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Abstract:

This paper is the second paper in a series of three papers on **Global Value Chains (GVCs)**, developed under the auspices of the Joint Research Centre (JRC) of the European Commission. It provides a clear understanding and comparison of existing theories and methodologies for mapping value chains and offer a demonstration of the use of such methodologies in the context of S3 and strategic interventions at regional, national and cluster level. The paper provides an overview of five distinctive theoretical frameworks to global value chain research, and related to them methodologies for mapping GVCs, and analysis of patterns of industry diversification and integration. The paper highlights that mapping interconnected industry capabilities at a global scale and GVC analysis requires the use of data on the operations of multinational enterprises (MNEs). This discussion is intricately linked to the third paper in the series, which presents a new methodological approach using a bespoke database of the most innovative biopharma MNEs, describing the step-by-step procedure for building the MNE database and mapping the biopharma GVC at country, region and cluster level. Our policy recommendations are co-aligned with the existing framework - EU industrial policy: 'Towards Industrial Renaissance', Regional growth through Smart Specialisation Strategy, COSME programme for SME support, building Circular Economy for sustainable and inclusive growth, cluster internationalisation, and other relevant policy initiatives by the European Commission.

Table of contents

| | |
|---|----|
| Executive summary | 2 |
| 1. Introduction..... | 3 |
| 2. Our current knowledge of global value chains | 6 |
| 3. Theoretical underpinning of value chain analysis and mapping | 10 |
| 3.1. Strategic management theory | 10 |
| 3.1.1. Strategy driven methodologies | 13 |
| 3.2. International business theory | 14 |
| 3.2.1. International business mapping approaches | 17 |
| 3.3. International trade theory | 19 |
| 3.3.1. International trade methodologies..... | 20 |
| 3.4. Globalisation and economic development theory | 22 |
| 3.4.1. Globalisation theory driven methodologies | 24 |
| 3.5. Industrial organisation theory..... | 26 |
| 3.5.1. Industrial organisation methodologies | 28 |
| 4. Conclusions | 30 |
| 5. References | 33 |
| List of web-links to resources..... | 46 |
| List of figures..... | 48 |
| List of boxes | 49 |
| List of abbreviations | 50 |

Executive summary

Policy context

This paper is the second paper in a series of papers on Global Value Chains (GVCs), developed under the auspices of the Joint Research Centre (JRC) of the European Commission, and in particular – the thematic work by the [Smart Specialisation Platform](#). It provides a clear understanding and comparison of existing theories and methodologies for mapping value chains, and explore the use of such methodologies in the context of S3 and strategic interventions at regional, national and cluster level. Our policy recommendations are co-aligned with the existing framework - EU industrial policy: 'Towards Industrial Renaissance', Regional growth through [Smart Specialisation Strategy](#), [COSME programme for SME support](#), building [Circular Economy](#) for sustainable and inclusive growth, [cluster policies](#) such as [cluster internationalisation](#) and mobilisation of [European Strategic Cluster Partnerships](#) for smart specialisation investments, [RECONFIRM Initiative for Regional Co-Operation Networks](#), or the implementation of [regional smart specialisation strategies](#) and inter-regional cooperation under the new thematic platforms launched at the [Smart Regions conference](#).

Key conclusions

The paper provides an overview of five distinctive theoretical frameworks to global value chain research and related to them methodologies for mapping GVCs and analysis of patterns of industry diversification and integration. The paper highlights that mapping *interconnected industry capabilities* at a global scale and analysis of GVCs require the use of comprehensive data on the operations of multinational enterprises (MNEs). Extensive firm datasets enable the identification of concentration of capabilities in the form of *strategic value chain groups*, which can be used to drive networks and connectivity while building the [Circular Economy](#) at regional and national level.

Mapping GVCs can assist regions in multiple ways – from capability audit, to identifying new opportunities for growth, developing their industrial renaissance and innovation strategies, or the implementation of their smart specialisation strategy for capturing inter-regional collaborative advantage and sustainable growth.

This theoretical paper is intricately linked to the third paper in the series, which presents a new methodological approach for value chain mapping, using a bespoke dataset of the most innovative biopharma MNEs, demonstrating empirical results of interconnected capabilities at country, region and cluster level.

1. Introduction

Global value chain (GVC) is the concept that captures the accelerating process of globalisation and fragmentation of production. Numerous other terms are used in the literature to reflect on this process, referring to firm-level strategies, such as: “vertical specialisation, outsourcing, offshoring, internationalisation of production, international production sharing, disintegration of production, multistage production, intra-product specialisation, production relocation, slicing up the value chain, and international segmentation of production”¹.

GVCs are at the heart of a number of policy debates on regulation of global trade, incentives for foreign direct investment (FDI), or stimulus policy interventions for economic development. About 60 per cent of global trade, which today amounts to more than \$19 trillion, consists of trade in intermediate goods and services (or trade within GVCs) and derives from interconnected markets². The challenges of double counting of trade flows (some \$5 trillion of the \$19 trillion in global gross exports [in 2010 figures]) and of emerging policy interventions for distribution of economic gains from trade to individual economies, are recognised as most critical to address³. These are directly linked to the underlying questions of how GVCs are constituted and governed, how countries / regions / clusters participate in GVCs and upgrade their position, or how trading countries, multinational enterprises (MNEs) and entrepreneurial firms are entangled in a global market driven collaborative web of value exchange.

The fragmentation of production and the international outsourcing of tasks and dispersion of activities across countries have led to the emergence of complex and borderless production systems, driven by MNEs, where states and global corporations are entangled in complex scenarios for long-term growth. Most manufacturing exports require services for their production and almost half of value added (46 per cent) in exports is contributed by services-sector activities. Services are intrinsic part of GVCs, and yet, there is very little known about the patterns of value added in services. The overall share of services in gross exports worldwide is about 20 per cent⁴ and services are showing a growing tradability and complex interaction with all sectors of the economy⁵. The evidence points at the accelerating bundling of manufacturing and services in products and process innovation, where value added from R&D is not included in trade statistics. For emerging and technology intensive sectors R&D is a fundamental part of their trading, and yet R&D is categorised in a very rudimentary way. The overview of value chain mapping methodologies in this paper is not able to capture theoretical developments that enhance the measurement of value added from services due to limitations of the scope of this paper. The subsequent empirical paper on methodologies and cases of biopharma GVC mapping provides evidence of the contribution and integration of value added services in the biopharma global value chain⁶.

The two fundamental mapping efforts by the OECD-WTO project and the UNCTAD-Eora GVC Database - both declare their limitations in terms of countries, industries and time series⁷. They are limited also regarding the mapping of the value added from innovation, as the existing categorisations of R&D bundle across all industry sectors with little differentiation. Conceptually, R&D activities are both - part of manufacturing, and a

¹ Amador and di Mauro, 2015:14.

² UNCTAD, 2013a.

³ UNCTAD, 2013a,d,e.

⁴ UNCTAD, 2013d; and WIR, 2013.

⁵ De Backer, et al., 2015.

⁶ See Todeva and Rakhmatullin, 2016

⁷ UNCTAD, 2013d.

service, as product and process design drives the technological connectivity through value chains.

In addition, the uneven development in the global market is a challenge to policy makers, although the share in global value added trade of developing-countries has increased from 20 per cent in 1990 to 30 per cent in 2000, and over 40 per cent by 2010 – a fact largely associated with the penetration of GVCs in emerging markets⁸. At the same time, many poorer developing countries are still struggling to gain access to GVCs and global production chains beyond natural resource exports – a challenge largely addressed with the literature on GVC upgrade⁹.

