) perspectives. This then leads to the identification of the new questions which future empirical research needs to address.

Keywords: innovation; outsourcing; global; knowledge; innovation system; global value chain; GVC; organisational decomposition.

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1 Introduction

Over the last three decades, the global economy has been transformed in a major way. Developing countries, particularly in Asia, have built up their industrial production capabilities very rapidly – often at the expense of OECD countries. The speed and extent of this dispersal of industrial production capability is historically unprecedented. In contrast, innovation capabilities have remained concentrated in OECD countries, but also this is beginning to change. A small number of developing countries has begun to make the difficult transition from being economically successful in industrial production to building up innovation capabilities. Even though the depth and width of this transition is not yet clear, it is giving rise to a fierce debate, not just amongst researchers but also policy makers and in the media. This debate is driven by concerns of whether the OECD countries can cling on to the innovation jobs which are the bedrock of their economic prosperity. Questions are raised about which sectors and activities are most threatened – and about which factors enable the (former) developing countries to make so much progress.

Recent literature points to a number of factors which explain the emerging shift in the global distribution of innovation activities. On the developing country side, these include:

- the return migration of engineers, scientists, and managers
- big state and private investment in higher education
- low wages (compared with OECD countries) for highly educated workers
- the insertion of local firms in global value chains
- the co-location (clustering) of local firms and support institutions in the developing world
- the increasing significance of lead markets in Asia and Latin America
- governments 'trading market access for technology'
- the willingness of governments and foreign enterprises to experiment with collaborative arrangements
- the enormous financial resources which government agencies and enterprises can mobilise to buy technology or research teams.

While the relevance of these factors varies between countries and sectors, they all need to be considered in a comprehensive explanation of the shift in the global distribution of innovation activities. Our main argument is that they cannot provide a sufficient explanation. We argue that there is something else going on which is fundamental but tends to be ignored. We call this underlying process the 'Organisational Decomposition of the Innovation Process' (ODIP). This process has been going on for some time, particularly in the OECD countries but its full significance has not been recognised. It is likely to have major ramifications for the location of innovation activities.

A fundamental change is currently occurring in the way innovation is organised. It tended to be centralised at or near headquarters but is now much more decentralised within the company. Equally significant, innovation activities that used to be carried out in-house by innovating firms themselves are carried out by independent suppliers

of Knowledge Intensive Business Services (KIBS), or are transferred to key suppliers. These changes in themselves are not new. Drawing on several strands of recent innovation literature, Section 2 presents a typology of ODIP. It also highlights that the dynamics of ODIP are poorly understood.

While the dynamics of ODIP remain unclear, there is no doubt that – in recent years – the organisational basis of innovation has changed in a major way. There is also little doubt that this organisational fragmentation makes geographical dispersal to other parts of the globe easier – at least in principle. Whether it will or not is discussed in the remainder of the paper. In doing so it concentrates mainly on the effect of transferring innovation functions to independent suppliers of goods and services. The paper focuses on this external ODIP and its spatial effects with a view of opening up an agenda for new research.

Sections 3 and 4 examine the arguments for and against this geographical dispersal happening. This discussion is driven by theory. Section 3 thus starts by recalling insights from the theory of knowledge production which have a direct bearing on the question of global geographical dispersal: tacitness, cumulativeness and path dependence speak in favour of a continuing concentration of innovation activities. The scepticism about geographical dispersal is also embedded in the innovation systems approach, though not always made explicit. The central proposition of the (local/regional/national) innovation systems approach is that innovative capability depends on the quality of the relationships between multiple actors and that geographical/cultural proximity enhances these relationships. The emphasis on the interactive and systemic nature of innovation leads to a scenario of continuing concentration rather global dispersal of innovation. Section 3 concludes with two contrasting propositions on how ODIP, in particular the involvement of KIBS, might change this scenario.

In contrast, the scenario of global dispersal of innovation capabilities finds support from approaches which focus on cross-border inter-firm relationships, in particular the Global Value Chain (GVC) and the Global Production Network (GPN) approach. However, as shown in Section 4, this support is neither clear cut, nor is it always explicit. Central to both approaches is the power of the lead firm in structuring the relationships with other firms in the global chain/network. These geographically distant firms are empowered to provide ever new products and services leading to a rapid build up of first production and then, in some cases, also innovation capabilities. But the strategic innovation tends to remain with the lead firm, so the scenario is one of rapid geographical dispersal of non-strategic innovation activities. Section 4 concludes with propositions on how the involvement of KIBS, might change the outcome.

