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Combining the Global Value Chain and the Innovation System

perspectives

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Abstract

In this paper we have chosen to focus upon how the research on innovation as an interactive process and innovation systems in a development context (Malerba and Nelson 2011, Lundvall et al 2009) can be combined with a family of approaches that study how the entrance of single enterprises (or clusters of enterprises) located in developing countries into global value chains (e.g. Gereffi 2005, Humphrey 2002) contributes to economic development. It is our intuition that such a new combination will be helpful both in enhancing the understanding of socioeconomic processes in poor countries and in building a more useful knowledge base for action.

At first glance the two perspectives may be seen as contradicting each other. While the dominating conceptualization of innovation systems has referred to the national level and often been linked to the design of government institutions and state policies the literature on Global Value Chains has been developed specifically to overcome the limitations of a nation state perspectives. This is the case both when it comes to the "national" perspective and when it comes to the focus upon state action.

The major criticism of the Global Value Chain approach has been its neglect of how local, regional or national

institutions condition the upgrading opportunities of single business activities and this is where value chain-scholars have pointed to the innovation system perspective as a potential supplement (Pietrobelli and Rabelotti 2010). Scholars working mainly from an innovation system perspective have argued conversely that in a globalized world the Global Value Chain approach might help us understand the limitations of national perspectives and strategies in relation to innovation (Ernst and Kim 2002).

In this paper we will try to dig deeper into the two literatures and demonstrate first that there is more overlap between the two perspectives than what is normally assumed and second that the potential for integration is more promising than what we would assume on the basis of "the first glance-impression".

We combine techniques from bibliometrics and natural language processing with a hermeneutic qualitative analysis. We find that the different approaches to economic development have evolved in parallel but with very limited interaction as reflected in shared references. The tribal divisions in the academic circles are not reproduced in the policy community. Our hypothesis is that governments in South Korea and China have acted "as if" they took into account both the need to build strong national innovation systems and the need to engage in "functional" upgrading.

The first results show that there is very little overlap in terms of the core literature. Nonetheless there is some rather limited overlap when it comes to references. Besides Michael Porter on competitive advantage we find references in both camps to geographers and regional studies experts such as Peter Maskell, Michael Storper, Bjørn Asheim and Phil Cooke.

In a separate more in depth analysis we use content analysis of abstracts to find articles that are relevant for both fields we then extract shared references to identify a potential conceptual overlap. Here we again find that the sub-field where there is most overlap between the two areas relates to the geography of innovation and industrial clusters.

On the basis of these observations we see good reasons for why an attempt to work toward a synthesis of innovation system and global value chain approach can and should be made. Starting point could be to build upon insights already established within the relative small overlapping sub-communities. That is the work on knowledge exchange in industrial clusters in the GVC-community and regional and sectoral systems of innovation on the side of innovation systems research.

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Lundvall, B.-Å., Joseph, K., Chaminade, C., and Vang, J., editors (2009). *Handbook of innovation systems and developing countries: building domestic capabilities in a global setting*. Edward Elgar Publishing.

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Combining the Global Value Chain and the Innovation System perspectives

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Abstract: In this paper we have chosen to focus upon how the research on *innovation as an interactive process* and innovation systems can be combined with a family of approaches that study how the entrance of single enterprises (or clusters of enterprises) located in developing countries into *global value chains* contributes to economic development. It is our intuition that such a new combination will be helpful both in enhancing the understanding of socioeconomic processes in poor countries and in building a more useful knowledge base for action. We combine a scientometric approach with a hermeneutic qualitative analysis. We find that the different approaches to economic development have evolved in parallel but with very limited interaction as reflected in shared references. The tribal divisions in the academic circles are not reproduced in the policy community. Our hypothesis is that governments in South Korea and China have acted “as if” they took into account both the need to build strong national innovation systems and the need to engage in ‘functional’ upgrading.

1. Introduction

In this paper we have chosen to focus upon how the research on innovation as an interactive process and innovation systems can be combined with a family of approaches that study how the entrance of single enterprises (or clusters of enterprises) located in developing countries into global value chains contributes to economic development. It is our intuition that such a new combination will be helpful both in enhancing the understanding of socioeconomic processes in poor countries and in building a more useful knowledge base for action. Actually, we believe that such a synthesis could help trigger a new generation of research that overcomes weaknesses both within innovation studies and in development studies.

Some preliminary observations on differences between the two perspectives

At first glance the two perspectives may be seen as contradicting each other. While the dominating conceptualization of innovation systems has referred to the national level and often been linked to the design of government institutions and state policies the literature on Global Value Chains has been developed specifically to overcome the limitations of a nation state perspectives. This is the case both when it comes to the ‘national’ perspective and when it comes to the focus upon state action. Many applications of the concept of innovation systems and of interactive learning in the context of innovation have been instrumental and normative looking for ‘good practise’ for firms and governments. Often these studies have presented interactive learning as a process where the interacting partners are on equal footing and where governments are neutral and effective in their execution of power. This may be contrasted with the global value chain approach which gives explicit attention to the power dimension (lead firms are assumed to have the upper hand in organizing the global value chains). The major criticism of the Global Value Chain approach has been its neglect of how local, regional or national institutions condition the upgrading opportunities of single business activities and this is where value chain-scholars have pointed to the innovation system perspective as a potential supplement (Pietrobelli and Rabelotti 2010). Scholars working mainly from an innovation system perspective have argued conversely that in a globalized world the Global Value Chain approach might help us understand the limitations of national perspectives and strategies in relation to innovation (Ernst and Kim 2002). In this paper we will try to dig deeper into the two literatures and demonstrate first that there is more overlap between the two perspectives than what is normally assumed and second that the potential for integration is more promising than what we would assume on the basis of ‘the first glance-impression’. In order to do so we need to go back to some of the original contributions and also to look more closely at contributions from scholars who have crossed the borders between the two ‘schools’. One important assumption behind our analysis is that knowledge is the most

important resource and learning the most important process and that this is true for countries at all levels of development. Therefore we will see the process of upgrading as it is referred to in the Global Value Chain analysis as outcomes of processes of learning. What is learnt and how it is learnt will of course be very different from one context to the other. This perspective does not rule out that there is scarcity of other resources than knowledge. Neither does it exclude that ‘pure power’, as based upon military strength and economic resources, may be a factor determining the rules for as well as the outcome of attempts to engage in learning. This implies that processes of learning may be blocked for individuals, firms, regions and countries and that access to knowledge may be unevenly distributed. This is not the first attempt to analyze the potential of such a new combination. Bell and Albu (1999) is an early attempt to create a link between innovation studies and value chain analysis as applied in a series of studies of clusters in developing countries. One explicit attempt to link innovation systems to global value chains was made in Pietrobelli and Rabellotti (2010). Nelson and Malerba (2010) on catching-up at the level of sectoral systems of innovation also relate global value chain analysis to the innovation system approach.

On the method used in this paper

We use the data base Web of Science ¹. We have looked at papers in the two areas and used citations to define and locate sub-communities within each field. As a second step we have focused upon the minority set of papers whose abstracts semantically relate to both areas. The most important result from this analysis is that the overlap in terms of objectives and concerns stands in contrast to the how little interaction there is between scholars from respective field.