It is acknowledged in the literature that GVC can explain the collapse of global trade post financial crisis of September 2008, as well as strongly becoming determinants, shaping alternative exit scenarios for the post-crisis period¹⁰. Studies of GVCs acknowledge the shortcomings and limitations of all present methodologies¹¹, including the scope of data analysis and the current trade and development policies. These studies point at the literature on GVC governance, suggesting that different types of governance (market, relational, hierarchical and captive), predetermine the location and direction of value capture and hence, lead to substantially different results, irrespective of the concentration and upgrade of capabilities.

Box 1: Drivers of value added flows

Disintegration of production, co-specialisation, re-integration of global supply, and coordination are mutually entangled in value-added flows across boundaries of firms, regions and countries.

In this context, the Smart Specialisation policy framework in Europe, called also 'knowledge for growth' strategy, was launched to address numerous challenges. The smart specialisation strategy (S3) acknowledges that a number of conditions are required, such as: effective investment in innovation; complex instruments for allocation of resources and coordinated action; interregional coordination of specialised capabilities across the European R&D space; more insight into the issues of fragmentation of production; mapping regional capabilities; pro-active GVC governance and transfer of knowledge across the public and the private domain, as well as effective monitoring of the value creation and value capture at regional level. To meet these conditions and bridge the gap between university – industry interactions at regional, national and pan-European level¹², imminent changes are proposed aiming to reconnect publicly financed R&D systems with the engines of economic growth. The main principle for smart specialisation (the entrepreneurial discovery) requires building new links between the sources of innovation and the market place, or the global value chains as drivers for growth¹³.

In the initial analysis by the European Commission that identified the main principles of *interregional comparative advantage*¹⁴, the targets for policy intervention have shifted and the focus concentrated on bridging the R&D deficit and the gap between public and

⁸ UNCTAD, 2013a.

⁹ Gereffi and Korzeniewicz (eds), 1994; Gereffi, 1999a; Kaplinsky and Morris, 2000; Kaplinsky et al., 2002; Gereffi, et al., 2005; Kaplinsky, 2010.

¹⁰ Escaith, 2009.

¹¹ Keane, 2008, 2014.

¹² European Commission COM, 2014.

¹³ Foray et al., 2009, 2012.

¹⁴ Foray et al., 2009.

private R&D, better harnessing of the innovation potential of universities and R&D organisations – to respond to the ‘Grand Challenges’, better governance and coordination of R&D policies to achieve *strategic complementarities of objectives and targets* across Europe, a new diffusion policy for the rapid adoption of key enabling technologies (KETs) across member states, the development of open, integrated and competitive European Research Area, the development and deployment of new strategic capabilities in Europe¹⁵. Subsequently, the European Commission focused its efforts on integrating a number of policy areas, such as: research policy ([Horizon 2020](#)); [innovation policy](#); [industrial renaissance policy](#) through [key enabling technologies](#) (KETs); [regional development](#) policies through [smart specialisation](#) and [SME support](#); cluster development, [collaboration](#) and [internationalisation](#) policy, [access to market](#) and demand driven economic growth. One of the key integrating components are the smart specialisation strategies at regional and country level, which have become instrumental for strategic long-term investment in R&D intensive assets, directing facilitated growth through co-specialisation¹⁶. Mapping and linking R&D capabilities and facilitating the expansion of innovation potential into commercially viable productive assets that add value on a global scale is a critical corner stone for smart specialisation in regions and countries.

Box 2: Value chains as policy targets

Research, innovation, investment and competitiveness all depend on co-alignment of policy interventions and institutional support. Smart specialisation, hence, needs inter-regional integration efforts to facilitate value-added flows across Europe.

The current work contributes to the increasing demand for knowledge on the sources and the impact of global connectivity and co-specialisation. The current paper follows from the previously conducted work on enhancing the understanding of global value chains and their analysis within the context of smart specialisation¹⁷. This complementary work provides an overview of five distinctive theoretical approaches to global value chain analysis and reviews the theoretical foundations of sequential production chains and complex networks that incorporate various stages of value added from the development, manufacturing and distribution of goods and services for final consumption. We look at some of the foundation principles for global connectivity, developed under a broad interdisciplinary umbrella of economic, business and management theories. This synthesise across the theoretical and methodological space highlights that mapping of interconnected capabilities at a global scale requires the use of data on the operations of multinational enterprises (MNEs), as well as novel methodologies for mapping strategic industry groups, industry integration and complementarity of manufacturing and service capabilities within global value chains.

¹⁵ Foray et al., 2009.

¹⁶ OECD, 2012.

¹⁷ Brennan and Rakhmatullin, 2015.

2. Our current knowledge of global value chains

A value chain describes the full range of activities that firm(s) engage in to bring a product (or a service) from its conception to its end use and beyond. This includes the entire sequence of value creation – from design, to supply with input materials, production, marketing, distribution, post-sales support for the final consumer and disposal after use activity, particularly in the context of green and sustainable growth¹⁸. The activities that comprise a value chain can be contained within a single firm or divided among different firms. They can be contained within a single geographical location, or spread over wider areas and across related and unrelated industries. Value chains from the primary sector supply value chains from the secondary manufacturing sector and beyond - to consumption services, linking industries and sectors of the economy in a complex value system.

There are two fundamental principles associated with value chains. First, this is the specialisation and division of labour between firms, and second – this is the interconnected capabilities across firms that link flows of resources and value added across boundaries. Division of labour is an old and classical concept used by economists to model optimisation of manufacturing and production process. The theory of the firm has acknowledged that internal specialisation and organisational structuring of activities within the firm enhances performance and maximises efficiency of resource utilisation.

The same notion of specialisation and organisational structuring of activities stands also in the foundations of value-chains¹⁹. In the same way as economists sought greater efficiency and maximisation of resource utilisation, strategists are now seeking optimisation of value-added processes and flows inside and across firms. Value chain theory explains the internal structuring of activities inside firms in two main dimensions – primary activities, or essential and interlinked operations that enable a firm to process inputs into outputs, and secondary activities, or organisational services that support the primary process. The value system concept refers to cross-sectoral and inter-industry connectivity in the economy, where inter-related activities and business-to-business (B2B) markets dominate the landscape.

Box 3: Value chain definition

Value chains contain fragmented, modularised activities across input-output markets, and describe interconnected industrial processes. They are typically presented as the sequence of: product (service) design, supply with input materials, production, marketing, distribution, post-sales services to consumers, and disposal after use.

The value-chain concept is an enhanced vision of the Fordist model of a conveyor belt in manufacturing, where co-specialisation and co-location enable a manufacturing firm to achieve economies of scale and economies of scope. The traditional concept of a value chain represents a modularised version of the Fordist manufacturing process based on the notion of a sequence of interconnected modularised production processes and business functions that each individually add value to the final output from a firm.

¹⁸ Kaplinski, 2000; UNIDO, 2009.

¹⁹ Porter, 1980.

The modularised processes are represented both as linear supply and distribution chains and as interconnected capabilities with reverse feedback loops of enhanced value added services and support. The linear representation of GVCs portrays upstream, midstream and downstream flows of value-added, or goods, services and payments. There is a vast pool of knowledge on the management and logistics of these flows. The upstream value chains are also researched as supply chains²⁰. Suppliers determine the cost structure of a firm production process, while the internal organisation of activities determines the specific value added generated by the firm. The input and output flows of a firm (i.e. supply and distribution / sales) represents interconnected resource flows, taking place within or outside the company. The integration of these operations and business functions is seen as a choice of senior executives to internalise or externalise value chain activities based on costs and quality considerations²¹.

