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Towards a Research Agenda

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Published in:
European Journal of Development Research

DOI (link to publication from Publisher):
10.1057/s41287-018-0137-4

Publication date:
2018

Document Version
Accepted author manuscript, peer reviewed version

This is a post-peer-review, pre-copyedit version of an article published in European Journal of Development Research. The definitive publisher-authenticated version "Jurowetzki, R., Lema, R. & Lundvall, BÅ. Eur J Dev Res (2018) 30: 364. https://doi.org/10.1057/s41287-018-0137-4" is available online at: https://link.springer.com/article/10.1057%2Fs41287-018-0137-4

Combining innovation systems and global value chains for development: Towards a research agenda

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Paper for Special Issue of
European Journal of Development Research (EJDR):
'Innovation Systems in the era of Global Value Chains'

Abstract

This paper contributes to ongoing work which seeks to bring together the national innovation systems and global value chain literature for the study of economic development. We depart from the view that such a new combination will be helpful both in enhancing the understanding of socioeconomic processes in developing countries and in building a more useful knowledge base for action. To this aim, we combine bibliometric analysis with a qualitative review of work from both bodies of literature. The purpose is to inform a research agenda suited for policy-relevant studies of economic development in the global economy.

1 Introduction

In recent years, there has been a renewed interest in multidisciplinary approaches to economic development. This interest reflects a crisis in development studies and the loss of faith in key

paradigms and ‘grand narratives’ in development theory and strategy (Buch-Hansen & Lauridsen, 2012; Schuurman, 2000). There is little mileage left in the assumptions, first, that developing countries are *internally* homogeneous and, second, that they are situated *externally* in a global economy with a simple separation, and division of labour, between countries that have either ‘advanced’ or ‘emerging’ economies (Harris, Moore, & Schmitz, 2009; John Humphrey, 2007).

Low and middle-income countries have in common that their citizens' living standards are lower, technologies used less advanced and that they are lagging behind in terms of productivity. This leaves them with a potential to catch-up with high-income countries in all these dimensions. But the paths followed will differ depending on the geographical and historical context. The shift away from grand narratives means there is increasing traction in the idea that economic development is essentially a process of ‘self-discovery’ (Hausmann & Rodrik, 2003) with no fixed directionality in development trajectories. There is also limited opportunity to transplant successful development strategy from one setting to another (B.-Å. Lundvall & Lema, 2014). Economic development is, therefore, fundamentally a process characterised by experimentation and learning; a basic tenet in the emerging field of ‘innovation and development’. As such, this newly emerging area of research constitutes a platform for intellectual interchange between perspectives from development studies, as well as perspectives from innovation studies.

In seeking to contribute to this field, we have chosen to focus, in this paper, on the prospects for combining two perspectives with arguably different spheres of attention. That is, the innovation system (IS) approach, which focuses on internal (national) characteristics and the global value chain (GVC) approach addressing external (global) circumstances of economic development in both low and middle-income countries.

We argue that such a ‘new combination’ will be helpful in enhancing the understanding of socioeconomic processes in low and middle-income countries, in addition to building a more useful knowledge base for action. It is our belief that such a synthesis could, to some extent, help trigger a new generation of research that overcomes weaknesses both within innovation studies and in development studies.

At first glance, the innovation systems perspective and the value chains approach seem to be in contradiction with each other. There are several dimensions of contradiction:

- While the dominating conceptualisation of innovation systems has traditionally referred to the country level and nation-state (Chris Freeman, 1995; Howells, 1994; B-A. Lundvall & Maskell, 2003), the literature on global value chains has been developed specifically to overcome the limitations of a nation-state perspective (Gereffi, 1996; Schmitz, 2007).

- Many applications of the concept of innovation systems see interactive learning (B. . Lundvall, 2010) as a process where partners are on equal footing and where governments are neutral and efficient in their execution of power. This may be contrasted with the global value chain approach, which gives explicit attention to the power dimension of corporate interaction and the limits of state capacity in developing countries (Gereffi, 2014).

- 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 (Whitley, 1996). Here, value chain-scholars have pointed to the innovation system perspective as a potential supplement (Pietrobelli & Rabellotti, 2011). Scholars working mainly from an innovation system perspective have argued, conversely, that in a globalised world, the global value chain approach might help us understand the limitations of national perspectives and strategies in relation to innovation (Ernst & Kim, 2002).

Throughout this paper, we will try to dig deeper into the two strands of literature and demonstrate, first, that there is more synergy between the two perspectives than what is typically assumed and, second, that the potential for integration is more promising than what we would expect, based on a first glance-impression. The key question addressed is whether (and how) the innovation system and global value chain approaches can be combined for analyses of economic development. Of note, GVC research emerged with a specific focus on ‘developing countries', whereas national innovation system (NIS) research began as an analytical tool for advanced economy phenomena and was only later applied to a low and middle-income setting. In this paper, we do not deal with NIS research in general, but primarily with the body of literature that targets innovation systems in developing countries (e.g. Lundvall et al. 2009).[1] While prior research has attempted to discuss these strands of literature, in conjunction (Altenburg, Schmitz, & Stamm, 2008; Pietrobelli & Rabellotti, 2011; Schmitz & Strambach, 2009), there are few empirical studies or detailed suggestions as to how the approaches can be brought together into a combined research agenda. This is what we discuss in this paper.

Section 2 is central to the discussion. It presents results of quantitative analysis of bibliometric data. We use bibliometric data from the Web of Science (WOS) database. It was found that the two different approaches to economic development have evolved in parallel but with very limited interaction. This is reflected in the limited number of shared references. Publications which explicitly link to both fields are scarce. But by focusing on the citation overlaps, we can identify some strands of literature which serve as common ground.

Sections 3 and 4 provide analyses of the similarities and differences between the two perspectives. There are fundamental differences in the default unit of analysis and the relative emphasis given to factors such as 'institutions' and 'power'. But the review of the two schools shows there is more overlap between the two perspectives than what is typically assumed. Both depart from quite similar conceptions of 'organised markets' and draw upon socio-economic theoretical foundations rooted in institutional and evolutionary economics and economic sociology.

Meanwhile, in *Section 5,* we discuss the prospects for synthesising the two approaches. It is evident from the preceding analysis that the potential for integration is more promising than what we would assume, based on a first glance-impression. New research drawing on an integrated foundation would give explicit attention to hierarchy and power relations in the analysis of interactive learning as an essential component in the process of economic development. Bringing together the analysis of interactions within and between the national and global dimensions, it would (a) open up national system analysis and put stronger emphasis upon how their integration in global chains conditions the processes of catching up and (b) anchor the chain analysis in regional and national contexts placing more emphasis upon how firm strategies for integration in chains are conditioned by local and national institutional contexts, and by the role of the state and state intervention. However, there are also significant challenges in bringing the approaches together, particularly regarding the methodological basis of empirical investigation drawing on an integrated research. We end the paper with Section 6 by outlining key challenges and questions for future research.