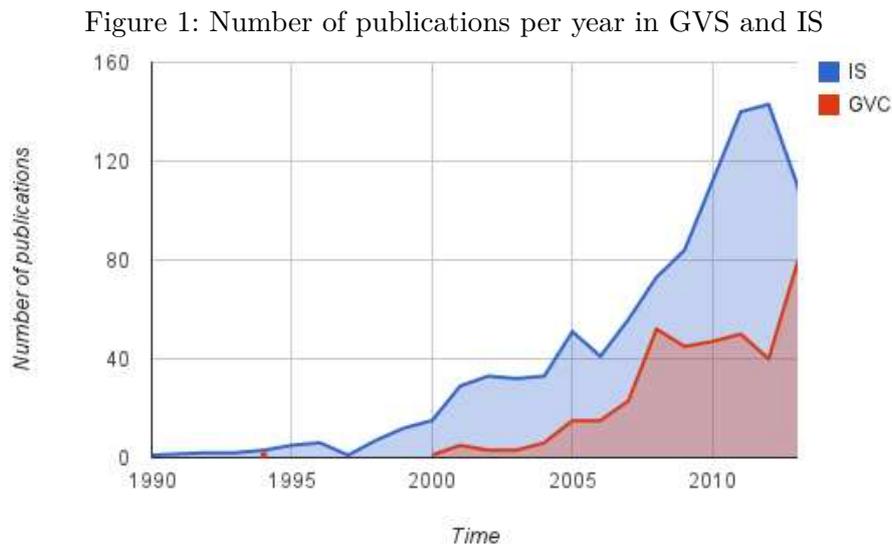
This points to the need to combine the scientometrics with a qualitative analysis of the literature. In order to understand how the two areas relate to each other in the current situation it is useful to study how the ideas have evolved over time. By

¹Here we favour WOS as it offers well refined bibliographic data. Compared with other databases, WOS is however rather restrictive and therefore the number of records is relatively low. In future versions we will therefore aim at including bibliographic databases with a broader scope (e.g. Scopus).

focusing on the very origin of the field and on critical turning points it is possible to explain why the fields, in spite of overlap in objectives and problems diverge and remain separate as academic fields.

Preliminary results of the Scientometric analysis

The scientometric analysis will be presented in detail in Appendix and the qualitative analysis will refer to it throughout the text. The first step in the scientometric analysis locates and maps the two main fields of research (GVC and NSI) in terms of sub-fields through the use of citations. This analysis gives us an idea of who are the most active researchers, research institutions and also of what constitutes the core literature.



We can also get an idea of how the two fields evolve in terms of growth in the frequency of publications. From Figure 1 we can see that both are young and rapidly growing scientific communities. Innovation system literature takes off in the middle of the 1990's while the GVC literature takes off 5 years later. In the most recent years there are signs of 'catching-up'. Table 1 presents the 10 most cited works in the respective fields:

- Innovation systems and development (searchstring: ‘Innovation system*’ AND ‘develop*’)²
- Global Value Chains (searchstring: ‘Global Value Chain*’ OR ‘GVC’)

Table 1: Comparing the core literature in two fields of research

Cited works in IS	N	F
Lundvall B-A, 1992, National Systems of Innovation, Book	285	0,2691
Nelson RR, 1993, National Innovation Systems : A Comparative Analysis, Book	240	0,2266
Freeman C, 1987, Technology, policy, and economic performance, Book	134	0,1265
Porter M, 1990, Competitive Advantage of Nations, Book	109	0,1029
Edquist C, 1997, Systems of Innovation: Technologies, Institutions and Organizations, Book	109	0,1029
Cohen WM & Levinthal D A, 1990, ADMIN SCI QUART, 35, 128	99	0,0935
Nelson RR & Winter S, 1982, An Evolutionary Theory of Economic Change, Book	93	0,0878
Cooke P, 1997, RES POLICY, 26, 475	91	0,0859
Bathelt H, Malmberg A, Maskell P, 2004, PROG HUM GEOG, 28, 31	79	0,0746
Hekkert MP et al., 2007, TECHNOL FORECAST SOC, 74, 413	76	0,0718
Cited works in GVC	N	F
Gereffi, G; Humphrey, J; Sturgeon, T, 2005, REV INT POLIT ECON, 12, 78	180	0,4296
Humphrey J & Schmitz H, 2002, REG STUD, 36, 1017	124	0,2959
Gereffi G, 1999, J INT ECON, 48, 37	121	0,2888
Gereffi G & Korzeniewicz M, 1994, Commodity Chains and Global Capitalism, Book - Chapter	81	0,1933
Gereffi G & Korzeniewicz M, 1994, Commodity Chains and Global Capitalism, Book - Intro	77	0,1838
Henderson, J; Dicken, P; Hess, M; et al., 2002, REV INT POLIT ECON, 9, 436	58	0,1384
Giuliani, E; Pietrobelli, C; Rabellotti, R, 2005, WORLD DEV, 33, 549	50	0,1193
Bair J, 2005, COMPETITION CHANGE, 9, 153	46	0,1098
Ponte S & Gibbon P, 2005, ECON SOC, 34, 1	42	0,1002
Porter M, 1990, Competitive Advantage of Nations, Book	40	0,0955

Notes: N: Number of citations, F: Frequency of citations

The first observation on the basis of table 1 is that there is very little overlap in terms of the core literature. The common reference to Porter (1990) reflects the centrality competitiveness and of the cluster concept in both camps. A second observation is that the most cited works on the IS-list (Lundvall 1992 and Nelson 1993) appear rather low on the GVC list (as no 50 and 120) while the most cited work on the GVC list (Gereffi 2005 and Humphrey 2002) appear even lower on the IS-list (as no 253 and 151). This pattern indicates that we are observing two different ‘tribes’ with very little exchange of ideas across the tribal borders. Nonetheless there is some rather limited overlap when it comes to references. Besides Michael Porter on competitive advantage we find references in both camps to geographers and regional studies experts such as Peter Maskell, Michael Storper, Björn Asheim and Phil Cooke.

²We have chosen to restrict the innovation systems field by adding the additional search term “develop*”

In a separate more in depth analysis we use content analysis of abstracts to find articles that are relevant for both fields we then extract shared references to identify a potential conceptual overlap. Here we again find that the sub-field where there is most overlap between the two areas relates to the geography of innovation and industrial clusters.

2. The development of the Global Value Chain approach

The global value chain approach has been developed under different headings. In the original work it was presented under the heading ‘global commodity chain’ with reference to Michael Porter and to Immanuel Wallerstein while in recent contributions some authors use the label ‘global production networks’. In some cases this change in terminology is motivated by the authors (Henderson et al 2002) in other cases there is no motivation for the distinctions made. The management literature using the concept global supply chain and this concept overlaps with the the concepts commodity and value chains.

The main research question in the more recent contributions is: How does the character of the global production chain contribute to or hinder the upgrading of activities in firms located in less developed economies? The complementary question is how the character of the chain affects the distribution of value that is produced along the Chain. This leads to the third question: Does the integration of local firms into global chains contribute to economic development in developing countries? As we shall see there is a tendency in the global value chain to assume a positive response and to argue that there is no better alternative.

One early major contribution to this field of research was the edited book by Gereffi and Korzeniewicz (1994) (Commodity chains and Global Capitalism). The book brought together contributions by scholars with different background. Some of the contributions were case studies while others were historical or theoretical. The main theoretical references were to respectively Immanuel Wallerstein’s contribution on the world system and on global commodity chains (Wallerstein 1980) and to Michael Porter’s work on competition and innovation (Porter 1987). The most important analytical step

taken was Gereffi's distinction between producer driven and user driven value chains. This established the beginning of the important discourse on 'governance'.

In the introduction to the book there is a critical reference to the traditional focus of development studies on the level of the nation state and on industrialization as being equal to development. It is argued that the focus upon global value chains may serve as a correction to these forms of bias: They 'allow us to focus on the creation and distribution of global wealth as embodied in a multi-dimensional and multi-stage sequence of activities, rather than as an outcome of industrialization alone'. It is said that the intention is to build a theoretical basis for understanding micro- and macro-processes within a new political economy of world systems.