Value chains, as well as operations of firms, take place within a particular industry structure and in particular economic sector. Outputs from the primary sector (extraction industry, oil drilling, mining, fishing, agriculture, forestry, or aquaculture) are expected in principle to involve labour intensive supply chains, while outputs from the secondary (manufacturing) sector include more technology intensive and high value added inputs. Construction and utilities represent special cases as they are network industries by their nature and firms' competitive advantage is determined to a greater extent by the industry structure and organisation. Business services from the tertiary sector are still seen as an essential part of the chain environment, rather than an integral part of it²². The tertiary sector comprises heterogeneous service bundled around trade, transport, public or personal services, tourism, education, insurance, business services, health care, nursing, entertainment. Services represents a strong value added component to existing product-based value chains, and as such they extend the connectivity in the economy. The exponential growth of the service sector since the 80s-90s represents both - input markets for high value added manufacturing, and support activities for all other economic sectors.

Box 4: Determinants of value chains

Value chains are determined by the production technologies, the manufacturing processes and the final products and services targeted for market realisation. Hence, value chains correspond both with market segments and product-based industry segments.

In the same way as industries are defined by specific products and market outputs, so do value chains. Value chains are categorised as: industry specific, product specific, technology specific, labour intensive, technology intensive, R&D intensive, capital intensive, energy intensive, trade intensive and value intensive²³. It is expected that value chains in primary, secondary or tertiary sectors of the economy will differ substantially. The processes in these value chains will be determined by the products / services, or by the technologies that are employed in the production process.

GVCs represent the new 21st century form of global trading, which connects countries and regions around the world in 'chains of value-added activities'. These chains are designed by multinational enterprises (MNEs) and trading companies and result from the

²⁰ UNCTAD, 2013d.

²¹ Todeva, 2006.

²² UNIDO, 2009.

²³ OECD, 2010; McKinsey, 2012.

fragmentation and internationalisation of production and operations and the globalisation of market demand²⁴. Both MNEs and trading companies as global players establish and orchestrate long-term non-market relationships with their supplier and buyers, and as such, they connect 'input markets' and 'output markets' into a vast interconnected network of contract relationships, crossing geographic and technological boundaries.

As a result of their international operations, MNEs control entirely their intra-firm trade, orchestrating trading relationships between countries, and hence, driving the global flows of goods, services, intangible knowledge and payments up-stream and downstream the value chains designed by them. Research concludes that the most favoured mode of inter-unit control in MNEs is the price mechanism under most circumstances. Inter-unit transactions are co-ordinated though by transfer-pricing mechanism, where value is determined by in-house MNE accountancy rules and decisions, and therefore is not subject to a market sanction²⁵.

For example, HP claims that they have designed and currently manage the world's Largest IT Supply Chain, worth US\$51B and comprising of 32 manufacturing plants, 88 distribution hubs, 700 suppliers, and 119 logistic partners²⁶. The literature on MNEs is hardly acknowledging their impact on the global connectivity. The sections further in this paper demonstrate details about the link between MNE capabilities and GVC, preparing the theoretical foundations for mapping GVCs.

Value chains emerge out of strategic choices by economic actors for specialisation, diversification or integration. For each product or service group the corporation makes strategic choices and decisions which activities to be performed in-house, and which parts of the chain to be externalised under the control of other firms. These decisions lead on one hand to specialisation and investment in product / service specific capabilities, and on the other – to a fragmentation of the value chain, where multiple supply chains enter and exit the firm and multiple value chains cross through the corporation at different stages²⁷.

Once these decisions are made, the corporation develops internal capabilities to deliver specialised services, as well as control mechanisms in order to manage all input and output relationships. Product / service diversification strategies determine the scope of operations and the required capabilities. Outsourcing and subcontracting are specific forms of business relationships used by the corporation in order to externalise costs and to appropriate value added from different parts of the value chain.

Value chains are product driven and technology driven as products and services are shaped by particular technologies, where in technology intensive sectors the input-output markets are orchestrated by the sequence of technology steps. The main applications for the sequence of activities and the associated capabilities are revealed at the level of a business network that is constituted by interconnected organisations within each specific supply and distribution channel (Figure 1). The input and output flows of MNEs represent interconnected resource flows that are taking place across the entire portfolio of subsidiaries and business partners.

Suppliers determine the cost structure of firm's production processes and the value of inputs, while the internal organisation of resources and activities determines the value added generated by the firm itself²⁸. This is particularly evident within the boundaries of MNEs²⁹.

²⁴ UNCTAD, 2013d.

²⁵ Hennart and Reddy, 1997; Todeva, 2006.

²⁶ Hartman et al., 2006.

²⁷ Todeva, 2006.

²⁸ Teece et al., 1997.

²⁹ Kobrin, 1991.

Value chains have multiple backward and forward (or upstream and downstream) linkages and resemble strategic alliance structures with complex logistics, pulled by the market with buyer-driven orders, and pushed by technology driven products and services³⁰. The globalisation of commodity chains has stimulated complex cross-border economies of scale and scope that have fostered a wave of strategic linkages between firms across geographic and industrial boundaries. Both concepts of supply chains and global commodity chains represent the same type of network relationship which is based on a sequence of value-added activities across input-output markets.

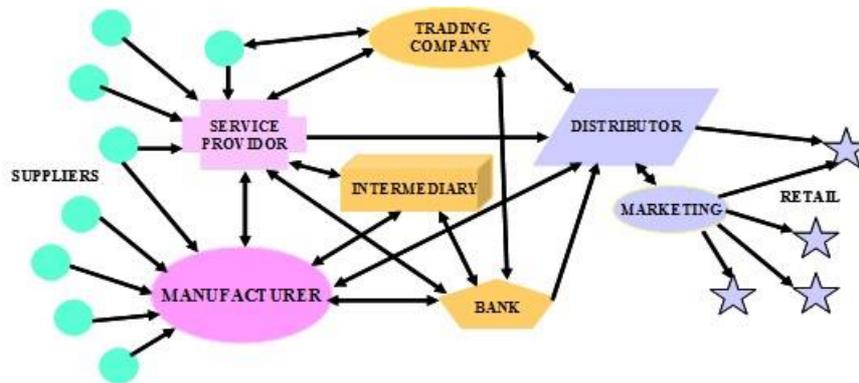


Figure 1: Global value chains, commodity chains and production networks

Source: Adopted from Todeva (2006).

Currently value chains are coordinated only across firm boundaries. Agglomeration of data in input and output tables reconstruct the chain of comparative advantage at country level, but these figures do not give a clear measure at industry level about the concentration of strategic capabilities in individual locations and individual industries. The European smart specialisation policy framework refers to a coordination mechanism, where concentration of capabilities in particular regions are leveraged across the European market space for a commercial impact. The mapping of concentration of capabilities, hence is a priority for regional policy makers and advisors, in order to support value chain linkages, extensions, and enhancement.

Box 5: Firm level value chains

Firms control value chains and coordinate value-added activities through managing their supplier networks, alliance partnerships and governance platforms for outsourcing and inbound / outbound logistics.