2 Mapping the literature

In this article, we take bibliometric analysis as a starting point for analysis of the potential of combining the innovation systems and global value chains approaches for the study of economic development. To identify interfaces, we start from a citation network-based bibliometric mapping. We cluster a large set of articles that contain references to publications from both communities.

2.1 Mapping method

We base our analysis on a corpus of 5000 publication records retrieved from the Web of Science (WOS) database that are bibliometrically related to the article "Global Value Chains Meet Innovation Systems: Are There Learning Opportunities for Developing Countries?" by Pietrobelli and Rabellotti (2011).[2] In that paper, the authors conduct an extensive but only qualitative review of the literature in which they identify key similarities in the two traditions. It was the first major article to bring together the two strands of literature explicitly. Thereby it contains references to both traditions.[3] Our corpus includes literature which is published both before and after the seed paper and is not based on an analysis of papers that cite it directly (Figure 1). Our 'snowballing' approach to corpus building (depicted in Figure 1) finds research that goes beyond the two focal traditions, as any article (up to the 5000 bound) that shares citations with the core paper will be included in the corpus. Given the type of analysis and the research interest, that is an advantage, as it provides the opportunity to set the two streams of literature in relation to other related traditions.

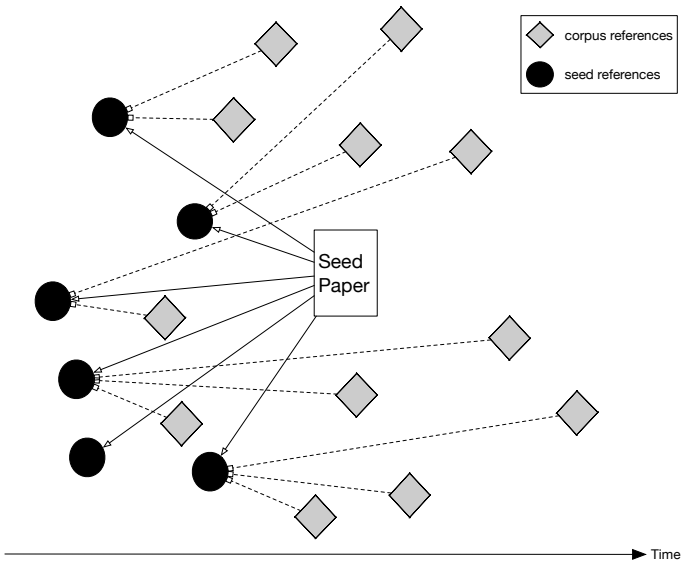


Figure 1: Bibliometric sourcing strategy

Out of these 5000 articles, approximately 25% of the articles lie outside social science and these are disregarded in the analysis. Our analysis is thus based on a subset (the operational corpus) which comprise about 75% of the initial corpus. We proceed with the operational corpus in two steps.

First, we identify seven clusters based on bibliographic coupling (Corpus 1). We apply the clustering to the citation network with the intention of agglomerating research that shares a relatively high number of references. Having identified the different communities that represent discussions and sub-discussions, we use descriptive analysis to understand their content and how they relate to each other. Notably, the identification of core references within delineated communities, central keywords – extracted from abstracts – and spatial descriptors such as country names helped us to unveil the communities.

Second, we focus on the specific subset of the corpus, consisting of a little over 250 papers, which are centred on developing countries (Corpus 2). We thus screened all records for mentions of developing countries, i.e. low to middle-income countries in the World Bank classification.[4] Table 1 presents the relative size of these seven communities in both steps.

Table 1: Clusters in the corpus

	Clusters	Corpus 1 (All)	Corpus 2 (Developing countries)
1	National innovation Systems	13.13%	0.81%
2	Technological Innovation Systems	9.83%	1.02%
3	Innovation Systems and Geography	13.59%	0.37%
4	International Trade and FDI	20.21%	1.18%
5	Supply Chains, Interaction and Trust	12.46%	0.70%
6	Globalisation and Economic Development	14.50%	0.37%
7	Global Value Chains and Networks	16.27%	2.36%
	Total	100.0%	6.80%

N = 3750

Our snowballing approach to sample selection was taken to create a focused corpus. Such focus would not have been possible with a string based search query. A search for ‘Innovation System’ and ’Development’ will return a very high number of records related to innovation systems and technological evolution (development) in high-income countries – not about innovation systems in low and middle-income countries as is the focus of this paper. Also, a search for ‘Global Value Chains' excludes relevant literature on, e.g. 'Global Production Networks' or ‘Global Innovation Networks'.[5]

It is important to note, however, that the corpus is constituted exclusively by journal articles listed in WOS (not journals outside WOS, working papers, books, reports etc.). This lead to bias which

gives precedence to authors from developed countries such as US, UK and Germany which 'have a longer history in academic publishing and have more research resources (e.g., funding, infrastructures, and institutions) than smaller or developing countries' (Mongeon & Paul-Hus, 2016, p. 224). Arguably, it also creates a bias towards measurable phenomena that can be more easily transformed into quantitative analysis.

2.2 The communities and their connections

It is important to note that discussion in this section is focused on the literature which deals which developing countries. Figure 2 shows the segmentation of the network between publication in the corpus while Figure 3 highlights the subset of publications with explicit mention of developing economies in the overall network. As such, it is intended as an analysis of articles which applies the different concepts and theories to research questions and problems in developing country settings. An initial observation is that the literature specifically on developing countries constitutes a relatively small subset of the overall sample (approx. 6.8%).[6] The following overview of the delineated communities cannot discuss the different research clusters in detail, but seeks to provide a brief sketch of each to provide a platform for discussion in later sections of this article.