The organisational decomposition and global dispersal have gone on for a very long time in the sphere of production. In the sphere of innovation they are a more recent phenomenon, underlining that there is no automaticity in the transition from production to innovation capability. If, as suggested in this paper, the various forms of ODIP reinforce each other, we are in the midst of a radical transformation of the innovation process in advanced countries. Understanding this change in the architecture of the innovation business seems essential for analysing the potentially vast global relocation of innovation activities. It is not sufficient for understanding the rapidly changing global knowledge divide, but it needs to be put centre stage. This is the main proposition of this paper. The final section sets out an agenda for advancing research on this proposition.

2 ODIP: types, dynamics and limits

The idea that the innovation process is organisationally decomposed is not new. It has been discussed most explicitly by Chesbrough (2003) in *Open Innovation*. This book sets out that for most the 20th century, corporations sought to become or remain competitive by funding large internal laboratories charged with producing new knowledge and developing new products and processes. He suggests that this practice changed in the 1990s when leading US companies began to rely increasingly on external sources of innovation. This leads Chesbrough (2003; 2006) to promote 'Open innovation' as the new paradigm for research and management.

This paper does not seek to make the business case for the ODIP. The objective is analytical. In this section we aim to:

- provide a simple framework which helps to identify different types of ODIP
- pull together the fragmented literature which helps to understand the different types of ODIP
- stress that it is important to see these different types in conjunction but that the dynamic between them is not well understood.

The literature shows that the organisational decomposition can occur in different ways. Table 1 suggests a typology for ordering the debate and aiding our subsequent analysis. The typology has two dimensions. The first one refers to decomposition within and between organisations. The distinction is between intra- and inter-organisational – or to keep the language simple: internal and external. The second refers to the extent to which innovation is integrated with production of goods and services. Innovation can be delegated to those who are primarily concerned with knowledge creation and have only a loose connection with the production of goods and services. Or it can be delegated to those who are tightly connected to the production of goods and services and have the latter as their primary function.

Table 1 Types of ODIP

Intra- and Inter-organisational / *Connection between innovation and production*	*Internal*	*External*
Loosely connected	*Type 1*	*Type 3*
	Decentralising the R&D Department	Commissioning research from universities or other organisations
	Setting up Internal Knowledge Communities	
Tightly connected	*Type 2*	*Type 4*
	Delegating the development of new products to subsidiaries	Engaging suppliers of products and services in developing new products or processes
	Setting up Internal Centres of Excellence	

This typology is informed by a wealth of recent literature which both helps to understand the four types but also shows that reality is more complex than suggested in Table 1. Some of that literature would even question our basic categories, for example stressing that the boundaries between internal and external have become increasingly blurred and that integration of innovation and production occurs along a continuum. There are also issues of different language used by different authors for similar phenomena. As far as possible we will steer clear of terminological differences and concentrate on clarifying the four types of ODIP and indicating how different bodies of literatures contribute to this understanding.

The *internal decomposition* of innovation processes (ODIP Types 1 and 2) is visible in the research on large firms, especially Multinational Corporations (MNCs). In the 20th century, the main source of innovation has been industrial R&D (Pavitt, 2005; Freeman, 1991). R&D centres were seen as main actors in knowledge creation and innovation processes. These centres tended to be located at or near the headquarters of the company. This began to change in a significant way in the 1990s. As shown by Gerybadze (2003), MNCs began to move away from a single, self-contained in-house centre of R&D for knowledge creation towards a more distributed architecture of innovation activities. R&D units in subsidiaries began to incrementally increase their competences with regard to high value research (Meyer-Krahmer and Reger, 1999; Gerybadze and Reger, 1999). This decentralisation then became more complex when new organisational forms for knowledge creation emerged. Knowledge communities (Amin and Cohendent, 2004) were created in order to shorten the innovation cycles and cope with the increasing complexity of knowledge. This decentralisation of the R&D department and the creation of knowledge communities represent *ODIP Type 1*.

ODIP Type 2 is also internal to the company but innovation is delegated to units whose primary function is the production of goods and services. This occurs typically when the development of new products is delegated to subsidiaries. Traditionally, subsidiaries are mainly involved in using and combining existing knowledge in accordance with instructions from headquarters. As shown by Zanfei (2000), subsidiaries are now increasingly involved in innovating the products they make and the processes they use. This has occurred for some time, notably where the aim was to adapt products and processes to *local* markets (Beise and Belitz, 1996); but some specialised subsidiaries now innovate for competing in *global* markets (Quadros and Consoni, 2009). Moreover, subsidiaries play an increasingly prominent role in intra-company innovation networks (Paterson and Brock, 2002; Zander, 2002). Some large companies have gone a step further and set up centres of excellence or competence centres which specialise in particular product lines. Such centres are expected to develop and spread specific knowledge to other parts of the company (Gerybadze and Reger, 1999; Frost *et al*., 2002). In short, the literature suggests significant intra-firm decomposition of the innovation process.