The current effort for regional development and smart specialisation across European regions is focused on data sharing and demand mapping³¹. This, however, does not indicate what kind of data can enable policy makers to engage in the match-making exercise, where specialised regions can facilitate value-added linkages across the European market. Although the institutional mapping is essential for building the facilitation framework, it is not sufficient to confirm presence and concentration of

³⁰ UNCTAD, 2013d.

³¹ European Cluster Observatory, 2014a, b, c.

capabilities, or to identify leading performing groups of firms. The survey methods for identifying market leaders are not capable of demonstrating critical mass in a particular sector and value added activity.

On the other hand, there are already a number of initiatives put in place at a regional level, enhancing the institutional environment for the implementation of smart specialisation strategies. A number of regions have advanced on integrating their research, innovation, and growth strategies, enhancing internal stakeholder collaboration³². Regional authorities are looking for new methods to identify capabilities in the niche specialisation areas selected for accelerated growth.

Box 6: Policy directions for integration of European value chains

Inter-regional cooperation for European value chain integration requires an actor and network approach, mapping firms, technologies, innovators, and broadly mapping innovation capabilities for smart specialisation at regional and country level.

The S3 policy framework is deeply rooted in the idea of value added specialisation. At the same time implementation methods have been largely ignorant to the mechanisms behind value added. The implementation of smart specialisation strategies and the mapping of internal stakeholders at a regional level, has been primarily driven by survey methodologies and self-reporting. This approach rarely captures the small players. It does not offer either an opportunity for measuring the impact of smart specialisation on value-added trade, or on value-chain linkages that can be pursued strategically for upgrade.

The following sections of this paper focus on the main theoretical contributions that elaborate on the mechanisms for value added, generating empirical observations and the number of efforts and analysis and mapping of global flows of value added.

3. Theoretical underpinning of value chain analysis and mapping

3.1. Strategic management theory

Strategic management theory hosts a number of theoretical perspectives that explain the formation of value chains connecting firms in input-output markets. Among these theoretical perspectives are: the resource-based view of the firm, the dynamic capabilities theory, the knowledge-based perspective, or the positioning approach and Porter's competitive forces model. The early stage of the development of the resource-based view is attributed to Penrose³³ who sees the firm as a collection of productive resources, and assumes that each firm possesses a distinctive set of competencies, specialised resources, skills, tangible and intangible assets that provide a competitive advantage in the market place, and generate a source of economic wealth. These skills and specialised resources are labelled by strategists as firm capabilities that enable firms to transform inputs into outputs. Porter value chain model in this context is the

³² Brennan and Rakhmatullin, 2015.

³³ Penrose, 1959.

analytical tool to look inside the bundle of resources and capabilities and to derive at a meaningful representation of the chain of value added activities.

The bundle of tangible and intangible resources and capabilities are discussed in the literature, including management skills, organisational processes and routines, information, knowledge, prior experience, competences, brand name, market share³⁴. Capabilities enable firms to transform inputs into outputs³⁵.

Box 7: Definition of firm capabilities

Firm capabilities are: a bundle of tangible and intangible resources, skills, organisational processes and routines, information, knowledge, prior experience, competences, patents (IP), licenses (rights), market reputation, or other resource and location advantages, that enable a firm to transform inputs into outputs for market realisation. Capabilities are a measure of HOW firms produce certain outputs and generate revenue from a particular product market, identifiable through the industry code system.

There are two specific observations about firm capabilities, which are important contributions to the value chain theory. First, this is the observation that firms contain bundles of distributed heterogeneous resources and that this heterogeneity persists over time³⁶. This means that capabilities include complementary heterogeneous resources that are required and applied in the production process. Second, this is the observation that resources and capabilities are not fixed but change over time as a result of the adaptation efforts and strategic choices made on behalf of the firm. Operations of the firm hence create dynamic capabilities³⁷. Dynamic capabilities are defined as those capabilities, by which managers build, integrate and reconfigure internal and external competencies to address rapidly changing environments³⁸.

Dynamic capabilities have been discussed in the context of R&D capabilities, product and process development, technology transfer and organisational learning, or all capabilities necessary for a GVC upgrade. Dynamic capabilities include also unique bundles of tacit and explicit knowledge³⁹.

It is acknowledged that learning takes place across the boundaries of the firm and this makes the value added process in firms driven by relationships and information flows beyond the control of the management. Resource flows and knowledge flows between firms are embedded in specific geographic locations, as well as responding to global competitive forces. In the context of MNEs, these resource flows and knowledge flows take place both across geographic and industry boundaries. The MNE as an organisational heterarchy and a complex network of subsidiary units across the globe exhibits a differentiate network of competences and capabilities that generate complementarities and synergies across vertically and horizontally integrated business system of the multinational firm. In the context of their complexity, there have been

³⁴ Barney, 1991.

³⁵ Teece, Pisano, and Shuen, 1997; Eisenhardt and Martin, 2000.

³⁶ Wernerfelt, 1984; Peteraf, 1993; Amit and Schoemaker, 1993; Helfat and Peteraf, 2003.

³⁷ Teece, Pisano, and Shuen, 1997; Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Winter, 2003.

³⁸ Teece et al., 1997, p. 516.

³⁹ Kogut and Zander, 1992; Grant, 1996.

very few research attempts to investigate their bundle of competences⁴⁰. Mapping the structure of MNE subsidiaries, hence, enables mapping the bundle of unique capabilities and resource flows both within and across geographic and industry boundaries.

Another aspect from strategy perspective is the product portfolio of the firm, which is an outcome of a complex internal process of bargaining and negotiations along the line of resources, capabilities, and strategic aims. Decisions on the product portfolio (or service portfolio) are framed by previous strategic choices related to resources, factors of production and target markets. The set of industry codes (NACE, US SIC, NAICS, ISIC, etc.), which firms declare annually as portfolio of activities, are one of the most adequate measures for their product differentiation and diversification of business operations. There is a close conceptual overlap between product markets, industry segments and organisational capabilities to service these markets. Industry codes, hence are a measure of the bundle of capabilities necessary for the production of these outputs. Industry codes are interpreted as bundle of capabilities that are necessary to produce certain outputs which subsequently can be sold to specific product market.

Box 8: Strategy perspective on value chains

Value chains from strategy perspective entail both - firm dynamic capabilities and input-output relationships, or all resource and knowledge flows that underpin the sequence of production processes and activities required to bring a product or a service to the market.

Although the measurement and evaluation of firm intangible resources and capabilities has proven extremely difficult, using outputs as a proxy for firm capabilities is a step forward. Industry codes are particularly useful indicators for measuring the specific bundles of capabilities within multinational firms.

MNE subsidiaries are known to be embedded in dynamic clusters and geographic locations that hold both competitive dynamics and comparative advantage. More recently such dynamic cluster environments are compared with open innovation ecosystems constituted of strategic groups of innovation firms. Such open environments attract further resources, generating concentration of regional capabilities, which translate into regional comparative advantage.

Overall, the local education and business context of firms represent the knowledge environment from which firms internalise their capabilities. Local or regional capabilities are culturally biased and institutionally framed by the regional knowledge and technology infrastructure. Text box 9 gives a definition for regional capabilities.

⁴⁰ Todeva, 2006.