The second most important reference as listed in table 1 points to Humphrey and Schmitz (2002). Those two scholars have affiliation at IDS at Sussex University. During the 1990's their focus was upon how the new understanding of industrial districts and cluster formation developed in Europe could inspire strategies for industrial development in developing countries (Humphrey 1995, Schmitz 1995, Humphrey and Schmitz 1996 and Schmitz 1999). Schmitz introduced the concept 'collective efficiency' as characterizing successful clusters. To begin with the global value chain perspective was not integrated in the analysis. However, Schmitz (1995) and Schmitz (1999) end by pointing to the global value chain perspective as a promising field for future research. And Humphrey (1995) has several references to the work by Gereffi.

Humphrey and Schmitz (2002) is an important paper since it marks a kind of merger between the Global Chain literature and the cluster literature emanating from IDS at Sussex University. It is also important since it on a few pages introduces some of the fundamental concepts that have shaped the value chain discourse onwards. First it makes the distinction between four forms of industrial upgrading:

- New process
- New product
- New function

- New sector

As compared to the innovation literature the third form of upgrading is of special interest. It may be seen as a form of innovation resulting in a ‘new organisation’. In the context of the global value chain literature it has a more specific connotation and great strategic importance. The value chain is seen as encompassing different functions spanning from exploitation of natural resources and production to R&D and marketing. It is assumed that firms that control the R&D and marketing functions can extract more value than those firms that are engaged in natural resource extraction or industrial production. Even when firms succeed in developing new products and more efficient processes, they will gain little if they remain a producer without access to R&D or to end-user markets. For the demand driven chains the most important factor is the control of end-user markets, including establishing a strong brand. For the producer-driven chains the most important form for function upgrading is related to the building of R&D-capacity.

The second conceptual contribution refers to the governance of networks. The analysis takes Williamson’s transaction cost theory as its starting point. It is argued that four types of relationships can be distinguished in the value chain:

- Arm’s length market relations
- Networks
- Quasi Hierarchies
- Hierarchy

The dominating form will depend upon a series of factors. Quasi hierarchies may reflect a combination of monopoly position of the buyer, need for speedy response among suppliers, limited capacity of suppliers and complexity in the product. It is argued that in a dynamic perspective the entrance of local firms into quasi hierarchies may support upgrading at least in terms of products and processes.

The paper points to the importance of understanding the role of global linkages for

firm level upgrading. But it also specifies that in order to be successful integration needs to be combined with investing in knowledge within the firm and that the more demanding forms of upgrading require a strong innovation system and active innovation policies.

A further step toward developing the understanding of governance of global chains was based upon the work by Sturgeon on modular production networks. Sturgeon (2002) argues that the modularization of information technology production chains should be seen in the light of transaction cost theory. By standardizing and codifying interfaces between those producing components and the major computer firms it has been possible to reap scale economies in production without imposing inhibitive transaction costs. It is argued that this is ‘a new American model of industrial production’ that can be applied in other sectors and set new global standards for the organization of value chains.

Gereffi, Humphrey and Sturgeon (2005) take these ideas into account and propose five different modes of governance:

- Hierarchy
- Captive
- Relational
- Modular
- Market

It is assumed that the further down we get on this list the less is the element of dominance. As compared to the categories used by Humphrey and Schmitz (2002) captive corresponds to semi-hierarchical while the network category has been divided into two types of networks – relational and modular.

Three different characteristics are used to explain why a transaction interface takes on a specific form:

- The complexity of information and knowledge transfer

- The extent to which the information can be codified
- The capabilities of suppliers

What is new as compared to Humphrey and Schmitz (2002) is that complexity now is explicitly related to information and knowledge and especially the emphasis upon the codifiability of the information.

Both Humphrey and Schmitz (2002) and Gereffi, Humphrey and Sturgeon (2005) emphasize that the governance mode may change over time. Humphrey and Schmitz refer to how a firm or a cluster of firms in a developing country can get out of captive network situation by diversifying their sale to new customers, including home market customers, by functional upgrading or by moving into new sectors. Gereffi, Humphrey and Sturgeon (2005) propose that the character of the transaction interface may change over time and they indicate that a dominant tendency may be that captive and relational networks will move toward the modularized form.

While Humphrey and Schmitz (2002) seem to assume that it is possible to characterize the whole global value chain by one dominant mode of governance Gereffi, Humphrey and Sturgeon (2005) are specific and relate the mode of governance to the relationship between the 'lead firm' and the first tier supplier. This focus upon one specific interface is more in line with the standard literature on governance and transaction costs. However, it also makes the analysis more complex than where the main distinction is between some chain-wide modes of governance.

This is a point made by Gibbon, Bair and Ponte (2009) who give a critical overview of the discussion of governance in relation to global value chains. They make a distinction between the original approach as developed in Gereffi and Korzeniewicz (1994) where they see 'governance as a driver' (the lead firm is either a dominant buyer or producer that drives the value chain) and the 'governance as coordination' (governance as referring not to the value chain as a whole but as referring to a specific transaction interface) as presented by Gereffi, Humphrey and Sturgeon (2005). The authors see this change of focus as problematic and they question that it adds anything to the understanding of the dynamics in value chains.

In an earlier contribution Bair (2005) gives a broader critical overview of the origin and evolution of the commodity and value chain approach. Here she contrasts the more recent developments in terms of global commodity chains and global value chains with the concepts' original roots in Wallerstein's work on World Systems. She points out that the concept of commodity chain dates back to an article by Hopkins and Wallerstein (1977) and that the more recent developments have deviated from the original world system view. The new versions tend to present globalization as a new phenomenon and they have narrowed down the perspective from the global system to what goes on at the micro and industry level. At the same time the chain analysis has become more concerned with what are commendable firm strategies and national policies. For the future she recommends a more explicit inclusion of international regulation and national institutions in the analysis. In Bair and Werner (2011) she makes the point that while the focus of the chain analysis is on cases of integration, actual developments show that 'exclusion' is another on-going process that needs to be given equal attention by scholars.

We can see that there has been an evolution of the understanding of the conceptual framework used to analyse global value chains. The different approaches have in common that they assume that some firms in the respective chain have the upper hand in organizing the activities in the chain. It is assumed that multinational firms from the North can use their control of end user markets or of technologies to reap most of the value produced in the chain. But this might be changed or at least modified if the integration takes a form of 'upgrading' – it is assumed that some forms of governance give more opportunities for upgrading than others.

Is there a difference between US and Europe chain research?

Gary Gereffi has played a key role in developing the ideas relating to global value chains. He made his Ph.D. on the failure of the Mexican pharmaceutical sector to become globally competitive and he presented this as a strong evidence in favor of the Latin American dependency school (Gereffi 1978). In his later empirical work he

focused especially on shoe and apparel industry where US-firms close to the market and with market control played a key role in organizing production in Asia and in Latin America (Gereffi 1994).

Gradually the focus changed from barriers to opportunities for firms that engage with lead firms. According to Bair (2005, p. 165) Gereffi (2001) argues that access to the lead firm is a necessary if not a sufficient condition for successful participation in global markets and that this insight should inspire public policy in developing countries. He seldom draws specific conclusions regarding national level state policy. Sometimes he motivates it by referring to the rule of Washington consensus and sometimes with the inability of governments ‘to get institutions right’. In these respects he differs from European scholars such as Hubert Schmitz.

In parallel with the development of the commodity chain approach Schmitz and other development scholars at IDS were inspired by the industrial district concept as developed with reference to Italian clusters by Brusco (1990) and Beccatini (1990), later applied to a cluster in Mexico by Rabelotti (1993). Schmitz followed the evolution of a specific shoemaker cluster in Simos Valley in Brazil and demonstrated how the cluster formation could give rise to ‘collective efficiency’ rooted in trust, informal collaboration and cooperative institutions, often supported by government policies. But this study also demonstrated how the links to foreign buyers made it more difficult to develop further and exploit the collective efficiency. This was the background for Schmitz becoming centrally involved in the analysis of global value chains after 2000. As we have seen this is also the time when the Chain literature takes off.