Figure 2: Layout and segmentation of the combined network

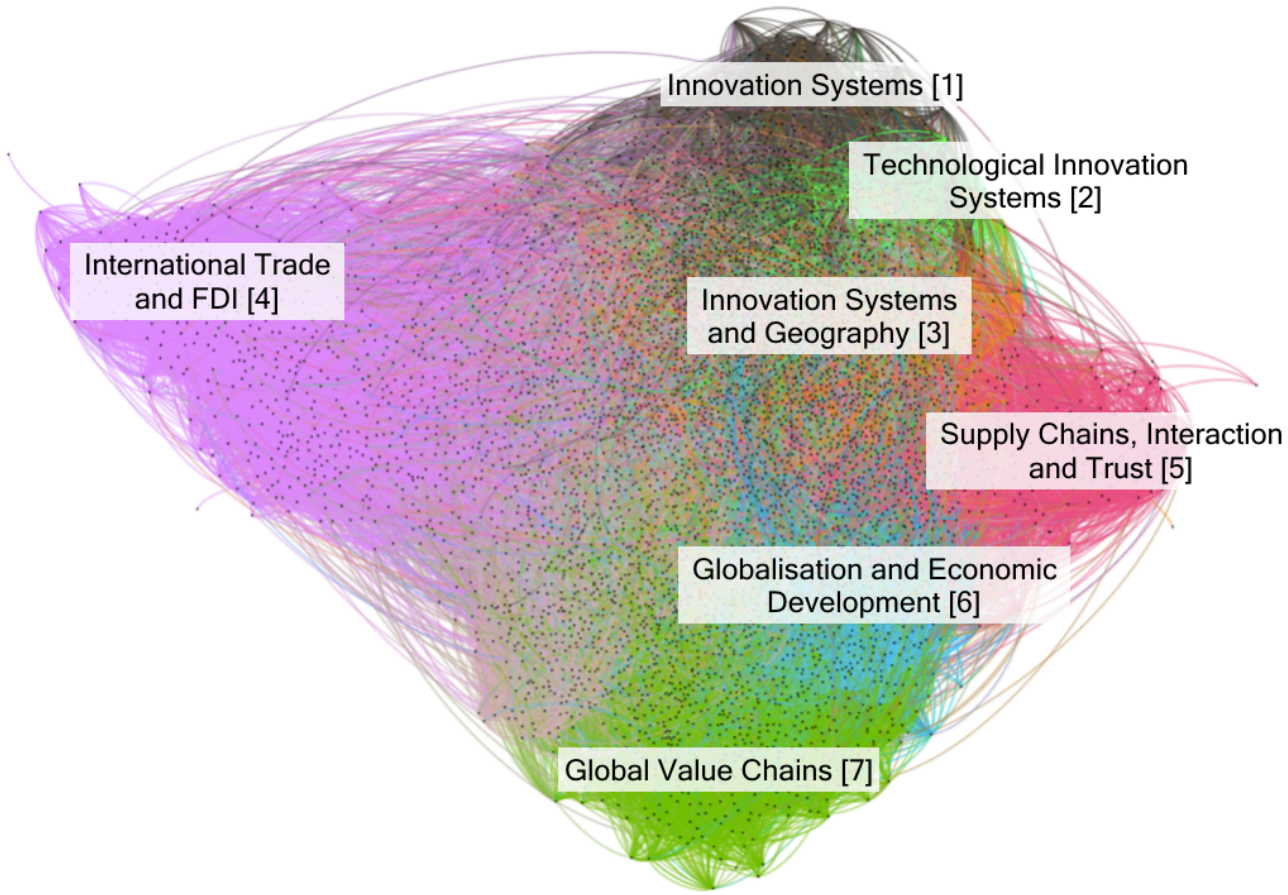
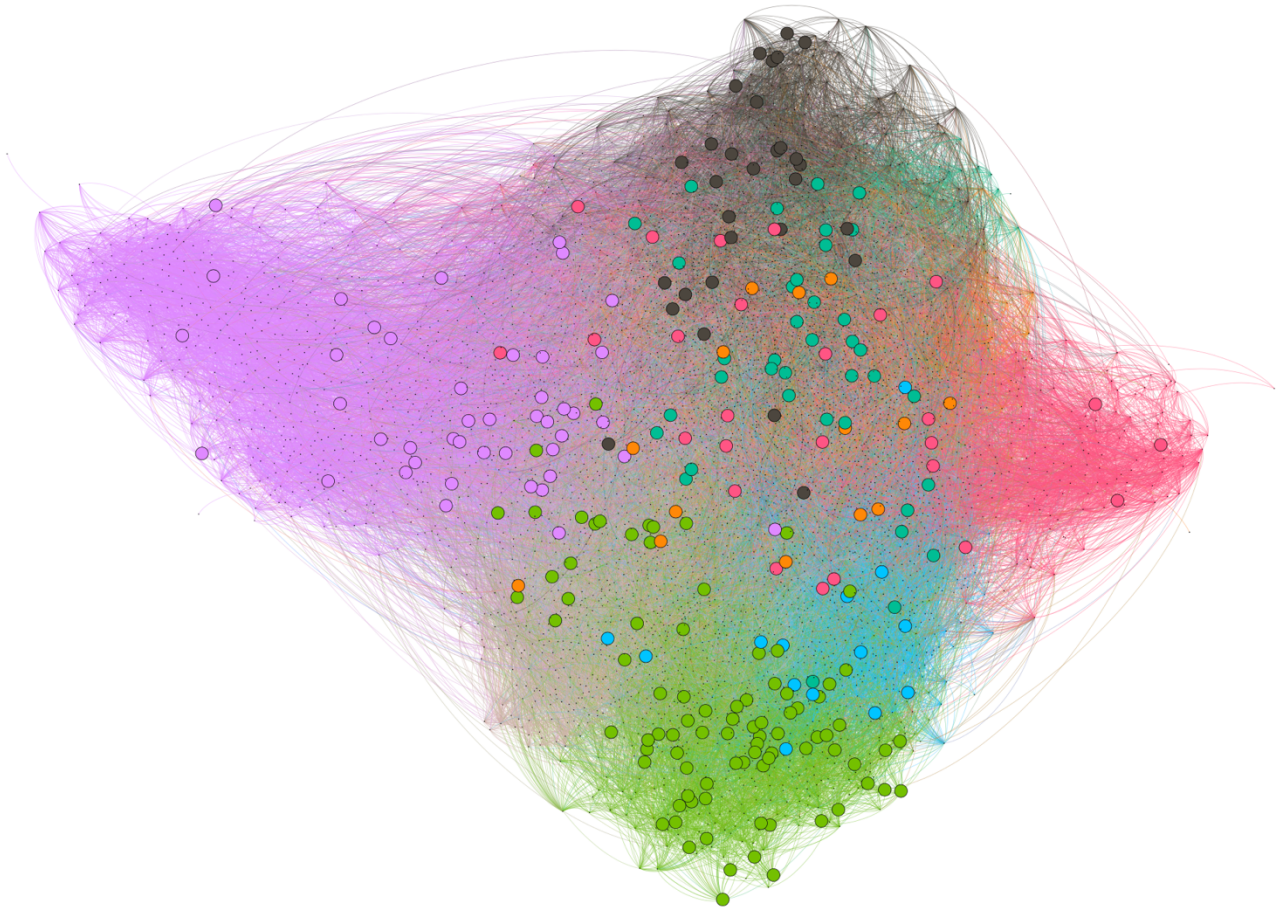


Figure 3: Publications with explicit mention of developing economies in the overall network



1. Innovation systems: This community refers to the literature in the innovation systems tradition, particularly, national innovation systems and triple helix (Etzkowitz & Leydesdorff, 2000; B.-Å. Lundvall, 1992; Nelson, 1993). In the focal literature, centred on developing countries, the top cited articles are Chang & Shih (2004), Leydesdorff & Wagner (2009) and Hong (2008). Some important observations about the focal literature are the following. First, it is concerned typical with larger, (upper) middle income countries. This can be concluded from the most central geographical entities mentioned in the abstracts of the publications. Here China and India are leading the ranking, but Latin America and East Asia are well represented. However, there are also some papers on poorer settings in sub-Saharan Africa (Kruss, Adeoti, & Nabudere, 2012). Second, the literature is focused either on 'macro' descriptions of innovation systems (Poon, Hsu, & Jeongwook, 2006), on science systems (Krishna, 2007) or, most predominantly, on university-industry linkages (UILs). In fact, most of the empirical work in the sample is quantitative and aims to examine the impact of linkages between knowledge producing organisations (often universities) and firms (e.g. Arza & López, 2011; Dutrénit, De Fuentes, & Torres, 2010; Sutz, 2003). Third the literature with more specified

domain foci are concentrated on relatively sophisticated (high-tech) technological fields and R&D, in areas such ICTs, pharmaceuticals and nanotechnology.