Equally, if not more, significant has been the *external decomposition*, as evidenced by the management literature on external sources of innovation (Chatterji and Manuel, 1993; Linder *et al.*, 2003; Chesbrough, 2007). Coming from different perspectives, the external decomposition is also visible in the literature on innovation networks (de la Mothe and Link, 2002; Powell and Grodal, 2005; Steinmueller, 2002) and innovation systems (Lundvall *et al*., 2002; Cooke, 2005; Edquist, 1997; Iammarino, 2005; Malerba, 2002).

From this literature we can distil two further types of ODIP. *Type 3* (see Table 1) is the sourcing of knowledge from external organisations which are exclusively concerned with the creation of new knowledge. The most 'traditional' form is the commissioning of research from universities or other research organisations such as the Fraunhofer Institutes in Germany. A more recent form is the contracting of small private organisations that concentrate on generating new knowledge. In the Turin and Rhein/Main auto industry for example, highly specialised firms are contracted to develop specific sub-components or processes (Civaregna, 2006; Rentmeister, 2001). There are signs that this kind of knowledge intensive business service is increasing rapidly (Miles, 2007) and is most developed within highly specialised regions (Strambach, 2002; Simmie and Strambach, 2006). But some seek a global reach; for example, a US venture is 'matching top scientists to relevant R&D challenges facing leading companies from around the globe' (www.innocentive.com, accessed 6 September 2007).

ODIP *Type 4* refers to the external sourcing of knowledge from organisations that are not primarily concerned with generating new knowledge but with producing a product or service. However, in the course of producing this product or service they generate new knowledge. For example, the suppliers of computer or auto components or systems are increasingly expected to generate the knowledge that is required to produce better or new components or systems. Some of the GVC and GPN literature suggests that this practice of pushing the innovation function onto suppliers of components is increasing (Jürgens, 2000; 2001; Humphrey, 2003; Fuchs, 2005a–b).

The same practice can be observed with regard to providers of services. The growth of these knowledge intensive business services has been particularly rapid and therefore deserves particular attention. In the early 1990s, the growth of 'producer services', as they were often labelled, was seen primarily as a cost-driven outsourcing phenomenon, linked with the vertical disintegration of industrial production and the organisational decomposition of the production process (Wood, 1991). Then in the course of the 1990s, it became clear that cost-driven externalisation can only partially explain the growth of these services and that the knowledge intensive ones registered the fastest growth in the OECD countries (Beyers and Lindahl, 1996; Eurostat, 2000; 2006). The demand for problem solving know-how was identified as the reason for their growth. In the course of providing such a problem solving service, new knowledge is often generated (Strambach, 2001).

More recent research shows the increasing differentiation and specialisation of KIBS (Bryson *et al*., 2004; Simmie and Strambach, 2006; Wood, 2002). Some focus on technical issues (for example, engineering consultants), others on organisational issues (for example, consultants for supply chain management), but some specialise in bringing the two together (for example, business software solution providers). Similarly, some focus on horizontal knowledge domains (for example, customer relationship management), others on vertical knowledge domains (for example, services for the financial sector), but increasingly there is a demand for integrative services.[1] Common to all of them is the search for customised solutions. The customer, instead of drawing on internal sources, hires external providers. And these providers often generate new knowledge in the process. While this '*ad hoc* innovation' (Gallouj, 2002) is of immediate importance to the customer, the external provider is a potential resource for other firms seeking to develop new solutions. This is why we ask in later sections how ODIP might affect the global distribution of innovation activities.