Box 9: Definition of regional capabilities

Regional capabilities are defined as the capacity of a particular geographic location to generate *collective performance* of its industry, localised infrastructure, institutional competences and human capital by employing the local bundle of tangible and intangible resources; or by recombining technological and scientific skills, information, knowledge, organisational processes, routines, or prior experience. Regional capabilities are a measure of HOW regions transform localised endowments and reach out for distant inputs in order to produce certain level of wealth creation, or sustainable life style and prosperity for its

Concentration of capabilities in specific industry segments (i.e. corresponding with a unique NACE code) constitute strategic industry groups. Diversified firms with a common pattern of diversification exhibit interlinked positions within the value chain. Industry codes, industry group membership and geographic location hence are the main indicators of the concentration of capabilities in a region.

Box 10: Definition of industry capabilities

Industry capabilities are defined as firm activities that generate outputs in a specific industry code. These activities assume a full set of tangible and intangible resources, scientific and manufacturing skills, information, knowledge, organisational processes, routines, or prior experience, employed by the firms from that industry.

3.2. Strategy driven methodologies

Analytical practices for value-chain mapping and analysis use extensively Porter's conceptualisation for mapping of capabilities, activities, the cost-structure while identifying the sources of competitive advantage of firms⁴¹.

The application of this analytical approach involves mapping of the value added from each group of activities and the input and production costs of these activities. The internal mapping of costs and value added within the value chain is compared against the estimated production costs of competitors (competitor intelligence), or the prices of inputs in intermediate markets in order to derive an assessment of the sources of competitive advantage and identification of critical success factors within the firm in order to support strategic investment and divestment decisions⁴². The internal mapping of value added activities is replicated into an external mapping of fragmented and interconnected industry segments and industry structure, captured by the hierarchical codes of industrial classification systems.

Firms have always used suppliers (for raw materials, technology, or services) and distributors to access markets. Hence, managing supply and distribution chains are an

⁴¹ Porter, 1985.

⁴² Kogut, 1985.

essential part of firm activities and mapping these value added linkages represent how firms are connected to input and output markets. Supply networks represent upstream value chains. The midstream value chains are constituted within firms and downstream value chains are recognised as networks of wholesale and trade of intermediaries that enable final products and services to reach their customers.

Box 11: Strategic approach to value chain mapping and capability analysis

The strategy approach to value chain mapping involves analytical mapping of the sequence of activities and categorical association of value added to each distinct set of activities. Its main advantage is the simple generalised visual representation of the value chain within firm boundaries and a single product category.

The professional literature often portrays the midstream value chain as the entire value chain for a product, usually controlled by a large firm (Figure 2).

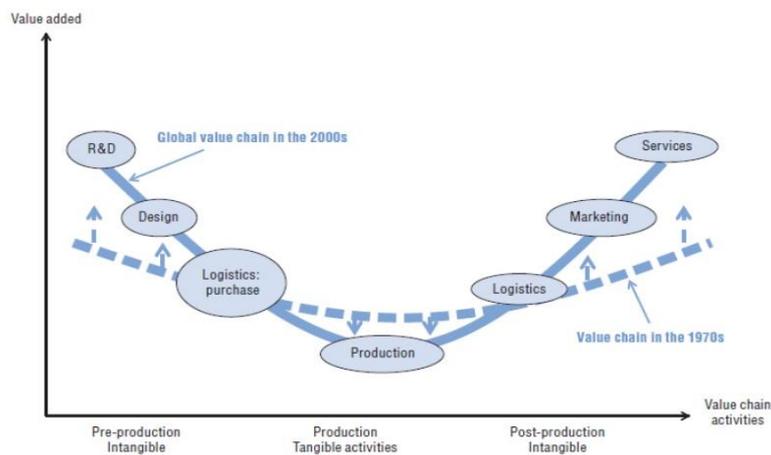


Figure 2: The chain of value added

Source: Adopted from Mudambi, 2008.

3.3. International business theory

International business theory acknowledges that the multinational enterprise (MNE) is the main vehicle for integration of fragmented production activities, and mapping the diversification portfolio of MNEs is a way of representing GVCs⁴³. The theory of the MNE acknowledges that MNEs differ widely in where they source (access to input markets) and in their sales performance (access to output markets)⁴⁴. Managing their factor costs (e.g., wages, materials, capital charges) becomes an incentive by itself for foreign market entry as input markets differ remarkably from one country to another – due to

⁴³ Bartlett, 1986; Prahalad and Doz, 1987; Jarillo and Martinez, 1990; UNCTAD, 1993; Cantwell and Mudambi, 2000, 2005; Buckley and Casson, 2009.

⁴⁴ Kogut, 1985.

different composition of comparative advantages in different locations and legal, institutional and cultural barriers to capturing such advantages.

In a multi-national context, the growth pattern of MNEs follow the framework of Bartlett⁴⁵ and Prahalad and Doz⁴⁶ in terms of global integration, local responsiveness, and global strategic co-ordination. *Integration* is related to the degree of subsidiary autonomy, and it is operationalised as intensity of flows of resources between parent and subsidiaries, and between the subsidiaries themselves. *Responsiveness* is the adaptation of the MNE to the local market and regulatory forces in its many locations that put constraints on standardisation of products and operations, and requires additional co-ordination⁴⁷. *Strategic coordination* involves the use of multiple governance forms for allocation of resources, sharing risks and benefits, and distribution of rents among multiple stakeholders.

Porter⁴⁸ defines MNE strategic co-ordination as implemented by the linkages between similar activities in different countries and/or different parts of the MNE's international network. He recognises that this form of coordination allows for accumulation and sharing of knowledge across the network that helps the MNE to gain international economies of scale, and also to shift comparative advantage between different locations. Strategic coordination in essence entails managing value-added flows and effective control of the entire global value chain.

The expansion of the operations of MNEs is through foreign direct investment (FDI), which has been a major driver of growth of GVCs, as illustrated by the close correlation between FDI stocks in countries and their GVC participation⁴⁹. Foreign capital is attracted to host countries by a number of factors, among which is: extending the portfolio of capabilities of the MNE⁵⁰. MNE capabilities, which are spread across subsidiaries around the world, include production capabilities, innovation capabilities, and market development capabilities. More recently, it is recognised that MNEs begin to target sustainable development, building unique value-capture and efficiency optimisation capabilities for sustainable growth in foreign markets. Among these new motives for MNEs and investors are seeking 'point efficiency', or location advantages based on direct market relationships. Kaplinsky develops the notion of '*systemic efficiency*', or ability to develop system type of coordination and control⁵¹. Similar concept is introduced by Pietrobelli and Rabelotti, who investigate '*collective efficiency*' as strategic advantage that arise from dynamic cluster participation⁵². These authors define the concept of 'collective efficiency' as the sum of external economies + joint actions, hence, stressing that value-added activities and interconnected operations are embedded in external context, associated with the geographic location of these activities.

MNEs internalise all parts of the value chain, often outsourcing only selected specialised services and operations. Each MNE designs its own value chain in all three dimensions of upstream, mid-stream, and downstream activities, as well as auxiliary services that support their operations. The diversification and scope of MNEs, determine how their value chain network is constituted, where individual products, services or technologies generate their own value chain and value chains intersect within the boundaries of the MNE into a value network.

⁴⁵ Bartlett, 1986.

⁴⁶ Prahalad and Doz, 1987.

⁴⁷ Jarillo and Martinez, 1990; Taggart, 1997.

⁴⁸ Porter, 1986.

⁴⁹ OECD, 2014.

⁵⁰ OECD, 2008a.

⁵¹ Kaplinsky, 2004.

⁵² Pietrobelli and Rabelotti, 2004.