2. Technological innovation systems: This cluster refers to work on technological innovation systems (Bergek et al., 2008; Carlsson & Stankiewicz, 1991; Hekkert, Suurs, Negro, Kuhlmann, & Smits, 2007). This approach has developed an operational technological innovation systems functions framework, which has frequently been applied in analyses of systems in the global south and which are visible in Sample 2 (see, e.g. Tigabu et al. 2017; Binz 2016). Additional work in this cluster mainly falls in two types. The first is work focused on the development and diffusion of specific technologies, such as software (D'Costa, 2003) or biotechnology (Adeoti & Adeoti, 2005). There is a predominance of work on environmental and energy technologies such as wind turbines (Gosens & Lu, 2013), jatropha biofuels (Romijn, Raven, & de Visser, 2010) or biomass (Hansen & Ockwell, 2014). The second is work related to appropriate technology in developing countries (Hall, Bockett, Taylor, Sivamohan, & Clark, 2001; Raphael Kaplinsky, 2011). Research in this cluster tends to focus on diffusion of innovation and includes work on international technology transfer and collaboration in this regard. Many of the empirical papers in this group deal with both capacity building in the South as well as global links.

3. Innovation systems and economic geography. This literature refers to theories on the spatial dimensions of innovation systems (Asheim & Gertler, 2005; Bathelt, Malmberg, & Maskell, 2004; Boschma, 2005) and is a clearly defined sub-community of scholars working on the geography of innovation. The most cited articles in the sub-sample are explicitly focused on industrial clusters in developing countries, written by researchers in the GVC tradition who focus on learning and innovation issues in industrial, districts (Giuliani, Pietrobelli, & Rabellotti, 2005; Nadvi & Halder, 2005; Mario Davide Parrilli & Sacchetti, 2008). Common for this work is the attention given to global connectedness of industrial districts. This cluster also includes work on the globalisation of innovation. The first three communities – all at the top of the network visualisations in Figure 1 – all refer explicitly to innovation system literature and concepts in different variations. The remaining clusters starts from other fields such as supply chains, international economics, international business and development studies.

4. International Trade and foreign direct investment (FDI): On the left side of Figure 1, we find Community 4, the largest among the identified groups, containing contributions that may be attributed to more general and mainstream trade, export and FDI-related literature. The key references

are articles in (international) economics and business journals (Barba Navaretti & Venables, 2004; Melitz, 2003; Wagner, 2007). The literature specifically focused on developing countries is predominantly centred on China and India (Chaudhuri, 2012; Franco, Ray, & Ray, 2011; P. P. Li, 2007; Zhang & Zhang, 2003). The cluster contains articles focused on trade and growth (Breslin, 2004; Seyoum, 2007) and foreign direct investments of multinational enterprises (Giuliani, 2008; Saliola & Zanfei, 2009).

5. Supply Chains, interaction and trust: This community contains literature dealing with industrial organisation, the organisation of transactions between firms, specifically the configuration of supply chains. A key reference point is transaction cost theory (Williamson, 1993). The main references are, however, works on trust and interfirm relationships published in business school journals in the 1990s (Dyer & Singh, 1998; R. M. Morgan & Hunt, 1994; Sako & Helper, 1998). The work on developing countries is also published in international business and marketing journals and deals with international supply chain issues. This includes, from a South perspectives, inter-organisational relationships, firm-level learning and export performance (J. Li, Chen, & Shapiro, 2010; Matanda & Freeman, 2009), and from a North perspective, global sourcing and management of suppliers firms (Nassimbeni & Sartor, 2007).

6. Globalisation and Economic Development: The key references in this cluster are on urban regions in the global economy (K. Morgan, 1997; Storper, 1995, 1997). It combines literature exploring the role of spatial dimensions regarding globalisation, particularly cities, regions, and industrial clusters (economic geography). This literature is closely related – in terms of a shared empirical focus and per the bibliometric results – to those publications that are found in Community 3 (Innovation systems and economic geography). However, here *innovation* does not figure as explicitly as a theme, as it does in Community 3. The extracted subset explicitly focused on developing countries tends to give emphasis to critical political analysis of globalisation (Arnold & Pickles, 2011; Popescu, 2008) and global commodity chains (Brown et al., 2010; Rammohan & Sundaresan, 2003).

7. Global Value Chains and Networks: The focal references in this cluster are by Gereffi (Gereffi, 1996, 1999; Gereffi, Humphrey, & Sturgeon, 2005) other prominent authors in GVC tradition (J. Humphrey & Schmitz, 2002; R. Kaplinsky, 2000), but also authors from the global production networks community (N. M. Coe, Dicken, & Hess, 2008; Henderson, Dicken, Hess, Coe, & Yeung, 2002). This cluster is found in the lower corner of Figure 2, building a dense community. The

literature is relatively homogenous, although using different concepts such as value chains, commodity chains and production networks. Conceptual work is focused on chain governance, including issues such standards, demand requirements and financialization as well as on upgrading, including the distribution of rents, capabilities and labour conditions, including gender relations. There is predominance of 'cases' that typically are delineated by sectoral rather than geographic boundaries (Ponte & Gibbon, 2005; Raynolds, 2004), but sometimes also with a particular geographic focus on specific buyer and/or seller locations, not least in industrial clusters (Jennifer Bair & Gereffi, 2001; Lund-Thomsen & Nadvi, 2010). There is a strong focus on production (as opposed to innovation) and labour (workers in industry and farmers). Looking at the empirical cases, low-tech and simple activities such as textile manufacturing, coffee, or fresh fruit cultivation clearly dominate the landscape, indicating the presence of a gap between the IS and GVC tradition regarding the technological sophistication of activities.

2.3 Inter-community relatedness

The network visualisation in Figure 1 shows the Innovation System and Value Chains traditions appear 'far away' from each other. There are very few common reference points as for the shared citations. This finding is reinforced and even more pronounced in Figure 3 (below) that aggregates all weighted links between the identified communities into a matrix. Higher scores on the normalised 0-10 scale represent higher compound values of bibliographic coupling between the communities and thereby greater similarity between the literatures.

The visualisation of inter-community connection reaffirms that the GVC and IS literature are rather unrelated in terms of bibliometrics. In fact, with a score of 1.6, this link is the weakest among all ties between the identified communities. Figure 4 in the appendix shows that the divide also holds for most of the publications that specifically address developing geographies. It is surprising, not least given that our starting point for corpus development was an article which sought to discuss the overlap between the two (Pietrobelli & Rabellotti, 2011).