The main objective of this section was to explain in more detail the meaning of ODIP and introduce a typology. Some observations, however, need to be made on ODIP as a whole. First, ODIP is not limited to the OECD countries. It also goes on in the new innovative regions. For example, in the Indian software industry, small niche companies are focused on providing intellectual property development for the telecommunications industry. On a contract basis these companies provide critical and customised software components to facilitate multimedia competences and applications in their customers' products. Catering for the life sciences and pharmaceutical industries, a Bangalore based firm provides predictive modelling, computational chemistry and research biology solutions. In São Paulo, the laboratory of the subsidiary of a German producer of transmissions and clutch systems, has created the experimental knowledge and develops the materials for clutches that are manufactured worldwide. The methodology for experimentation has been developed by the materials laboratory of a Brazilian federal university. A local software company based in São Paulo, which specialises in retail automation, provides and maintains the systems used by McDonald's restaurants worldwide. Moreover, some KIBS have internationalised and operate in several countries simultaneously. For example, the Brazilian subsidiary of EDAG, a German supplier of engineering services for the auto industry, works for the local subsidiaries of their European clients, complementing the product development work carried out by assemblers locally.[2] However, the bulk of innovation activities remain in the OECD countries and the question is to what extent and how the organisational decomposition contributes to their geographical dispersal.

Second, the different types of ODIP do not represent separate developments. To some extent they are connected. Increasing reliance on (internal) Types 1 and 2 often goes hand in hand with (external) Types 3 and 4. As headquarters delegate innovation jobs to subsidiaries, the latter sometimes reproduce the outsourcing adopted by the parent company. Or take the case of strategic alliances for innovation purposes: they rarely involve the entire company but a relationship between a particular internal group – formed in the course of intra-firm decomposition – with external actors. Such interconnections come out clearly in the literature on innovation networks. The innovation system literature goes a step further by proposing a systemic relationship between the various actors in the innovation process, while recognising that sometimes these relationships remain precarious.[3]

Third, ODIP is not a static phenomenon. It is a process, but its dynamics are not well understood. There are two questions concerning this dynamic which are particularly important for our concerns:

1 Do the four types of ODIP reinforce each other?

2 What are the limits to ODIP?

These constitute under-explored territory but let us briefly set out the issues for future research. Most of the literature dealing *explicitly* with aspects of the organisational decomposition takes the large firm as the starting point. While under pressure from outside, these large firms are considered the main actors, they decide what is carried out in-house and what is out-sourced to whom. At any particular point in time, this is a useful focus. It assumes that the large firms are the decision-*makers* and other contributors to the innovation process are decision-*takers.* The problem is that from a dynamic point of view, this can be misleading. The organisations, which are at the receiving end of the

outsourcing decision, do not stand still. In the course of working with other clients they develop new competences. In some cases they join forces with other specialists and move into new knowledge domains. In some cases, they cluster and new specialisations develop and new lead firms emerge from amongst them. In other words, they do not remain decision-takers, they develop a dynamic of their own, and they change the landscape in which the large client firms operate. Little is known about these processes and the contingent factors that make them happen. Our general proposition is that *ODIP has its own dynamic*. In other words, the different types of ODIP reinforce each other, accelerating the process of organisational decomposition. Future research will need to establish the circumstances in which this does or does not happen.

A related question which needs further research concerns the *limits of ODIP*. Are there innovation functions which companies have to carry out in-house or can they outsource everything? The literature on modularity and systems integration provides some insights. Brusoni *et al*. (2001) stress that, in spite of the trend towards modularity, companies need to retain knowledge and competences to integrate the various outsourced activities. Framing the problems and synthesising require higher-level understanding by an internal staff. This view comes in particular from research on complex product development (Prencipe, 1997; Brusoni, 2005). Pavitt (2005) goes a step further and suggests that coordinating and integrating specialised knowledge is needed in *all* innovation processes, implying that it needs to be done in-house. The KIBS literature on the other hand, indicates that some KIBS have moved from solving specific problems to offering integrative services. Is the implication that all innovation activities can be outsourced?

While the limits of ODIP are not entirely clear, it is clear that it can – and already does – go quite far, much further than would have been expected some ten years ago. The remainder of the paper examines whether this organisational decomposition contributes to global dispersal or reinforces the existing geographical concentration. In doing so it focuses on the effects of the external decomposition.

3 Dynamic stability in the global distribution of innovation activities?

As seen in the course of Section 2, there are several strands of literature which help to understand the different types of ODIP. Rich as it is, this literature rarely addresses the question of how the organisational decomposition changes the global distribution of innovation activities. The main exception is the literature which examines multinational companies and the changes that occur within them (Cantwell and Janne, 1999; Cantwell and Mudambi, 2005; Narula and Zanfei, 2005; Quadros, 2003; UNCTAD, 2005). This literature on internal (intra-organisational) decomposition includes some examination of geographical dispersal but is mainly concerned with dispersal within or between *advanced* countries. The remainder of this paper concentrates on those changes in the global innovation map which are least understood: the external (inter-organisational) decomposition of the innovation process and the implications for the global distribution of innovation activities. This is uncharted territory.