The idea of collective efficiency in clusters as rooted in trust and collective action that Schmitz and Humphrey brought into the chain analysis was not seen as uncontroversial for some of the original commodity chain scholars. In their case study of Torreon’s blue jeans industry Bair and Gereffi (2001) conclude that there is little horizontal cooperation and that supporting institutions did not play any significant role. And they end up arguing that since governments in developing countries have difficulties to get institutions right ‘the questions becomes how firms can use their participation in global

commodity chains to pursue development goals.’

This reluctance to come with policy recommendations seems to characterize the US-scholars working on global value chains. In a recent contribution on the post-crisis situation by Cattaneo, Gereffi and Staritz (2010) the major policy recommendations is basically for firms to engage in global value chains and for governments to avoid any form of protectionism. This is not surprising given that it is a World Bank publication. But the recommendation stands in contrast to some of the cases presented where the outcome of integration is often quite problematic seen from a development and upgrading perspective.

The work by Sturgeon (2002) – another of the US contributors to the chain-literature – is also, at least indirectly, critical to the industrial district approach. Long term relations in the form of non-traded interdependencies are seen as burdensome in terms of transaction costs and as rigidities that can be simplified and made more flexible by codification and standardization.

Bair (2005) divides the life of the global chain approach into three stages (with overlaps). The first stage is true to the world system perspective, the second refers to global commodity chain analysis where the focus is upon the distinction between buyer and supplier driven global commodity chains and the third refers to global value chain with the focus upon governance at the micro-level.

We see another split in the global chain-literature where European scholars tend to favor a mixed perspective where local capacity building and national policies are seen as necessary for successful integration in global value chains. The US-scholars tend to downplay the importance of local context as well as the role government intervention. Within the group of US-scholars some such as Bair remain more true to the Marxist heritage while others have become engaged in giving useful advice to business, international organizations and governments.

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We see another split in the global chain-literature where European scholars tend to favor a mixed perspective where local capacity building and national policies are seen as necessary for successful integration in global value chains. The US-scholars tend to downplay the importance of local context as well as the role government intervention. Within the group of US-scholars some such as Bair remain more true to the Marxist heritage while others have become engaged in giving useful advice to business, international organizations and governments.

On the economics of the Global Value Chain approach

In a brief paper Adrian Wood (2001) presents an economist's view of the global value chain approach. He points to three lessons that economists can learn³

1. The important role of marketing and branding for the world-wide distribution of value added.
2. The fact that most transactions take place in networks and not in pure markets.
3. That firms make conscious efforts to upgrade and that their capacity to do so is heterogeneous.

That firms make conscious efforts to upgrade and that their capacity to do so is heterogenous. In the rest of the paper Wood points to how economists can contribute to qualify the global value chain approach under two headings: Accounting and causation. In order to get a more systematic understanding of the relevance of the value chain approach he recommends to use input output analysis to locate those chains with participation from suppliers in developing countries where there are identifiable lead firms.

His most important point is that there is a need to establish an analytical link from upgrading at the level of the single firm to the development of a whole economy. Without such a link there is no way that one can conclude that upgrading of a single firm or one single cluster of firms is good for economic development. This 'fallacy of composition' may actually be the weakest point in the global value chain analysis. This weakness has to do with the research methodology that dominates in the chain literature

³The innovation system literature should also learn the first lesson while the message in the second and third are already integrated in the analysis of innovation systems. To this should of course be added the more specific lesson that many firms in developing countries are dependent on lead firms when it comes to shape processes of innovation and learning and that this may contribute to explaining opportunities as well as barriers for learning at the regional and national level.

Methodological problems

The research method used in GVC is strongly dominated by case studies. One problem with that is that with competing lenses you may see different things and, perhaps as important, you are free to choose the case so that it fits with what you are looking for – one example is the blue jeans paper by Gereffi and Bair (2001) referred to above – in contrast to many other case studies made by Europeans they find upgrading through interaction with lead customer but no industrial district characteristics. Another problem with research method is that data gathering is not always well documented when western scholars make their often rather brief visits to study clusters in developing countries.

The paper by Guiliani, Pietrobelli and Rabelotti (2005) is interesting since it makes an attempt to present a picture of local vs global interaction in Latin America on the basis of no less than 40 case studies. Their conclusions are that you find elements of 'collective efficiency' in most clusters while the form it takes depends on sector as well as regional and national context. They also confirm that in order to explain how integration in global value chains affect upgrading in the firm you need to take into account the characteristics of regional and national systems of innovation and especially the firm's own effort to engage in capacity building.

This corresponds to what is found in Malerba and Nelson (2011). Studying 'catching-up' in six sectoral innovation systems they find that industries differ in terms of how they link up with international firms. In some successful cases of catching up (automobiles in Korea) the access to foreign technology was crucial while in other cases (software, semi-conductors and agro-food) multinationals operated as customer lead firms in global value chains. But again in order to explain success and failure in catching-up – a concept close to upgrading of the national industry - it was necessary to link the analysis of sector characteristics to the analysis of the national innovation system.

But the analysis of a wider set of cluster developments or of sectoral systems does not solve the 'fallacy of composition'-problem. Even if it can be shown that most clusters

can benefit from firms' integration in global value chains and that specific sectors can catch up it does not follow that this will contribute to economic and social upgrading at the national level. This is not to degrade the importance of case studies and sector studies but it is a strong argument for combining different methods in order to make it possible to establish links from micro- and meso-levels to what happens at national level.

Milbjerg and Winkler (2010) use national aggregate data on exports, value added and employment for 40 developing countries to analyze the possible link between joining global value chains and economic and social upgrading for the period 1980-2006. In general they find a weak positive correlation between export growth and value added per employee. Using the ratio between the rate of growth of value added per employee and the rate of export growth as indicator they found upgrading only in 9 of the 40 countries while 'downgrading' characterized the 31 other countries. As explanation they refer to the explosive growth in the employment in export zones and to the related fact that the import prices to the US of many of the commodities that the global value chain approach focuses upon have fallen drastically over the period.

A final observation on globalization and catching up

As some of the critiques have pointed out there is a need to study exclusion as well as inclusion in value chains and to study the phenomenon of downgrading as well as upgrading. To develop methods that give a balanced understanding of the consequences of globalization for the less developed countries is a major challenge. This might require that the global value chain analysis is complemented with quantitative research using input-output analysis and that the role of lop-sided global rules and institutions is taken into account. Such a change in the value chain analysis might help to give a realistic assessment of current export oriented strategies and also of the consequences of the limited capacity of governments to get institutions right.

3. The development of the Innovation System approach

There are already a number of publications that study the origins and development of the literature on innovation systems. An early example is McKelvey (1991) who compares the approach to innovation systems of the four scholars Freeman, Lundvall, Nelson and Porter. (they have turned out to be the most cited authors see table 1 above). Sharif (2006) gives an interpretation of how the concept has evolved and combines use of written material with interviews of some of the key persons in the field. In Lundvall (2010) (post script to the new edition of Lundvall 1992) an attempt is made to explain how the concept was developed. These sources show that the concept emerged in the beginning of the 1980's. Conversations between Freeman and Lundvall when Freeman was guest professor at Aalborg University were important (Freeman 1981). The first reference to the 'national innovation system' can be found in an unpublished working paper produced for OECD (Freeman 1982) and the first publication referring to 'innovation system' was (Lundvall 1985). Other early contributions that developed the concept were (Freeman 1987, Freeman and Lundvall 1988, Freeman 1988, Nelson 1988 and Lundvall 1988). It might be argued that at the of the 1980's the idea was in the air. At OECD the concept national science system came into use in the beginning of the 1980 and US-scholars such as Michael Porter, Richard Nelson and Nathan Rosenberg had a systemic view of the innovation process. More systematic efforts to develop the theoretical foundation of the concept came later in Lundvall (1992) and in Edquist (1997). A series of case studies of national innovation systems were presented in Nelson (1993).