The visualisation above also suggests that GVC literature has fewer linkages to other strands of scholarship as compared to the IS tradition. The strongest connection is to the literature on globalisation and economic development. But, on average, it has a weaker connection to other communities in the corpus.

Figure 4: Relatedness between research communities

1	Innovation Systems							
2	Technological Innovation Systems	4.7						
3	Innovation Systems and Geography	9.3	4.4					
4	International Trade and FDI	6.0	2.3	4.5				
5	Supply Chains, Interaction and Trust	6.2	3.0	5.5	8.7			
6	Globalisation and Economic Development	5.8	2.4	7.8	3.7	3.2		
7	Global Value Chains	1.6	3.6	3.5	5.1	4.5	6.7	
		1	2	3	4	5	6	7
		Innovation Systems	Technological Innovation Systems	Innovation Systems and Geography	International Trade and FDI	Supply Chains, Interaction and Trust	Globalisation and Economic Development	Global Value Chains

Legend:

From	To	Colour
0	3.3	
3.4	6.6	
6.7	9.9	

A key result from this analysis is that there is markedly little interaction - as reflected by citation patterns - between scholars from the respective fields; this stands in stark contrast to the perceived usefulness of bringing the literatures together (Chaminade & Vang, 2008; Pietrobelli & Rabellotti, 2011; Schmitz & Strambach, 2009).

This paradox points to the need to follow up the bibliometric analysis with an analysis of the core literature in both traditions. Why is the link so weak? To understand how the two fields relate to each other, it is useful to study how the ideas have evolved. Reviewing the origin, development and key ideas of the respective fields, it is possible to explain why the fields, despite an overlap in

objectives and problems, diverge and remain separate as academic traditions. The next two sections provide a review of respectively the value chain and innovation system literatures.

3 The Global Value Chain approach

The global value chain approach has emerged as an important methodology and theory in many development policy agencies and multilateral institutions (Pietrobelli & Staritz, 2017). That follows more than twenty years of value chain research and the establishment of GVC research communities in universities and research institutions across the world. Core research questions addressed in this literature are: How does the character of the global value 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. That leads to the third question: Does the integration of local firms into global chains contribute to economic development in developing countries?

3.1 Origins

The global value chain approach has roots in the world system perspective (J Bair, 2005). The main theoretical references in the initial formulations (Gereffi, 1994) were to respectively Immanuel Wallerstein's contribution on the world system and global commodity chains (Wallerstein, 1980) and Michael Porter's work on competition and innovation (Porter, 1987). One significant contribution to this field of research was the edited book by Gereffi & Korzeniewic (1994), criticising the traditional focus of development studies on the nation-state and industrialisation as being equal to development. It is argued that the focus on global value chains may serve as a correction to these forms of bias. One important analytical step taken was Gereffi's distinction between producer driven and buyer-driven value chains. This established the beginning of the discourse on 'governance'.

3.2 Key concepts

The 'value chain' refers to 'the full range of activities that firms and workers do to bring a product from its conception to its end use and beyond' and the literature centres on value chains that are divided among multiple firms and spread across geographic space.

The two most significant and interlinked conceptual advances made by the GVC literature are on respectively 'governance' and 'upgrading'. The early governance taxonomy of buyer-driven and producer-driven value chains from the 1990s has been subsequently expanded and refocused by Humphrey & Schmitz (2002). Gereffi et al. (2005) propose five different modes of governance: *Hierarchy*, *Captive*, *Relational*, *Modular* and *Market*. It is assumed that the further down we get on this list the less is the element of dominance. The second key conceptual advance of the literature is that of 'upgrading'. Initially upgrading was seen only as 'moving up the value chain' (Gereffi, 1999). But Humphrey & Schmitz (2002) introduced some of the fundamental concepts that have shaped the value chain discourse onwards. It draws on Schumpeterian heritage and makes the distinction between four forms of industrial upgrading: (1) process upgrading, (2) product upgrading, (3) functional upgrading, resembling the initial general concept and (4) inter-chain upgrading.

Against the backdrop of innovation literature, the third form of upgrading (moving up the value chain) is of particular interest. It has a specific connotation and great strategic importance, for instance even when companies succeed in developing new products and more efficient processes, they will gain little if they remain a supplier without access to R&D or end-user markets. Recently, the upgrading concept has been criticised within the GVC community. The critique targets mainly two points: First, that the assumption that an upgrading path exists may be unrealistic, especially when addressing functional upgrading (Tokatli, 2013). Second, in many cases, various forms of downgrading play a significant role when companies join GVCs (Blažek, 2016). In the context of developing countries, the concept of social upgrading (Barrientos, Gereffi, & Pickles, 2016; Barrientos, Gereffi, & Rossi, 2011) has been proposed to capture labour condition improvements.

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 organising the activities in the chain. One central assumption is that multinational companies 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' – with some types of governance supposedly giving more opportunities for upgrading than others.

While most of the GVC literature's concepts and insights relate to the vertical dimension, i.e. the attributes of the chain setup, the processes of joining chains and upgrading are to some embedded in and shaped by their institutional and spatial context. In a recent review paper on GVCs and cluster

studies, Gereffi & Lee (2016) argue that despite the ongoing dialogue between the GVC and cluster literature there is a lack of understanding of the interplay between GVCs and industrial clusters in developing clusters. The authors also emphasise the differences in the level of analysis when comparing the two traditions. While cluster scholars tend to focus on horizontal governance dimensions such as those present in inter-firm learning within specific areas, GVC scholars explore vertical governance structures and conditions that influence the diffusion of global standards along these. Related literatures, focused on the concepts of global production networks (Neil M Coe, Hess, Yeung, Dicken, & Henderson, 2004; Ernst & Kim, 2002; Yeung & Coe, 2015) and global innovation networks (M.D. Parrilli, Nadvi, & Yeung, 2013) go further by making the embeddedness of such networks an explicit part of the theoretical framework. As such they have tended to give more analytical emphasis to the role of institutional frameworks in shaping linkage formation and inter-firm dynamics. Arguably, this literature provides a closer connection to this dimension of innovation system research.

4 The Innovation System Approach

A body of work focusing on the role of regional and national systems of innovation in developing countries has emerged over the last 10-15 years (Chaminade & Vang, 2008; Fu, Pietrobelli, & Soete, 2011; Intarakumnerd, Chairatana, & Tangchitpiboon, 2002; Bengt-Ake Lundvall et al., 2009). The concept has also witnessed proliferation in development agencies, not least in discussion about how such systems can foster inclusive and sustainable innovation (e.g. Chataway et al. 2014; Lema et al. 2015) or in relation to sectoral development in areas such as health or natural resources (Andersen et al., 2015; Hanlin & Andersen, 2016). The innovation and development community using the innovation system concept has now become well-established although it is still relatively young. Key questions addressed include the following: What is the nature and characteristics of innovation systems in developing countries? Where systems are weak or fragmented, how can they be improved? How does innovation take place in the system? How does innovation translate into macroeconomic performance?