The external decomposition is particularly interesting because, while often initiated by the powerful corporation, it develops outside the control of these corporations. Are they planting something that contributes to the renewal of their own core regions or something that other companies in other regions of the world can use to their advantage?

There is no doubt that, in principle, organisational decomposition makes geographical dispersal easier.[4] But is it happening? If not, why not? This paper does not seek to fill this empirical vacuum. It asks what theory would lead us to expect. What do different analytical approaches tell us about the likelihood of geographical dispersal versus continuing concentration? We start with the latter, distilling those arguments from the theoretical literature which support the case for continuing concentration and then ask which new research questions ODIP gives rise to.

Central to the innovation literature is the question of how knowledge evolves. Evolutionary knowledge economics has stressed three features which are particularly relevant for our concerns (Antonelli, 2005; 2006; Cowan *et al.*, 2000; Loasby, 1999; Malerba and Orsenigo, 2000; Strambach, 2004):

1 tacitness

2 cumulativeness

3 path dependency.

These three features make geographical dispersal very difficult.

Innovation systems theory has been influenced by and contributed to evolutionary knowledge economics. It has however a distinctive core: innovation is seen as an interactive process (Lundvall, 1988). There are three interrelated aspects of this interactive process which can but do not have to go together:

1 the quality of relationships

2 geographical and/or cultural proximity

3 systemic gains.

This is the core of *systems of innovation approaches* with a territorial perspective. *It implies a strong argument for geographical concentration, whatever the precise organisation of the innovation process*. This is the key point given the concerns of this paper.

There is a huge literature one could draw upon to back up this point. It comes clearest out of work using the *regional* innovation systems approach (Cooke, 2001; Iammarino, 2005). The latter has proved more insightful than the *national* innovation systems approach (Lundvall *et al*., 2002), not because national factors are unimportant but because *mutual reinforcement* of factors enhancing innovation is the key.[5] In this respect regions differ, even in small nations.

The innovation systems approach certainly helps to explain why innovation activities concentrate in particular regions and why this location keeps being reproduced. Recall that the distinctive core of the approach is to regard innovation as an interactive process. The central proposition is that the innovative capability depends on the density and quality of relationships amongst enterprises and the relationships between enterprises and support institutions. While such relationships can be forged over long distances, short distances make interaction easier. This is particularly relevant in innovation, because tacit knowledge constitutes the most important basis for innovation-based value creation. While there is a debate on whether tacit knowledge can travel across regional or national boundaries there is no doubt that geographical proximity facilitates the production and sharing of tacit knowledge (Gertler, 2003).

In the analysis of regional innovation systems, a lot of emphasis is placed on the institutional constellations and arrangements which influence the interaction and learning processes (Asheim and Gertler, 2005). Such institutional arrangements and complementarities are difficult to recreate. In short, the innovation systems approach provides numerous arguments which stress that innovation activities are interconnected, embedded and sticky, thus explicitly or implicitly arguing against global dispersal.[6]

How would ODIP change this picture? This is particularly interesting because the KIBS themselves are concentrated in particular regions. But this in itself does not tell us much about their concentrating or dispersing effect on the enterprises/regions they work for. In fact, there is very little knowledge on this. In principle, both effects are possible. On the one hand, KIBS reinforce the concentration argument. KIBS have the potential to open up new trajectories for the long established innovating regions and thus contribute to their renewal. KIBS are intermediaries of knowledge, they extract knowledge from different sectors and regions and recombine and apply it in other sectors and regions (Strambach, 2008). In this sense KIBS contribute to what Cooke (2005) calls 'dynamic regional knowledge capabilities' and reinforce the existing uneven knowledge endowment and strengthen the well established innovating regions.[7] They contribute to what we tried to capture in the heading of this section: the 'dynamic stability' in the global distribution of innovation activities. On the other hand, KIBS de-contextualise knowledge, make tacit and implicit knowledge more mobile and thus make migration easier. This is particularly relevant for new innovating regions which can mobilise substantial financial resources to hire such KIBS or 'hijack' entire research teams (Altenburg *et al*., 2008).

Future research will need to show which effect is dominant. The dispersal argument has barely entered the radar screen of the KIBS research; most of it tends to favour (implicitly) the scenario of dynamic stability. This may need to be reconsidered in view of the increased absorptive capacity and enormous purchasing power of new innovating regions, in particular in China and India.