MNEs resemble complex heterogeneous networks of owned and controlled units (subsidiaries, branches, joint ventures, strategic partnerships and long term contractual relations), all of which encompass distributed upstream and downstream capabilities, resource flows and governance forms with fuzzy boundaries of a hierarchical and headquarters-centred network⁵³. Distributed share-holding of units demonstrates the blurred boundaries of the MNE and is exhibited in a multi-level ownership structure and in reverse ownership (when subsidiaries and parents own shares in each other - already identified in business databases (Figure 3).

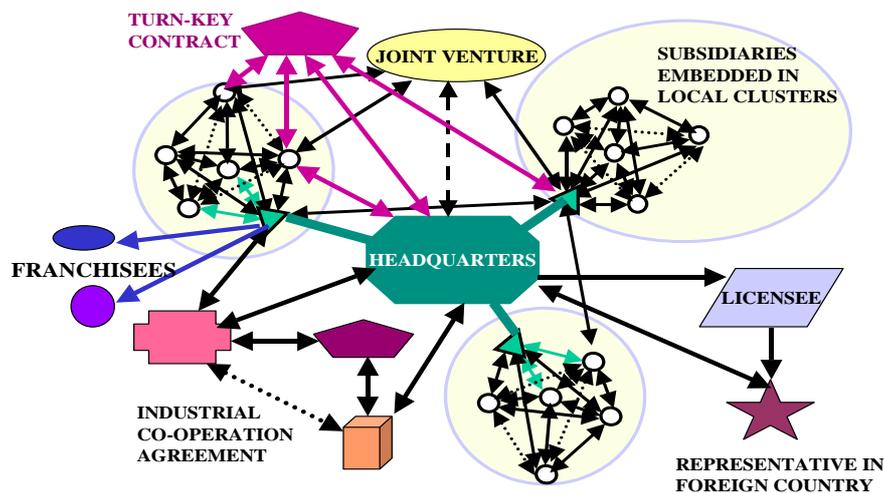


Figure 3: Business value networks of multinational enterprises

Source: Adopted from Todeva (2006)

The international business theory acknowledges also that MNEs and national governments are entangled in a close relationship aiming to affect positively the factor costs in a country (through regulation), the intensity of factor use within the value chain, and the distribution of value-added and value-capture activities between countries⁵⁴. Labour-intensive activities are expected to be located where unskilled labour is inexpensive, and capital-intensive and knowledge-intensive activities are located where capital is inexpensive and knowledge is abundant.

MNEs are highly differentiated organisations that comprise of multiple units located in different countries and embedded in different business systems and socio-political contexts. The evolution of the national firm to a multi-national corporation includes a progressive vertical integration of down-stream and up-stream operations within individual product value-chains, as well as managed diversification of the initial product/service lines. Part of this evolution is the internal structuring of units and operations, and the external positioning of these units in relation to suppliers, customers, and competitors.

Two trends in the 1980s changed the nature of these interconnected value added activities and paved the foundations of the current *dispersed manufacturing* in the shape of Global Value Chains⁵⁵. On one hand large corporations started outsourcing and subcontracting business operations to other firms in their attempt to externalise costs.

⁵³ Todeva, 2006.

⁵⁴ Kogut, 1985.

⁵⁵ Todeva, 2006.

This led to a wave of new business start-ups and spin-offs from the main corporation and a flow of resources from the corporation to its vendors and partners externally, enhancing the business opportunities for a constellation of supplier and subcontractors situated at the periphery of the focal corporation. As a result of this trend, the supply chain grew invisibly into a supply network, intertwining the corporation into long-term contract relationships with its suppliers and vendors.

On the other hand, the 80s are characterised with a wave of international expansion of activities by multinational enterprises, which involved FDI abroad in the form of green-field investments, mergers and acquisitions, establishing subsidiaries in remote locations worldwide, and transfer of low value added activities to foreign units in host countries, while building a high value added capacity at home. With the technological revolution driven by information and communication technologies (ICT), outsourcing of highly specialised operations and services to external and international vendors accelerated. In this way the value chain of international corporations stretched across geographic borders or industry boundaries and started to represent a dispersed network of interconnected activities and operations, called: 'global value chains'⁵⁶, 'global supply chains'⁵⁷, 'global commodity chains'⁵⁸, 'global production networks'⁵⁹, or 'global business networks'⁶⁰.

3.4. International business mapping approaches

The expansion of the operations of MNEs through foreign direct investment has been a major driver of growth of GVCs, as illustrated by the close correlation between FDI stocks and countries' GVC participation⁶¹. The presence of foreign affiliates is clearly an important factor influencing both imported contents in exports and participation in international production networks.

Box 12: International business perspective on global value chains

Global integration of dispersed value added activities involves new governance models that enable coordination and control across firm boundaries, and across distant geographical locations. Value added from firm activities flows in and out of companies and regions through foreign trade and foreign investment linkages, which are in the hands of multiple global stakeholders.

Recent mapping of global payments and monetary transactions has produced a unique map of inter-industry connectivity indicating some form of supply relationships (Figure 4). The pharmaceutical sector at this level of aggregation of data is well connected to health, but not connected at all to the chemical industry, from which it originates. This suggests that if there is a value added connectivity – it is internalised within an ownership structure.

⁵⁶ Kogut, 1984.

⁵⁷ Cohen et al., 1989.

⁵⁸ Gereffi, 1990.

⁵⁹ Dicken, 1998.

⁶⁰ Todeva, 2006.

⁶¹ UNCTAD, 1998.