4.1 Origins

The concept emerged at the beginning of the 1980's in Europe with Christopher Freeman as a pioneer (Freeman, 2004 [1982]). But it was latent in the innovation studies community and elsewhere

until when the concept became more widely spread at the end of the 1980s. At OECD, the concept national science system came into use at 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. Systematic efforts to develop the theoretical foundation of the concept came later (Charles Edquist, 1997; B.-Å. Lundvall, 1992).

There has been a different 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 & Orsenigo (1996) and presented in Malerba (2002). One of the arguments for focusing on 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 sectors that are driven by new entrepreneurial initiatives and sectors dominated by major incumbent corporations. This resonates closely with the GVC approach.[7]

4.2 Key concepts

Some scholars tend to operate with more narrow versions of systems that refer to the national knowledge infrastructure and 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 found in Freeman (1987) and Lundvall (1988). 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 (B.-Å. Lundvall, 1992)

Narrow versions tend to give special attention to hi-tech sectors such as pharmaceuticals and information technology, as observed in many empirical studies in community 1 in the bibliometric analysis. When it comes to economic development, the focus is on 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'.

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 critical to 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, organisation patterns of firms as well as education and labour market institutions that shape human competencies and patterns of social interaction are therefore seen as shaping innovation activities.

The narrow definition may be of limited relevance for developing countries, where few 'new to the world' innovations arise out of the science system. Martin Bell has consistently criticised the narrow view of innovation by emphasising the close connection between production and innovation capabilities and provided useful analytical frameworks for investigating (the formation) of capabilities in the grey area in between activities that are 'producing' and 'using' knowledge (Bell, 2009; Bell & Figueiredo, 2012). The emphasis is, however, mainly on individual enterprises. The wider definition of national systems emphasises the role of absorptive capacity embedded in broader institutional structures which are crucial for how firms can benefit from integration into production and innovation activities in global value chains (B.-Å. Lundvall, 2007). Further research is needed, however, in laying out the particular issues faced by developing countries in building relevant (inclusive) national systems of innovation in less developed countries (Adebowale, Diyamett, Lema, & Oyelaran-Oyeyinka, 2014; Altenburg, 2009; B.-Å. Lundvall & Lema, 2014).

5 Competing or complementary approaches?

The two approaches to economic development have evolved in parallel but with very limited interaction as reflected in shared references and their application to empirical work in developing countries. Essentially, the main point in global value chain analysis is that more and more transactions take place internationally and that for a development country firm (or a cluster of firms) it may prove helpful to join a global value chain to upgrade its activities. It pays specific attention to the challenges and opportunities for upgrading and how these are structured by the power of lead firms and broader patterns of governance which shape interaction in the chain. The main point in innovation system analysis is, first, that companies need to build in-house capacity to absorb knowledge from the outside, including from abroad, and, second, that national context matters for how they can do that. In our view, both are relevant observations that need to be considered by the enterprises and by national governments that design policies and institutions.

The approaches are therefore relevant to think about in conjunction, from a policy perspective. But they are also complimentary from an analytical viewpoint. As discussed in greater detail below,

each has a different unit of analysis, emphasis and methodological strength and weakness. In that sense, they are complementary. On the one hand, this makes a clear case for combining the two approaches. On the other hand, there may be a trade-off since all-encompassing theories may become analytically diluted.

But there is a middle ground where research is problem-oriented and where elements from different theories are combined, depending on the nature of the research question. This is demonstrated by research that departs from a technological or geographical delineation (see 2.2), acknowledging the role of national policies as a determinant for competence building in companies as well as to some extent the character of global interaction. The two research communities can learn from each other by engaging in joint research projects utilising the strengths of each approach. In the remainder of this paper, we use insights from the bibliometric analysis and the review of the literature to help provide a foundation for research that takes inspiration from the two strands of literature.

We proceed as follows. We start by providing some suggestions as to how synthetic research can be built. We do so based on a comparison of the two approaches along seven dimensions. We then address two specific dimensions in more detail – methodology and policy – because we see these two dimensions as the most interesting and challenging elements when it comes to combining GVC and NIS theory. Last, we end the paper with some final remarks about future research which draws on these approaches.

5.1 Distinctive features and connections

Table 2 provides a comparison of the two approaches. The comparison is simplified and seeks to boil down the essence, rather than to account for the variations noted in earlier sections. The account below of the seven dimensions aims to identify distinctiveness as well as connections between the two literatures.

Table 2 Comparison of the two approaches

	Global value chains	**National innovation systems**

Unit of Analysis	Relationships and exchange of goods and services between buyers and suppliers in the global economy.	Relationships within and between firms, institutions, and socioeconomic structures at the national level
Dimensions of variability	• Value chain governance • Corporate power • Upgrading	• Coherence/fragmentation of the system • Science-based and experienced-based learning • Rate and direction of innovation
Level of technological / activity sophistication (in empirical cases)	• Mainly simple manufacturing (e.g. textiles) • Use of (technological) capital goods	• Middle and high-tech • Focus on the creation and diffusion of technology
Acquisition of capabilities	Learning from lead firms and buyers	Local interactive learning
Policy focus	Joining and upgrading in global value chains	Building and strengthening innovation systems
Methodological approach	• Case studies • International trade statistics	• Community innovation surveys • Analyses using indicators such as patents, R&D • Case studies
Disciplinary foundation	Economic sociology	Evolutionary economics

Unit of Analysis: The literatures are complementary in the sense that they focus on different units of analysis. Even when NIS research operates with open systems, the focus is upon the performance of national economies whereas GVC research has its focus on verticals of production that transcend national boundaries. NIS research also gives explicit attention to the role of institutions, something which is not central to the GVC approach (Gereffi, 1996; Gereffi et al., 2005). Yet, both approaches have in common that they are inherently relational. Synthesis research has the challenge of disentangling the relationships that matter (regardless of their loci) while avoiding excessive

complexity. At the same time, such research would focus not only on features intrinsic to the relationship (relative capabilities and features of the interaction itself) but also exogenous factors such as the national and international institutions that influence the relationship and its outcomes.

Dimensions of variability: Both approaches are relational, but GVC research tends to focus on the dyadic corporate relationship and their aggregations at the sectoral level, whereas NIS research includes a wider multitude of relationships that make up the system. This means that the former has also been able to conceptualise a diversity of governance forms and pay attention to the role of unequal power relationships. NIS research focuses on the relative coherence of the system but does not (yet) provide established typologies of different forms of systemic relationship in developing countries; as mentioned it has tended to work on the assumption of equal exchanges. GVC literature, on the other hand, emphasizes upgrading, but despite its Schumpeterian grounding, the process of upgrading is weakly theorised (Bell & Albu, 1999). The difference between upgrading and innovation appears largely semantic (see Morrison et al. (2008) for a discussion) but synthesis research can seek to further develop the conceptualisation of the *process*, including its multitude of sources such as science and experience-based learning.