Lundvall (1985) and Lundvall (1988) were referred to by Nelson (in Dosi et al 1988 and in Nelson 1993) as offering a micro foundation for the innovation system concept. These two papers focused upon the interaction between producers and users in connection with product innovation and the most important message was that innovation is an interactive process. This insight was not new. Rothwell (1972) and Rothwell (1977) reported from the Sappho-project as the most important result that interaction within firms across departments and interaction with external partners such as suppli-

ers, customers and knowledge institutions were crucial for the success of innovations. Around the same time Kline and Rosenberg (1976) had developed a criticism of the linear approach to innovation showing how innovation projects required an on-going interaction between enterprises and the research institutions.

Economic Geographers were among the first to recognize the potential of an innovation system approach. They used it to understand the dynamics of the location of economic activities. One of the early contributors to the concept regional innovation system is Phil Cooke (Cooke 1992, Cooke 1996 and Cooke 2001). An important more recent reference is the paper by Bathelt, Malmberg and Maskell (2004). Here the authors develop the distinction between 'local buzz' and 'global pipelines'. Hereby they open up for a potential relation to global value chain analysis but the only reference to authors operating in that community is the reference to Humphrey and Schmitz 2002.

Carlsson and Stankiewicz (1991) introduced a version of the concept technological system that had characteristics in common with the innovation system but where the focus was upon the emergence of new technologies. Their work have inspired a subfield of research where the 'functions' of innovation systems are seen as crucial for understanding and managing the emergence of new systems (Rickne 2000, Edquist 2005, Hekkert 2007). This sub-community thrives at technical universities and the functionalist approach has been adopted quite widely by scholars working on how innovation may contribute to the development of sustainable technologies.

Another subfield came from the field of science systems and sociology of science. Here the concept of triple helix as developed by Etzkowitz, H and L. Leydesdorff (1995) became widely diffused as an alternative. This concept was related to the innovation system approach in Etzkowitz, H and L. Leydesdorff (2000). The approach became quite popular among innovation policy makers. This reflected the rather simple operational set-up, where the task of the policy maker is to bring together partners from private sector, public sector and universities in collaboration. The proponents of the triple helix approach see the neglect of the role of the public sector in innovation system approach as a weakness while proponents of the innovation system approach are

critical to triple helix' neglect of the kind of experience based learning that takes place within the industrial system.

The scientometric analysis shows that there is a new growing community of scholars who have specialized in applying a kind of innovation system perspective on agricultural development in developing countries. According to the scientometrics a central reference is to Klerkx, Aarts and Leeuwis (2010). This paper has focus on innovation in agriculture using system theory and communication theory. It is interesting to note that there are several references to socio-technical version of innovation system but none to the standard references (Freeman, Nelson and Lundvall). Neither is there any reference to the global chain literature in the paper. Finally the bibliometric analysis demonstrates that a small group of scholars have connected the innovation system to the analysis of international trade and to multinational firms. The most important early reference is to Granstrand, Bohlin, Oskarsson and Sjoberg (1992). Those who developed the concept of innovation systems and the standard references for the field as a whole were all economists – some with a general economics background (Freeman, Nelson and Lundvall) and others with a background in business studies (Porter). As demonstrated in the brief overview scholars from other disciplines (Geography, Science studies, Engineering, Sociology) have adapted and transformed the concept so that fits into their own mode of thinking.

There has been a diverse development also within the core group of scholars that link innovation to economic theory, economic institutions and economic performance. The concept 'sectoral system of innovation' was developed in the 1990's by Malerba and Orsenigo (1996) and presented in Malerba (2000). One of the arguments for focusing upon the sectoral level is of course that innovation studies have demonstrated that innovation takes place differently in different sectors and an important distinction in this literature is between sector that are driven by new entrepreneurial initiatives and sectors dominated by major incumbent corporations. Another argument that relates to the global value chain approach is that the sector approach (as well as the technological system approach) makes it possible to analyse innovation processes that cross national

borders. As mentioned Malerba and Nelson (2010) use the sectoral system approach to study catching up and gives an important contribution to the understanding of how national and sectoral characteristics are combined with international interdependence in shaping innovation and economic development.

A series of important studies of the role of regional and national systems of innovation in developing countries have been produced over the last 10 years in the framework of the Globelics network (Arocena and Sutz 2000a and 2000b, Cassiolato, Lastres, and Maciel. 2003, Lundvall et al 2009). The fact that they do not appear strongly in the scientometric analysis reflects a bias in the citing patterns where US-sources get over represented while scholars from the South are under represented.

Following one track within innovation studies

As we have seen different sub-groups follow different trajectories within the innovation system literature and it is not possible to follow the evolution for each of these tracks. In what follows we focus upon the evolution of ideas that stick to interactive learning as a core concept. To illustrate the evolution we will refer to five publications that we see as important steps in deepening and widening the understanding of the innovation system. One reason for selecting these five publications is that they contain elements and concepts that overlap with or complement the global value chain literature.

1. User-producer interaction and product innovation (Lundvall 1985).
2. From user-producer interaction to the national system of innovation (Lundvall 1988).
3. The learning economy (Lundvall and Johnson 1993).
4. How Europe's economies learn: a comparison of work organization and innovation mode for the EU-15, (Arundel et al 2007).
5. Forms of knowledge and modes of innovation (Jensen et al 2007).

Lundvall (1985) is based upon four case studies of ‘industrial complexes’ in Denmark. It analyses the interaction between producer and professional user sectors in the development and use of information technology in Denmark. It has several connections to the Global value chain literature:

1. It starts from a criticism of neo-classical economics and transaction economics and introduces ‘the organized market’ as an intermediate form between ‘pure markets’ and hierarchies. This is what the value chain literature refer to as ‘networks’.
2. It makes a distinction between producer and user dominated dyads. Domination is assumed to reflect the combination of market power and technological capacity and it is assumed to be especially strong when technologies are systemic. This idea is parallel to Gereffi’s distinction between producer and customer dominated value chains.
3. It is assumed that unbalanced relationships tend to result in ‘unsatisfactory innovation’. This idea is parallel to the idea of unequal distribution of value produced.

One major criticism of the transaction cost theory in Lundvall (1985) was that it underestimates the advantage for users and producers to have diverse partners with whom to interact in the ongoing process of innovation and change. Vertical integration tends to lead to isolation since former partners in the vertical of production become competitors. Transaction costs needs to be seen in relation to ‘learning benefits’. This argument is similar to the argument used in Sturgeon (2002) to explain the modularization.

Lundvall (1988) used the user-producer interaction analysis as the basis for developing the concept national system of innovation. While the ideas on user vs. producer domination and unsatisfactory innovation were integrated in the analysis they were largely neglected by those who adopted the innovation system concept later on. Therefore most of the literature on innovation systems has presented interactive processes as balanced and they have tended to neglect that there are dominating parties in the

interaction. This is true also for much of Lundvall's work.

Lundvall and Johnson (1993) was an attempt to go deeper into the dynamics of learning in an economy characterized by rapid change. A taxonomy of knowledge is introduced (know-what, know-why, know-how and know-who). Here the connection to the global value chain literature is the discussion of the important distinction between codified and tacit knowledge, later to be used to characterize governance modes in for instance Gereffi (2005). But here as in later publications the emphasis is upon the limits of codification in contexts which are constantly in flux.

Jensen et al (2007) use data from Danish surveys on innovation and organizational learning to make the distinction between learning modes that are more dominated by tacit knowledge and learning modes that are more dependent on codified knowledge. The most important result is that firms that combine the two modes of learning are more innovative than those that only practice one mode. This is a result that can be linked to the literature on local buzz and global pipelines since science based and codified knowledge more easily can move across borders. This result can also be used to illustrate the importance broadening the concept of absorptive capacity so that it is not seen only as requiring investments in R&D.