Indeed the extent of dispersal of innovation activities depends on a combination of factors in the new and old innovating regions. As stressed in the introduction to this paper, most recent research concentrates on the new innovating regions in the (former) developing countries. This section has explored whether the organisational changes in the old innovating regions are likely to contribute to this geographic dispersal.

4 ODIP and the global distribution of innovation activities: increasing geographical dispersion?

This section continues to ask what theory would lead us to expect with regard to the global dispersal versus concentration issue. The scenario of substantial international dispersal of innovation capabilities finds support from approaches concerned explicitly with cross-border inter-firm relationships: the GVC and the GPN approach. Since differences between them are minor, except in terminology, we will treat them as one approach. The insights provided by this approach concern in particular ODIP Type 4 (Table 1), namely the role of suppliers in developing new products and processes.

In order to capture the contribution of this literature we need to recall the distinction between production and innovation capability. There is no automaticity in moving from one to the other (Bell and Albu, 1999). This is underlined by developments over the last three decades: there was a massive dispersal of production capability to the developing world, in particular Asia, while the innovation capabilities remained heavily concentrated in the OECD countries. The GVC approach helps to understand the former: the speed with which these capabilities were acquired is due – in large part – to the integration of developing country producers into chains governed by lead firms in the USA or EU (Gereffi, 1999; Schmitz, 2006). As regards the spread of innovation capabilities, the approach is more ambiguous, indicating both forces that might block and constellations that accelerate the dispersion of innovation activities:

- *The central role of the lead firms* – while research on GVCs distinguishes between different types of chains with different power constellations, it has given most attention to captive chains (Humphrey and Schmitz, 2004; Gereffi *et al*., 2005). In such chains, the lead firm (often the global buyer) has coordinating power and can set the terms under which other firms in the chain operate. The acquisition of supplier capabilities which is in the buyers' interest is likely to progress fast and might even be supported, notably the knowledge-using activities geared to strengthening the producers' existing position in the GVC. The acquisition of capabilities which is against the buyers' interests is less likely to thrive and might even be discouraged, notably in chain coordination, design and marketing.
- *Dynamic chain analysis* – the insights one can derive from chain analysis for our concerns depend to some extent on whether these chains are examined in a static or dynamic way. Chain governance is a dynamic process. A dynamic perspective helps to recognise why (in captive chains) the limits to innovation might be temporary. Power is relational, *i.e*., the exercise of power by one party depends on the powerlessness of other parties in the chain. Existing producers, or their spin offs, may acquire new capabilities and explore new markets, and this changes power relationships. The acquisition of these new capabilities does however require investment in equipment, organisational arrangements and people. Where this investment is made, there is a way of breaking out of the captive relationship: using the knowledge acquired in supplying the main global buyer for supplying other (probably smaller) markets in which relationships with the customers are more symmetrical (Navas-Aleman, 2006).[8]
- *Strategic and non-strategic innovations* – the central proposition of the value chain approach – relevant for our concerns – is that the lead firms of value chains have a major influence on the spaces in which other firms in the chain can innovate. Implicit in this approach is the distinction between strategic and non-strategic innovation – from the point of view of the lead firm. This then leads to a further proposition: *the lead firm keeps strategic innovation activities in-house or close to home and disperses the non-strategic innovation activities.* As regards the main concern in this paper, namely concentration *versus* dispersal of innovation activities, we can thus derive a very interesting and differentiating proposition from the GVC approach. The unresolved question is how to define 'strategic'. A business perspective would suggest that strategic activities are those which are expected to

earn the highest rents. From an innovation perspective it would probably be more interesting to borrow from the modularity and system integration literature and distinguish between problem framing and problem solving (Brusoni, 2005). Problem framing is exactly what the lead firms of GVCs do.

- *From supply platform to innovation hub?* The GVC approach is not restricted to analysing strategies of the lead firms. Its key feature is the focus on relationships in the chain and the effects of different kinds of relationship on the acquisition of capabilities by suppliers. Over time these relationships change, partly as a result of increasing supplier competence. Sturgeon (2002) in particular suggests that the greater attention given to the core competences of the lead firms has resulted in a relative neglect of the outsourced non-core operations. Precisely because outsourcing has become more generalised, new developments have occurred in the supply base. 'To meet the growing demand of full-service outsourcing solutions, suppliers have in many cases had to add entirely new competence areas, increasing their scope of activities while improving quality, delivery and cost performance' (Sturgeon, 2002, p.455).