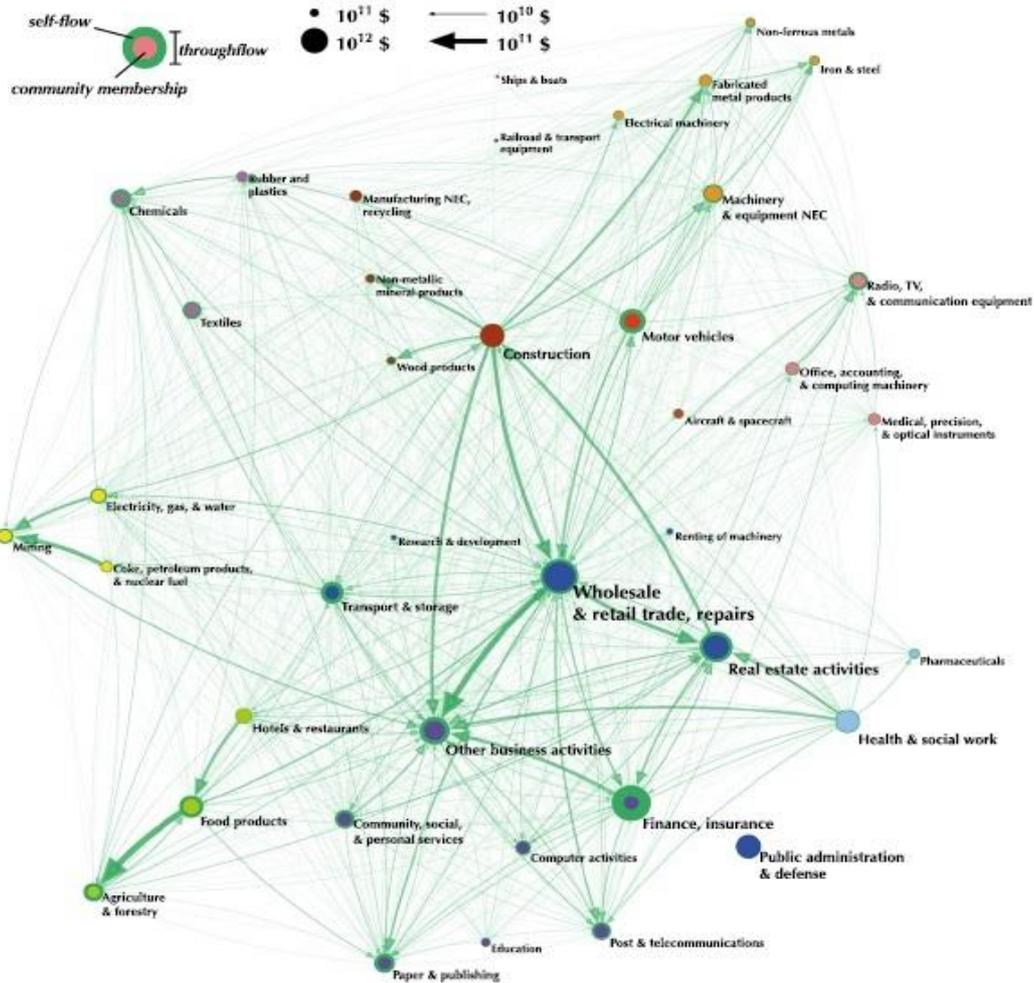


Figure 4. Inter-industry global connectivity measured through monetary flows

Source: Adopted from McNerney et al., 2013.

With reference to the ownership structure of MNEs, mapping exercises produce a visualisation of the location of different types of activities from the value chain of an MNE (Figure 5).

Box 13: International business approach to global value chains

International business scholars have adopted a pragmatic approach to mapping global value chains, representing global capital flows and global location of assets. These methodologies represent either firm-level value chains within the MNE, or aggregate level of concentration and distribution of FDI and payments.

Overall, international business research on GVCs has focused on the display the ownership structure of the MNE and to demonstrate different modes of foreign market entry, which is a useful approach when data on the constellation of suppliers, vendors, and alliance partners is available. There are, however, insufficient results of mapping the chains of ownership and resources within and across the MNEs at corporate, or industry level.



Figure 5. Nutella global value chain (Ferrero Group)

Source: Adopted from De Backer and Miroudot, 2013, p. 18.

3.5. International trade theory

International trade scholars have recognised that trading between nations represent a directed network of flow of value added⁶². Industry classifications are used to outline the hierarchical structure of value added, where outputs from one industry are inputs to another, and all firms in these two industries are involved in these input-output relationships. Input-output tables reconstruct the chain of comparative advantage at country level as a measure of the factor costs and the differences in factor intensities in the production of intermediate and final goods⁶³.

Comparative advantage of countries resembles their endowments and composition of factors of production, policies that affect the factors of production (i.e. labour, capital, resources, technology and entrepreneurship) determine the type of business activities of MNEs, or the type of intermediate and final goods and services - produced and traded. A *chain of comparative advantage* at country level reflects the differences in factor costs and the differences in factor intensities in the production of intermediate and final goods⁶⁴. A GVC, hence, is a chain of intermediate products and services, that are produced and delivered using some competitive and comparative advantage that firms in a particular location have.

Two factors prevent the clean and tidy ordering of industries along the chain of comparative advantage. These are: the factor cost of transportation and tariffs, or exchange rates, which can create strong barriers between nations⁶⁵. In addition, the more recent trade data enables alternative analysis as a proxy to mapping global value chains, which introduces new indicators at country and industry level, such as: *country participation in GVCs* (what is the share of exports involved in a vertically fragmented

⁶² Baldwin and Venables, 2010; De Backer and Miroudot, 2013.

⁶³ Deardorff, 1979; [OECD, Input-Output Tables](#).

⁶⁴ Deardorff, 1979, Kogut, 1985.

⁶⁵ Kogut, 1985.

production); *the length of GVCs* (how many production stages in the GVC process); or *the distance to final demand* (what is the position of a country in the value chain)⁶⁶.

One of the weaknesses of the international trade approach is that its theories and mapping methodologies ignore the fact that *trade between countries* takes place as *trade between firms*, and the drivers of trade flows are associated not only with countries' comparative advantage, but also with firm strategies. A firm changes its strategy in response to international competition where host country endowments are a moderating factor. But in general, firms, and in particular MNEs, develop strategies leveraging their competitive advantage in one location across their internal value chain⁶⁷. The literature confirms that the competitive advantage of a MNE can overcome the comparative disadvantage of country location. However, the stronger the location disadvantage, the more potent the competitive advantage of the firm must be⁶⁸.

Box 14: International trade perspective on value chains

International trade research of GVCs is often referred to as New trade theory, and it is criticised for omitting the 'growth' component, ignoring key sources of growth, such as product innovation, technology development, externalities and spill-over effects at firm, industry, or country level. Models are also based on the inadequate assumptions of free markets and a linear progression of the value added, where value added from R&D is not reflected in the current measures.

3.6. International trade methodologies

At present there are five initiatives to develop new data source, which is more suitable for measuring the chain of value added. These are: a) TiVA database, based on OECD / WTO national input-output tables⁶⁹, b) [UNCTAD-Eora-MRIO](#) GVC database, c) [IDE-JETRO](#) database by the Institute of Development Economics, d) [GTAP Database](#) by Purdue University (with additional data on energy, land use and international migration), and e) World [Input-Output Tables](#)⁷⁰. The analytical products from these databases are still under scrutiny. These tools are focused on measuring a country's individual positions in aggregated GVCs, without delivering a meaningful notion of input or output connectivity within the GVCs themselves.

One of the first efforts to map GVCs was the development of the input-output tables, using the International standard industrial classification (ISIC). ISIC bundles industry sectors that are hierarchically related, which demonstrates that all current estimates of the length of the value chain exclude from the analysis the entire R&D part, as well as other related services and industry segments.

The key value added trade indicators at a country level that are currently promoted are: *foreign value added in export, GVC participation, and contribution of value added trade to GDP*. A fundamental assumption remains that initial input markets are associated with the lowest value added, in spite of the wide recognition of the inverted value added

⁶⁶ De Backer and Miroudot, 2013.

⁶⁷ Kogut, 1985; Porter, 1986.

⁶⁸ Kogut, 1985.

⁶⁹ De Backer and Miroudot, 2013; OECD, [Measuring TiVA](#)

⁷⁰ OECD, [Input-Output Tables](#).

curve of the smile, where initial R&D inputs generate more value added than the subsequent manufacturing.

The international trade perspective has identified three types of trade flows ['importing to produce' (I2P), 'importing to export' (I2E) and 'value added trade' (VAT)], and two stages – trade of intermediary goods and services and trade of final products and services. The methodology is outlined in OECD publications and includes the measure 'Revealed Comparative Advantage' (RCA) as a key measure applied to industry sectors, product categories, and other structured tools for measuring export performance⁷¹.

Box 15: Shortfalls of the international trade methodologies

The main shortcomings in the new trade methodologies are widely recognised as the double counting of intermediate goods and services and the fact that the new aggregate measures conceal the actual patterns of trade and beneficiaries. In addition, these methods generate global comparisons with very large number of odd cases, which reveal further shortcomings of the measurement methodology. Further criticism is that the new indicators ignore a widely recognised fact that GVCs are governed by different types of governance, which often creates **Immiserising effects to participants**.