Arundel et al (2007) links innovation performance at the national level to how work is organized. It shows that countries that offer opportunities for discretionary learning to workers are more innovative than other countries. In some of the more recent contributions to the global value chain analysis the focus has been on how integration of firms in global value chains affect work mainly in terms of pay and working conditions (Barrientos, Gereffi and Rossi 2011, Coe and Hess 2012). To widen the analysis of work organisation and access to learning to developing countries would be a way to give more concrete indicators that capture both economic and social upgrading.

What can be learnt from the Innovation System approach

The most obvious lesson from innovation studies for global value chain analysis is that the outcome of integration in a global value chain will be determined by the effort

made inside the firm, the regional and national context as well of the specificity of the industry. Many of those working in the global value chain tradition have demonstrated that these contexts must be taken seriously (Kaplinsky 2000, Schmitz 1999, Giuliani, Pietrobelli, and Rabellotti 2005). None the less there is a bias in favor of focusing upon the vertical learning taking place across regional and national borders.

As indicated above the learning economy perspective may be useful in qualifying the use of transaction cost theory as the basis for defining governance within global value chains. Also there is a potential in integration workplace innovation and workers' learning in the analysis of economic and social upgrading.

Finally and perhaps most important the strong emphasis upon interactive learning may be used to specify how the different forms of upgrading requires different forms of learning as well as different forms of institutional support for learning processes.

Broad and narrow definitions of innovation systems

In the analysis of the value chain approach we pointed to some differences between how European scholars and US scholars regard 'the social dimension' of clusters. Interesting enough we find a similar division in the field of innovation systems. While US-scholars tend to operate with more narrow versions of systems that refer to the national knowledge infrastructure and to national science and technology policy and work with a more demanding definition of innovation as new to the world technological breakthroughs. This stands in contrast to the broad definition that was developed in Freeman (1987) and Lundvall (1988) (and the one used as framing for Globelics where 'lics' stands for learning, innovation and competence building systems). Here 'innovation' refers to a process that covers the creation as well as the diffusion and use of technology in low-tech as well as high tech sectors (Lundvall 2010). Narrow versions tend to give special attention to hi-tech sectors such as pharmaceuticals and information technology. When it comes to economic development the focus is upon spill-over effects from transnational firms operating in such sectors and the role that national knowledge infrastructure and in house R&D may play in promoting 'technology

transfer'. When influential scholars who are experts on knowledge based development (Viotti 2002; Mathews 2001, Lall and Pietrobelli 2003) raise doubts about the use of 'innovation system' in the context of developing countries one reason may be that they take the narrow definitions as reference. In Lundvall et al (2009) we recognized that the broad definition of the innovation system could as well be referred to as 'a learning system' but also that the broad understanding of innovation is important for developing adequate 'innovation policies' both in the North and in the South. Broad definitions of innovation systems give attention to a wider set of institutions as being crucial for innovation driven economic development. Besides the R&D-efforts and the formal education system 'learning processes' taking place in everyday life activities are crucial for the capacity to absorb and use new technology. Low tech activities as well as high tech activities will require that firms and workers combine codified with tacit knowledge and tacit knowledge is rooted in experience-based learning. National patterns of work, organization patterns of firms as well as education and labor market institutions that shape human competences and patterns of social interaction are therefore seen as shaping innovation activities. Actually the narrow definition is of limited relevance for all economies with the exception of the largest and most advanced (US, Japan and Germany). In the rest of the world there are few innovations new to the world and more or less active national learning systems will be fundamental for economic performance. The major difference between a small developed economy and a developing country is in the institutional richness and efficiency of the national innovation system. This wider definition of national absorptive capacity is crucial for how firms can benefit from integration in global value chains.

On the importance of origins

It is interesting to note that there is a certain element of simultaneity between the development of the early ideas behind chain analysis and the early ideas behind the innovation system approach. Gereffi publishes already in 1978 an important paper based upon his doctoral thesis on pharmaceutical industry in Mexico (Gereffi 1978). Here

he finds that the dominance of transnational US-firms is strong and that attempts by Mexican government to overcome it by industrial policy failed. He presents the case in a book 1985 where he introduces a broader perspective including the experience from other Latin American countries. The case is one where the Mexican firms that had advantages in terms of access to a unique natural resource to engage in upgrading and becoming competitive. But even under these advantageous conditions the combination of powerful transnational capital, US government intervention and corrupt Mexican policy makers blocked their path of development. He presents the Mexican case as strong evidence and support for the theory of the dependency school.

This early work may be seen as an interesting background for the launch of the concept global commodity chains in 1990s, later on renamed global value chains and even later also presented as ‘global production networks’. These concepts may be seen as new combinations of a sociological approach to dependency and elements taken from industrial economics. While the original case indicated the almost hopeless situation of domestic firms in developing countries the new understanding opened up for forms of international integration that allow for the upgrading of firms. The key concept in this connection is the governance of the production chain and it refers to who is in control and to the degree of autonomy that the firms in the developing country.

In the beginning of the 1980s Lundvall was involved in studying the impact of information technology on the economy of a small rich country – Denmark (Lundvall 1985). The method used to obtain results was to study how information technology was diffused and used in four ‘industrial complexes’. The major analytical outcome of this work was the analysis of user producer interaction in connection with product innovations. Based on this work Lundvall (1985) presented a new perspective on markets as organized with built in social relations that included trust. What is worth noting is that these relations were characterized in terms of ‘dominance’ and semi-hierarchy. Several examples where the dominance of producers in relation to users and vice versa were presented and it was argued that such constellations resulted in ‘unsatisfactory innovations’.

When we go back to the origin of the two tribes we find that they have more in common than what you would assume at first sight. But it is true that most of the innovation study community has been slow to take up the ideas about power and dependency. As the ideas were diffused to policy makers, business schools and technical faculties the critical dimension became suppressed and the analysis became increasingly normative in order to respond to the demand for policy advice from business and government. Therefore it is no surprise that development scholars assume that the dimensions of power and dependency are alien to innovation systems.

An important message in Lundvall (1985) was that neither standard economics nor transaction economics could explain the frequency and importance of product innovations. The ‘pure market’ with anonymous agents operating at arm’s length could not offer the exchange of information between producer and user that was crucial for successful product innovations. Neither could it be explained by transaction economics. When a new product is developed for the market the uncertainty is embedded in the product itself and therefore we should assume that most innovations take place in house as process innovations.

It is interesting to note that the original analysis in both cases had a critical edge to it that to some degree has been lost as the concepts have become widely diffused and used. In Gereffi (1978) the focus was upon the downside of globalization and in Lundvall the focus was upon uneven power relationship that resulted in ‘unsatisfactory innovations’. Soete (2013) points to the risk that innovation studies end up with a message saying that ‘innovation is good for you’ (with reference to the slogan ‘Guinness is good for you’). In the chain literature there is a similar tendency to focus upon situations where ‘globalisation is good for you’ since the focus of the empirical analysis has been about inclusion rather than exclusion. Working toward a synthesis could be combined with going back to the early contributions and use them to challenge the two examples of optimism bias.

4. Moving toward a synthesis

Building a synthesis could involve the following steps:

1. For innovation system analysts: Give explicit attention to hierarchy and power relations in the analysis of interactive learning.
2. For global value chain analysts: Analyse the dynamics of value chains as processes of interactive learning. Link a broadly defined absorptive capacity to the analysis of technological learning within value chains.
3. For innovation system analysts: Open up the national system analysis and put stronger emphasis upon how their integration in global chains conditions the processes of catching up.
4. For global value chain analysts: Anchor the chain analysis in regional and national contexts putting more emphasis upon how firm strategies for integration in chains are conditioned by local and national institutional context and by the role of the state and state intervention.