Level of technological/activity sophistication: The analysis in section 2 showed that the NIS literature tended to focus on technology in general, e.g. on aggregate R&D investment or knowledge production or university-industry interaction. In principle, the NIS approach would allow for a broad perspective regarding technological focus. Yet, most of the empirical studies carried out in a developing context which has a specified technology focus tend to address high-tech industries such as ICTs or nanotechnology[8]. Articles investigate the development or diffusion of certain technologies because of linkagesin the science system. This stands in contrast to the low level of technological and activity sophistication in GVC research on developing countries where there is a predominance of 'low-tech' sectors, e.g. textiles or furniture that may have weaker connections to the science system and depend more on 'doing, using and interacting' forms of learning. Synthesis research will need to find a middle ground, exploring technological contexts where GVC interaction takes place, and there is potential for competence building, supported by national policies and interaction. The bibliometric analysis points to the work of authors that were taking a technological focus as a potentially fruitful inspiration for the selection of empirical cases.

Acquisition of capabilities: It follows directly that the GVC-focus on learning from lead firms and buyers (Schmitz & Knorringa, 2000) will often be too narrow for wider questions about industrial development. On the other hand, GVC literature may offer insights to the innovation literature about this specific form of learning and the role of 'user-driven' innovation in a low-income economy context. More broadly, however, synthesis research can use the concept of *interactive learning* as core foundation – examine such learning in both local and transnational linkages while keeping into account the constraints to learning arising from power relationship, institutions and socio-economic structures.

Policy focus: Given the differences in focus and emphasis noted above, the two approaches have tended to differ in suggested prescriptive measures which can be encapsulated by strategies of 'joining global value chains' with rather narrow export promotion schemes as opposed to 'building development' by means of strengthening domestic systems interaction and industrial policy (Lauridsen 2017). The need to address national policy and capacity building in conjunction with (sometimes careful and selective) world-market integration is discussed further below.

Methodological approach: Given their different starting points, it is not surprising that the methodological approaches of GVC and NIS research differ considerably. The global value chain literature was initiated by sociologists and scholars from political economy perspectives. However, it has also received considerable attention by heterodox economists (Kaplinsky 2000). The core of the literature was devised explicitly to overcome limitations of methodological nationalism, and GVC research is dominated by cross-national sectoral case studies, but quantitative studies have been increasing in recent years, particularly in institutions such as the World Bank, UNIDO and OECD. The innovation system literature has typically had a stronger foundation in quantitative approaches. Yet, the work focused on innovation systems in developing countries has also made extensive use of country-level case studies. Standard metrics such as patent data and R&D expenditure are often unavailable or patchy and have proven to be less relevant for measuring innovation in developing countries. Efforts toward collecting innovation data in developing countries, such as community innovation surveys, have only been initiated within the last ten years or so.

Disciplinary foundation: Both are socio-economic, and both are multi-disciplinary. The innovation system approach was started by economists and moved from a criticism of standard economics to

the integration of institutions and organisations in the analysis. The global value chain approach started from sociology and integrated elements from industrial organisation, development economics and transaction cost theory.

5.2 Research methodologies used in the two fields of research

While there are efforts at improving the empirical foundation with new and better data sources in both schools (see above), there is little research which has made full use of improvements in both fields. Insights relevant to the overlap between the two literatures still come mainly from case-based comparative work. When Malerba & Nelson (2011) studied 'catching-up' in six sectoral innovation systems, they found that industries differ regarding 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, semiconductors and agro-food) multinationals operated as customer lead firms in global value chains. But again, to explain success and failure in catching-up – a concept close to the upgrading of the national industry – it was necessary to link the analysis of sector characteristics to the analysis of the national innovation system.

The paper by Giuliani et al. (2005) is interesting since it attempts to present a picture of local vs global interaction in Latin America on the basis of no less than 40 case studies. They conclude that you find elements of 'collective efficiency' – i.e. the competitive advantage derived from local external economies and joint action (Schmitz, 1999) – in most clusters while the form it takes depends on the sector as well as the regional and national context. They also confirm that to explain how integration in global value chains affect upgrading in the firm you need to consider the characteristics of regional and national systems of innovation and the firm's own effort to engage in capacity building.

But the analysis of a wider set of cluster developments or sectorial 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, little is known about the degree to which this contributes to economic and social upgrading at the national level. Cluster and sector studies provide valuable insights, but there is a strong argument for combining different methods to make it possible to establish links from micro- and meso-levels to what happens at the national level.

Milberg & Winkler (2010) use national aggregate data on exports, value added and employment for 40 developing countries to analyse the possible link between joining global value chains (exporting) and economic and social upgrading for the period 1980-2006. 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 an indicator they found upgrading only in 9 of the 40 countries while 'downgrading' characterised the 31 other countries. As an explanation, they refer to the explosive growth in the employment in export zones and the related fact that the import prices to the US of many of the commodities that the global value chain approach focuses upon having fallen drastically over the period.

This means that there is a need to study exclusion as well as inclusion in value chains and to explore the phenomenon of downgrading as well as upgrading (Gereffi, 2014). A major challenge is to develop methods that help to disentangle the consequences of the insertion in the global economic system for low and middle-income countries and the conditions that produce differentiated outcomes. This will require that the research in the overlap between global value chain and innovation system analysis strengthens quantitative research using input-output analysis and trade data as well as data on capabilities and institutional strength of national low and middle-income economies while also considering the role of (often lop-sided) global rules and institutions.

5.3 Implications for policy

Both approaches have developed in academic institutions, but have managed to diffuse to policy circles, in national governments and multilateral institutions such as the World Bank and ILO. Both have had a significant influence on thinking about industrial policy in developing countries in the context of economic globalisation. Innovation systems approaches have been an important part of a theoretical foundation for a new economic policy which emphasises capabilities and structural transformation (e.g. Cimoli et al. 2009). Often policy makers and international organisations have adopted the narrow version of the concept so that it becomes more compatible with mainstream economics.

The global value chain insights about current economic globalisation have been used to emphasise difficulties of traditional economic policy as increasing fragmentation and decentralisation makes production more footloose and challenging to regulate (Whittaker, Zhu, Sturgeon, Tsai, & Okita, 2010). GVC scholars have also questioned inflated expectations of what soft and captive

governments can do (Altenburg, 2009). But as noted by Lauridsen, global value chain perspectives have now permeated the research and policy agenda of international economic organisations "with the message of ‘joining global value chains' rather than ‘building development' by means of industrial policy" (Lauridsen 2017). The approach has been adopted by leading donor agencies as a disguise for ‘recycling fruitless orthodox policy advice' (Ibid; see also Neilson 2014; Fernández 2015).