In this kind of chain, firms develop information-intensive relationships, dividing essential competences between them. The lead firm provides the design and product specification and highly competent suppliers provide products and services at short notice to any kind of specification drawing on the specialisations amongst the clustered suppliers. Hence the term 'modular network' (Sturgeon, 2002) is used to capture the relationships in this kind of value chain. Over time, the Taiwanese computer producers managed to develop this kind of relationship with their customers in the USA and Japan. Kishimoto (2004) shows that by the end of the 1990s, Taiwanese firms had the entire range of required production skills; all the specialists were available locally, they could produce infinite product variety, any combination of attributes stipulated by the customer could be dealt with; and where required they provided incremental R&D to solve specific problems. However, new product definition and leading edge innovation remained in the USA and Japan. So the insight that emerges is that *clustered suppliers in new spaces acquire some limited innovation capabilities.*

The same insights can be derived from the work on 'GPNs' by Ernst (2002).[9] He is explicitly concerned with the changing geography of innovation and suggests that GPNs play a critical role in reducing the spatial stickiness of innovation and dispersing innovation capabilities. The sequence of arguments is as follows:

- GPNs provide the lead firms (Ernst calls them 'network flagships') with quick access to lower cost suppliers.
- This outsourcing includes not just routine activities but increasingly also knowledge-intensive activities.
- However only knowledge-intensive activities which are complementary to the network flagships' own strategic innovation activities are outsourced.
- 'Geographic dispersion is heavily concentrated in a few specialised local clusters' because spatial synergies continue to matter (Ernst, 2002, p.504).

In other words, while using different terminology, the GVC and the GPN approach (Ernst version) share three key propositions:

1 The power of the lead firms (flagships) is critical.

2 The build up of innovation capabilities of suppliers is substantial but ultimately limited to non-strategic areas.

3 The dispersion of capabilities is concentrated in particular clusters.

This emphasis on 'concentrated dispersion' (Ernst) is particularly interesting for the purposes of this paper. There is organisational decomposition (ODIP Type 4) and there is geographical dispersal to particular clusters, but the innovation activities dispersed to these clusters are non-strategic. It is the latter proposition which is in greatest need of empirical research. Such research would need a staged approach. The Stage 1 hypothesis would be that the initial outsourcing involves non-strategic activities. The Stage 2 hypothesis would be that these outsourced suppliers themselves take advantage of ODIP and hire KIBS which have expertise in the strategic areas. Or the outsourced suppliers might even accumulate internal resources to develop capabilities strategic to their own future.

5 Conclusions and questions for future research

As stressed in the introduction, there is increasing recognition that the global distribution of innovation activities is moving away from the OECD countries and towards the developing world. The process is very uneven between sectors and countries but it is underway. Explanations for this change rarely take into account the change in the innovation architecture in the OECD countries, notably the organisational decomposition of this innovation process. This paper puts ODIP at the centre of the analysis and asks whether and how it contributes to global dispersal or continuing concentration of innovation activities.

Putting ODIP centre stage does not imply that it alone can account for any geographic dispersal of innovation activities. Far from it. There are contingent factors that – in differing combinations – determine whether the opportunities for dispersal to developing countries are transformed into realities. The purpose of this paper was to explore the new possibilities that arise in the wake of the organisational decomposition. This final section draws together some of the key issues for future research which emerged in the course of the analysis.

The literature helps to understand the different forms of ODIP but tells us little about the relationships between them and their dynamics. Particularly critical is the question of whether the various forms of ODIP are reinforcing each other. This is an important question because it raises the spectre of ODIP having a built-in accelerator.

While these endogenous dynamics require further exploration, changes in the global distribution of innovation are moving apace. We know that in principle the organisational decomposition facilitates global dispersion but we do not know to what extent this is happening. And to the extent that it is happening, is there a causal relationship between ODIP and geographical dispersion? Are particular types of ODIP more relevant for

global dispersal than others? There is some literature on how the internal re-organisation of multinational companies affects the location of innovation activities, but very little on the effects of external decomposition, notably the effects of KIBS, on the global distribution of innovation activities.

Given these empirical uncertainties, it is important to seek guidance from theory. Sections 3 and 4 distilled the insights which various theories provide on the issue of concentration versus dispersal of innovation activities. This discussion helped to identify questions which future research needs to address for both the long established and the newly emerging innovating regions. The innovation systems approach leads us to ask whether the systemic features of the innovation process prevail in spite of its organisational decomposition. In what circumstances do KIBS contribute to the renewal of the old innovating regions and thus enhance the geographical concentration of innovation activities? And in what circumstances do KIBS contribute to the geographical dispersal of innovation activities?