There are also a number of challenges in moving toward a synthesis:

1. How to relate the firm's interactive learning taking place at the numerous interfaces (this is crucial in innovation studies) to the aggregate concept 'value chain' with strong focus upon one vertical of production and a lead firm. Is it meaningful to regard all production activities as integrated in global value chains and as governed by one of the listed five modes of governance? And vice versa: How can you introduce the full complexity of learning at a multitude of interfaces without losing theoretical clarity.
2. The original ideas behind innovation systems were critical to transaction cost theory as being too static to capture 'learning' and 'innovation'. This stands in contrast to the GVC approach where a modified version of transaction cost theory is used to develop the modes of governance.

3. The innovation system approach assumes that governments have important roles to play in designing policies and institutions. In some versions of the GVC approach the role of government is downplayed and in recent contributions there are hints that ‘the business sector should be in the driver’s seat’ and that globalization is a process that cannot and should not be interfered with. And conversely is the innovation system approach suffering from ‘methodological nationalism’ and from exaggerated expectations of what soft and captive governments can do?

5. Preliminary conclusions

It is interesting to note how two different approaches to economic development have evolved in parallel but with very limited interaction as reflected in shared references. Both are socio-economic. The innovation system approach was started by economists (Freeman, Nelson and Lundval) and moved from a criticism of standard economics to the integration of institutions and organizations in the analysis. The global value chain started from sociology (Gereffi) and integrated elements from industrial organisation and transaction cost theory. The main point in global value chain analysis is that more and more transactions take place internationally and that for a development country firm it may prove helpful to join a global value chain in order to upgrade its activities. This is obviously a correct and relevant observation that needs to be taken into account both by the enterprises and by national governments design policies and institutions. The main point in innovation system analysis is, first, that firms need to build in house capacity to absorb knowledge from the outside, including from abroad and from lead firms in global value chains, and, second, that national context matters for how they can do that. That national context matters is confirmed in comparative case studies that are central for the global value chain literature.

Conversations with policy makers and experts from donor organizations engaged in programs to promote industrial development in developing countries indicate that while they give different weight to strengthening national, sectoral and local systems of innovation on the one hand and integration in value chains on the other most of them

see a need to combine the two perspectives in their practice. The tribal divisions in the academic circles are not reproduced in the policy community.

Are there national governments that have been especially keen to simultaneously draw lessons from the two perspectives and did it result in successful outcomes? Our hypothesis is that governments in South Korea and China have acted ‘as if’ they took into account both the need to build strong national innovation systems and the need to engage in ‘functional’ upgrading (it is interesting to note that Chinese scholars have been among the most active in the sub-cluster on industrial development within the global value chain camp). Future research should look more into the public policy strategies of these countries and consider if they can serve as inspiration for developing country governments. This analysis may show that in some countries there is too much openness given the weakness of absorptive capacity while in others more openness may be a way to support the process of catching up.

On the basis of these observations we see good reasons for why an attempt to work toward a synthesis of innovation system and global value chain approach can and should be made. Starting point could be to build upon insights already established within the relative small overlapping sub-communities. That is the work on knowledge exchange in industrial clusters in the GVC-community and regional and sectoral systems of innovation on the side of innovation systems research.

We do believe that the time is now ripe for a globelics giga-project linking to each other scholars working from the two perspectives. The project should study the consequences of the integration and exclusion of firms and clusters located in regional, sectoral and national innovation systems. It would bring together scholars from all the regional Lic including the newly founded EuroLic. The project would use many methods and aim at linking micro to and meso to macro and the other way around.

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A. Details on the Scientometric Analysis

The quantitative analysis in this paper has two main goals. First of all it aims at supporting the qualitative description of the two research fields. Furthermore, it helps to identify a “factual-overlap” between the fields. For that we combine established bibliometric methods with techniques from natural language processing and network analysis and apply them to a dataset extracted from Thomson Reuters Web of Science (WOS).

A.1. Data

The data on GVCs consists of records on 419 papers between 1994 and 2014. By constructing a more restrictive search string with a focus on development (“Innovation system” AND “Develop*”) we could reduce the number of records related to IS literature to 1059 articles from 1990 to 2014⁴. Only 8 records were matched in both cases, indicating that the publications explicitly linking to both fields are very scarce. A big advantage of the WOS database is the routinised normalisation of publications, institutions, authors and citations. The drawback of WOS is the relatively lower number of records as compared with other bibliographic databases (e.g. Scopus).

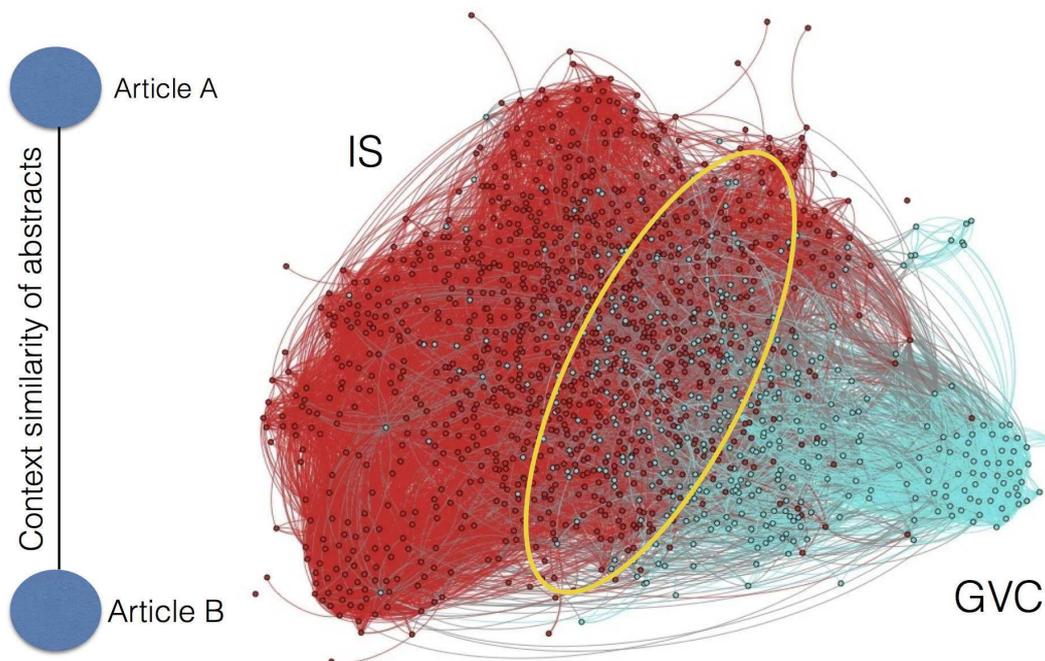
A.2. Methods

For now this version of the paper presents counts and relative frequencies of references in papers belonging to the two fields. In the next version we will include the results of within-field community clustering based on pairwise bibliographic coupling of all records within the IS (resp. GVC) group computed as $w_{ij} = \frac{n_{ij}}{\sqrt{n_i * n_j}}$, where n_{ij} is the number of shared references, and n_i (resp n_j) the number of references of publication i (resp j). The result of this calculation is an adjacency matrix, describing a network of articles. We use the heuristic Louvain algorithm based on modularity optimisation to extract the community structure of the network (Blondel et al. 2008).

⁴Topic search TS=(“Global Value Chain*” OR “GVC”), TS=(“Innovation system*” AND “develop*”) for Articles and Abstracts of published items in Science Citation Index Expanded (SCI-EXPANDED) —1900-present and Social Sciences Citation Index (SSCI) –1956-present

Clustering allows to identify communities that usually translate to sub-discussions within the IS or GVC. This categorisation supports our aim at mapping the two traditions of literature in detail considering the different discussions and nuanced angles.