Although emerging originally out of world systems theory and focusing on extraction and shifting of economic value from the peripheral to advanced economies, the GVC approach has become a clearly export optimistic approach. But simple forms of export are unlikely on their own to ‘develop neither the institutions, nor the know-how, nor the consumer markets needed to create and sustain entire industries’; hence the key challenge for GVCs research is precisely ‘to identify the conditions under which developing as well as developed countries and firms can ‘climb the value chain’ (Gereffi 2014: 18).

Although a major area in GVC research is about interventions and pressure points that allow for a change in value chains to facilitate economic and social upgrading, many GVC scholars tend to observe changes in policy rather than prescribe them. But a group of GVC researchers, referred to by Morrison et al. (2008) as the industrial development schools within GVC research differs in this respect. For example, Humphrey & Schmitz (2002) demonstrated how the cluster formation could give rise to ‘collective efficiency’ rooted in trust, informal collaboration and cooperative institutions, often supported by government policies. These studies also demonstrated how the links to foreign buyers made it harder to develop further and exploit ‘collective efficiency’. These researchers tended to favour a mixed perspective where local capacity building and national policies are seen as necessary for successful integration into global value chains (Altenburg et al., 2008; Lema, Quadros, & Schmitz, 2015; Pietrobelli & Rabellotti, 2011).

Lauridsen refers to such perspectives as updated GVC scholarship that is sensitive to industrial policy and which shares common ground and is complementary with scholars focused on innovation systems, technological capabilities and structural transformation: “By developing the meeting points further [...] the research frontier can be moved forward” (Lauridsen 2017:28). The final section of the paper provides some remarks about opportunities and challenges for doing so.

6 Final remarks: Moving towards a research agenda

It is evident that economic development will depend both upon the strategies of firms that are internationally interconnected and upon the characteristics of institutions and government interventions at the regional and national level. Policymakers engage in programs to promote industrial development in developing countries tend to give different weight to strengthening national, sectoral and local systems of innovation on the one hand and integration in value chains on the other, but most of them combine the two perspectives in their practice. The scholarly divisions in academic circles are not reproduced in the policy community. The primary purpose of this exercise was therefore to stimulate a reflection on how the two knowledge fields can be combined to overcome limitations in their respective perspectives on economic development.

Are there national governments that have been especially keen to simultaneously draw lessons from the two perspectives and did it result in successful outcomes? We hypothesise that governments of successful catch-up countries, e.g. South Korea and China have acted by considering both the need to build strong national innovation systems and the need to engage in upgrading in global value chains. 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. There are intricate (but dynamic) points of balance between the type and degree of value chain insertion and domestic strength of the innovation system. In some countries, a high degree of value chain insertion may not be conducive because of weaknesses of absorptive capacity while in others, more openness combined with an active policy may be a way to support the process of industrial development and catching up.

This type of hypothesis cannot be examined without conceptual and methodological innovations. 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. But as addressed in this article, such a new combination is not straightforward. How can new research relate firms' interactive learning that takes place at the numerous interfaces to the aggregate concept of vertically segmented value chains and lead firms which exert influence over learning and capability building in far-off parts of the chain? Conversely, how can it introduce the full complexity of learning at a multitude of interfaces without losing theoretical clarity? These are difficult questions that still need to be tackled. The difficulty is because there is still no firmly established research community specifically focused on innovation and development, as was shown in the bibliometric analysis discussed in section 2. And

there is a marked ‘cognitive gap' between the communities – as reflected in the rather limited degree of citation overlap – that needs to be bridged.

Our suggestion is to move in the direction of research programmes which are question-driven and conceptually innovative and open. The analysis in this paper leads us to believe that it requires that such new research opens up national system analysis and puts stronger emphasis upon how their integration in global chains conditions processes of industrial development and catching up. Such research should also address questions about 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. It should give explicit attention to hierarchy and power relations in the analysis of domestic and transnational interactive learning. Conversely, it should analyse the dynamics of value chains as processes of interactive learning, linking firm and system level capabilities and absorptive capacity to the analysis of technological learning within value chains. We believe that such research has the potential to deepen our grasp of system-chain interaction and provide policy-relevant knowledge about potentials and pitfalls of industrial development strategies in an increasingly integrated and knowledge-based global economy.

7 Notes

[1] For value chain research, the opposite is true, i.e. there is now a considerable variety of work on GVCs which is focused on advanced economies (Beugelsdijk, Pedersen, & Petersen, 2009; Chiarvesio, Di Maria, & Micelli, 2010). It is originated as a body of research concerned with developing countries but has now become a theory aiming for wider applicability. As such, it has gone in the 'opposite' direction of the innovation system approach which started as an OECD country theory, but which has more recently sought to address developing country problems.

[2] The database utilises an internal measure of relatedness that – similar to the measures that we use in this article – is based on bibliographic coupling, i.e. when two works reference a shared third publication in their bibliographies.

[3] In this paper, we add to the foundational work by Pietrobelli and Rabellotti (2011) by providing quantitative analysis for identifying bibliographic connections. Other papers which brought these literatures together include Lema (2006), Altenburg et al. (2008) and Schmitz & Strambach (2009).

[4] A detailed description of the used methods can be found in the longer version of this paper see http://www.xxx.xxx.xx (link to the working paper version).

[5] In an earlier version of this article (B. A. Lundvall, Jurowetzki, & Lema, 2015) we used a string based query approach as described above and relied on a smaller dataset. The analysis presented in the current version was able to identify more nuanced relationships between the traditions and put both, GVC and development-related IS publications, into a broader context.

[6] A second observation is that even within this subset most of the registered contributions are authored by scholars with affiliations in the US (28% for the GVC group and 24% for the NIS group) or Europe (52% for the GVC group and 20% for the NIS group). As mentioned, the character of the database – as constituted by journal articles from journals registered in WOS – gives a systematic bias in terms of giving less weight to research on development by scholars from the South. Through our participation in the Globelics network (www.globelics.org) we are aware of many important research projects on innovation and development as well as trade and development by scholars in Latin America, Asia and Africa often not reflected in journal publications (Cassiolato, Lastres, & Maciel, 2003; Kraemer-Mbula, Wamae, & others, 2010; Lee, 2005).

[7] Some of the antecedents of the NIS approach have close connections to the global value chain literature. Lundvall (1985) analysed the interaction between producers and professional users. It started with a notion of the 'organised market' as an intermediate form between markets and hierarchies. It also made a distinction between producer and user dominated dyads, reflecting market power and technological capacity. Unbalanced relationships between users and producers tended to result in 'unsatisfactory innovation'. While the ideas on user vs producer domination and unsatisfactory innovation were integrated into the analysis, they were largely neglected by those who adopted the innovation system concept later. Therefore, most of the literature on innovation

systems has presented interactive processes as balanced, and they have tended to overlook that there are often dominating parties in the interaction.

[8] In the 30 documents clustered into the NIS group and exploring a developing country context, only 4 take a more specific focus on a particular technology. 2 of them refer to nanotechnology and 2 to ICT and related hi-tech. In the GVC community (overall 87 documents) the main focus areas are clothing and textile (35), agri-food (30), retail (3) and furniture manufacturing (3).

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