The GVC approach suggests that dispersal is likely but limited to non-strategic activities. The lead firm is likely to retain the strategic activities, notably the coordination of the innovation process. In a curious way, the literature on modularity and development of complex products supports this, stressing that the *problem framing* function is retained by the systems integrator and that outsourcing (and by implication off-shoring) is limited to specific *problem solving* functions. But perhaps this literature underestimates the extent to which KIBS can erode the power of the lead firms and contribute to integrating functions. In other words, future research will need to examine whether there is a gradual transition from non-strategic to strategic activities in the new innovative regions. Do the KIBS from the old innovative regions help them to make this transition? Or do the KIBS that have emerged in the hubs of Singapore and Hong Kong play this role? Presumably, the more one adopts a dynamic analysis the greater the likelihood that 'initiatives from below' can be captured.[10]

The question driving this paper is whether and how ODIP contributes to changes in the global distribution of innovation activities. We have highlighted forces which make such changes likely and others which hold them back. Future empirical analysis is likely to conclude that the strength of these forces varies by absorptive capacity in recipient regions and by (sub) sectors. But perhaps the most important variable influencing the outcome is time. It is likely that the outcome on the dispersion versus concentration question varies with the time-scale considered. As stressed by Bell (2006), much progress has been made in understanding the (lack of) build up of innovation capability in the developing world, but little of this work has adequately addressed the empirical heart of this dynamic issue: the time-scales involved, their differences and the reasons for these.[11] The conclusions of researchers on whether the build of innovation capability is truncated or progressing varies with the time-scale considered. It is a simple but fundamental point which seems highly relevant for the research agenda set out here. This new research needs to capture changes in old and new innovating regions and the connections between them. The conclusions of researchers on whether the build up of innovation capability is truncated or progressing vary with the time-scale under consideration.

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Notes

1 The distinction between vertical and horizontal knowledge domains is explained more fully in Strambach (2008). Integrative KIBS draw on vertical and horizontal knowledge domains, combining and reconfiguring knowledge units flexibly, and producing high-level customised 'knowledge products'.

2 The above examples were provided by Ruy Quadros and Rasmus Lema, based on their research in Brazil and India respectively.

3 Coombs *et al*. (2003), in their review of 'distributed processes of provision and innovation', stress the importance of asymmetric power relationships between contributors to the innovation process.

4 Arora *et al*. (1997) suggest that the modularisation of technology leads to the dispersal of innovation to where the users of this technology are located. This and related work on modularity (Arora and Gambardella, 1994) has attracted a lot of criticism (Brusoni *et al*., 2001; Ernst, 2005) stressing that modular technology *per se* does not translate into modular organisation – and by implication – geographical dispersal.

5 If 'system' (or 'systemic') means anything it is presumably about mutual reinforcement.

6 The same conclusion can be drawn from the literature on 'localised learning' (Malmberg and Maskell, 2006) which avoids the term innovation system but is in substance very close to the regional innovation systems literature.

7 The key regional capability seems to be the capability of aligning different networks (von Tunzelmann, 2005).

8 A dynamic approach would in particular look to the role of a new generation of managers in existing enterprises. And, especially relevant in clusters, to the spin-offs. Often they feel less constrained by the bonds with existing powerful customers and are more able to take new initiatives.

9 The term 'global production network' is also used by Henderson *et al.* (2002). They criticise the global value chain approach for being too linear and vertical. We agree with them that there are important relationships with other actors outside the chain which are important for competitiveness and innovation and which are not adequately captured by the GVC approach. The strength of their analysis lies in bringing to the fore the full range of institutional and actor constellations which influence economic development. We doubt however the analytical value of packing all these relationships and constellations into the concept of 'GPNs'. We believe it is more useful to draw out the strengths of the GVC approach and then deal with the weaknesses by complementing it with other approaches. This seems to offer a better chance of exposing analytical connections or gaps.

10 For example, in the case of the Sinos Valley footwear cluster (Brazil), an 'underground revolution' happened after two decades of domination by global lead firms (Bazan and Navas-Aleman, 2004). In the biotechnology industry some multinational companies have changed their innovation strategies due to failed internal big pharma research; some have started to work with or in distant regions with high KIBS density, in order to overcome uneven knowledge capabilities in their home region (Cooke, 2005).

11 For exceptions, see Figueiredo (2007).