Figure A.1: Semantic overlap between GSV and IS abstracts



The WOS records include also abstracts of the publications, which allows to use natural language processing to analyse semantic patterns within and between publications. Using a vector space model on bag of words⁵ representations of the abstract corpus we calculate pairwise cosines between vector representations, which represent a semantic similarity measure between the articles (both GVC and IS) in the database. Figure A.1 presents a visualization of the created. Selecting heterogeneous pairs (one from GVC and one from IS) with high similarity scores allows to identify publication in the overlap between the two fields. To understand the nature of the overlap we can extract shared citations between the most similar pairs. Table A.1 lists these references for the most similar 200 pairs (excluding the 8 identical papers in the two groups).

⁵Theme relevant nouns and noun phrases (here only within text bigrams). We use a the random indexing algorithm, a fast implementation of latent semantic analysis (Kanerva et al., 2000).

Many of the publications are work within economic geography and related to clusters.

Figure A.2: Clustering of the Bibliographic Coupling Network of GSV literature

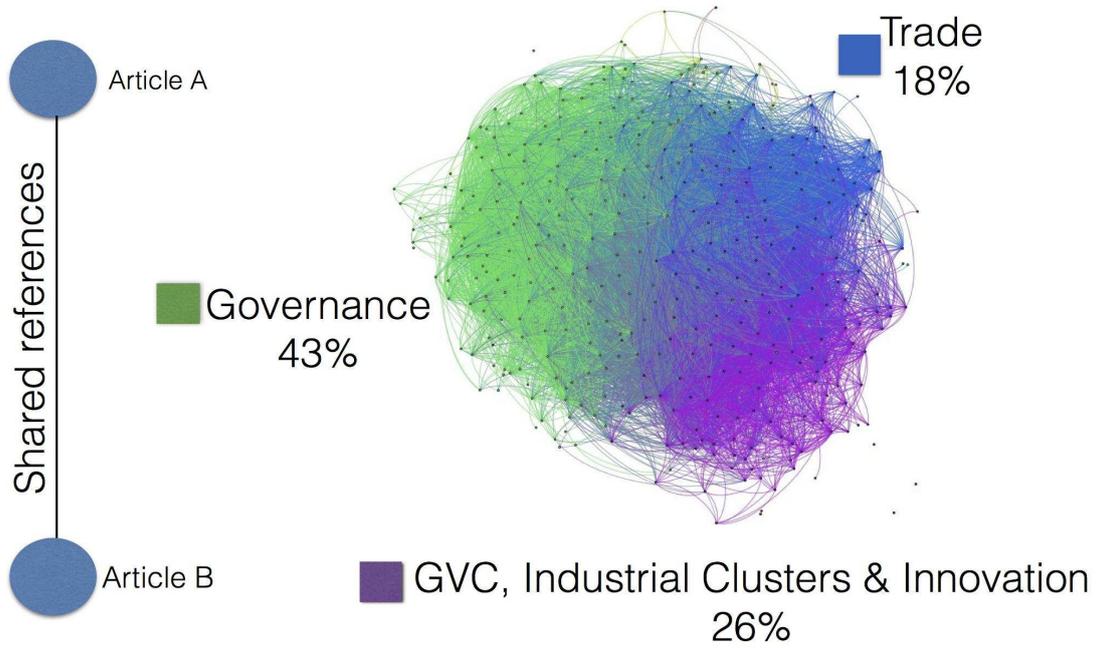


Figure A.3: Clustering of the Bibliographic Coupling Network of IS literature

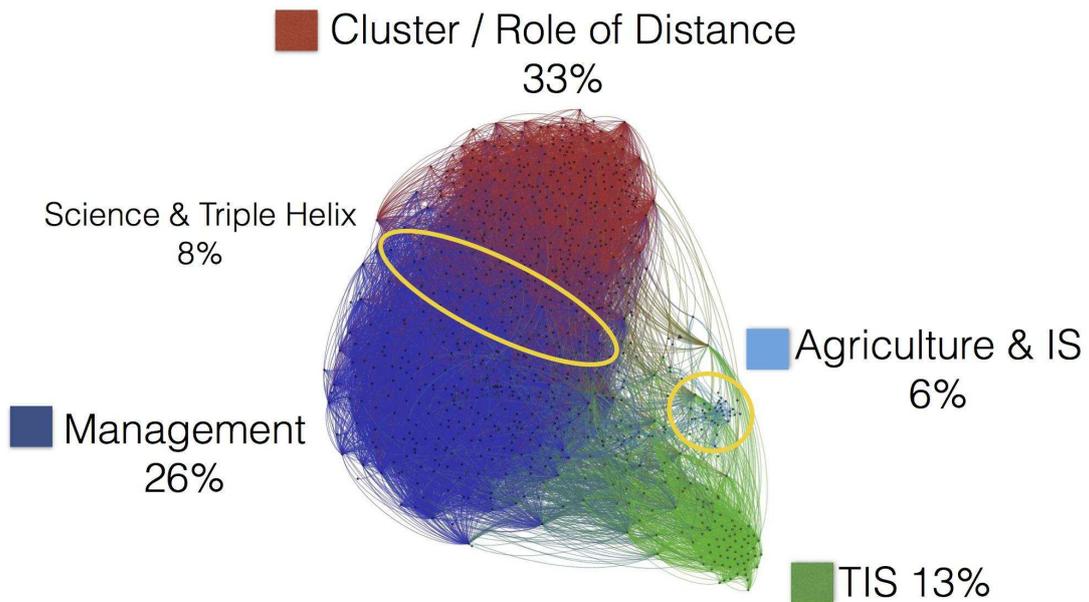


Table A.1: Shared References in the Overlap

Cited works	count of shared occurrences
Humphrey J & Schmitz H, 2002, REG STUD, 36, 1017, DOI 10.1080/0034340022000022198	8
Cohen WM & Levinthal D A, 1990, ADMIN SCI QUART, 35, 128, DOI 10.2307/2393553	7
Gereffi, G; Humphrey, J; Sturgeon, T, 2005, REV INT POLIT ECON, 12, 78, DOI 10.1080/09692290500049805	7
Gereffi G, 1999, J INT ECON, V48, P37, DOI 10.1016/S0022-1996(98)00075-0	5
Belussi F., 2000, EVOLUTIONARY PATTERN	4
Edquist C, 1997, Systems of Innovation: Technologies, Institutions and Organizations, Book	4
Bair J, 2001, WORLD DEV, V29, P1885, DOI 10.1016/S0305-750X(01)00075-4	4
FREEMAN C, 1995, CAMBRIDGE J ECON, V19, P5	3
Maskell P., 2001, IND CORP CHANGE, V10, P921, DOI DOI 10.1093/ICC/10.4.921	3
Boschma RA, 2005, REG STUD, V39, P61, DOI 10.1080/0034340052000320887	3
Sammarra A, 2006, ENTREP REGION DEV, V18, P543, DOI 10.1080/08985620600884685	2
Maskell P, 1999, CAMBRIDGE J ECON, V23, P167, DOI 10.1093/cje/23.2.167	2
Nelson RR, 1982, EVOLUTIONARY THEORY	2
Czarnitzki D, 2003, SERV IND J, V23, P1, DOI 10.1080/02642060412331300862	2
GRANOVETTER M, 1985, AM J SOCIOLOG, V91, P481, DOI 10.1086/228311	2
Furman JL, 2002, RES POLICY, V31, P899, DOI 10.1016/S0048-7333(01)00152-4	2
Giuliani E, 2005, RES POLICY, V34, P47, DOI 10.1016/j.respol.2004.10.008	2
Storper M, 2004, J ECON GEOGR, V4, P351, DOI 10.1093/jnlecg/lbh027	2
Muller E, 2001, RES POLICY, V30, P1501, DOI 10.1016/S0048-7333(01)00164-0	2
PAVITT K, 1984, RES POLICY, V13, P343, DOI 10.1016/0048-7333(84)90018-0	2
Torre A, 2000, REG STUD, V34, P169	2
Martin R, 2003, J ECON GEOGR, V3, P5, DOI 10.1093/jeg/3.1.5	2