A new attempt to map the global trade connectivity is made by Caldarelli et al.⁷², exhibiting some deeply embedded trade relations where connectivity between countries demonstrate certain level of strength in trade preference (Figure 6).

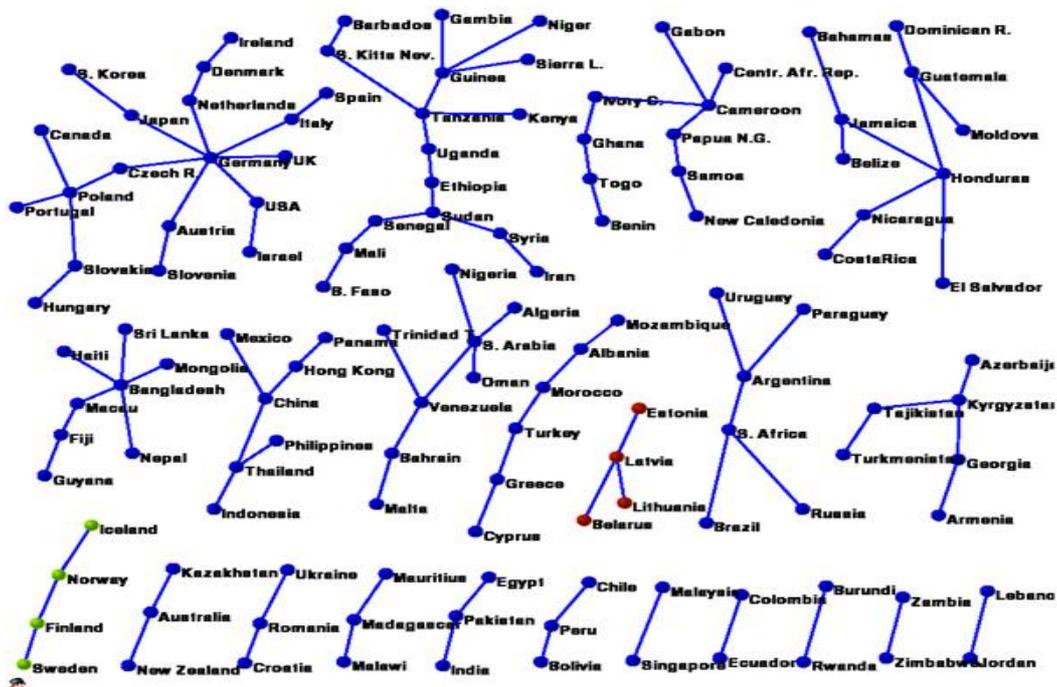


Figure 6. Network analysis of export flows

Source: Adopted from Caldarelli et al. (2012).

⁷¹ OECD, 2013.

⁷² Caldarelli et al., 2012.

The network map of the strongest trade relations in Figure 6 reveals the complexity of drivers that can explain the pairing of countries, including regional proximity, stage of economic development, or other preferential trade relations that can explain pairs such as: Australia and Kazakhstan, Russia and South Africa, or China and Mexico.

Caldarelli methodology is visualised in Figure 7, where the authors describe the use of two-mode networks that are constituted by industries and countries. The power of this method is that such data set can reveal both inter-industry connectivity and country connectivity. Further analysis of on-mode networks (countries or industries) can reveal further which industries have the highest scope of globalisation of their supply chains and which countries exhibit the highest governance power of coordinating GVCs. As such, this network methodology has the potential to overcome some of the shortfalls of the current international trade GVC analysis.

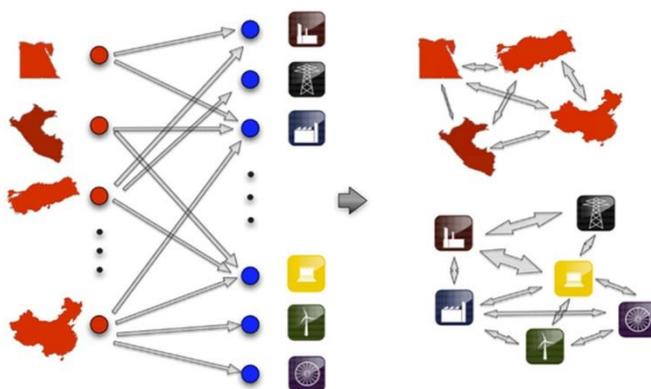


Figure 7. The network of countries and products and the two possible projections

Source: Adopted from Caldarelli et al. (2012).

3.7. Globalisation and economic development theory

Globalisation is defined as the *functional integration of internationally dispersed activities*⁷³. As a theoretical approach it elaborates on a number of concepts such as global production networks, global commodity chains, and now global value chains. It acknowledges that integration into the global economy for developing nations accelerates their growth, but can cause an immiserising effect, diminishing potential sources of competitiveness⁷⁴.

Authors acknowledge that the vehicles for such integration in GVCs are foreign market operations of firms, exports of domestic firms, and re-direction of GVC flows through new regions, clusters and countries that offer new business opportunities. Theoretical discussions are focused on the role of FDI and foreign trade policies, which at present do not have significant impact on the configuration of GVCs. It is acknowledged that GVCs constitute the nexus between investment and trade and that the MNEs drive all three of them⁷⁵.

⁷³ Dicken, 1998.

⁷⁴ Kaplinsky, 2000; UNIDO, 2009; UNCTAD, 2013e.

⁷⁵ UNCTAD, 2013a,b,d.

Globalisation theory has produced one of the most elaborate accounts of actors and processes that can be observed as part of the global value chains. Among the leading theoretical advancements are the acknowledgement of the economic globalisation through trade, foreign direct investment (FDI), and the intra-group trade by MNEs⁷⁶. The theoretical discussion of Gereffi (1999), Kaplinsky, Humphrey and Schmidt (2002) Pietrobelli and Rabellotti (2004) extends the notion of global economic integration emphasising on the input-output structure of value-added relationships, the territoriality of resource supply. Factors of production, costs and market realisation, distinctive types of GVC governance (market, modular, relational, captive, network, quasi-hierarchy and complete hierarchy), institutional constraints for participation and upgrade, the role of collective efficiency that emerges within clusters and GVCs, the four types of upgrading (product, process, functional and inter-sectoral), and the variations in strategic drivers across types of sectors and industries (such as resources-based, traditional manufacturing, complex product systems, and high-tech or specialist suppliers)⁷⁷. At the same time, it is acknowledged, that upgrading takes place at multiple levels, i.e. firms, industries, countries, and regions⁷⁸.

The early work of writers on global commodity chains emphasises on the presence of four interconnected segments of the production process: raw material supply network, production network, export network, and marketing network⁷⁹. Each segment represents a distinctive network of interlinked firms, and resembles an input-output structure with spatial dispersion and concentration of units. The whole chain is led by a governance structure to co-ordinate its entire production system⁸⁰. Subsequently, the distinction between traditional producer-driven commodity chain and buyer-driven commodity chain was replaced by numerous classifications of modes of GVC governance⁸¹.

Box 16: Globalisation and economic development perspective on value chains

Research from globalisation and economic development perspectives emphasises the broad range of drivers on GVC performance and impact, such as, mode of governance, level of sophistication of technology, existing infrastructure, synchronisation of trade and investment policy frameworks and institutions, government support for building domestic productive capacity, government measures enabling participation in GVCs, enhancing domestic value added in trade and business linkages, countries' economic structure and export models, structure of exports and relatedness – referring to a multi-stakeholder orchestration and coordination of GVCs, led by the MNEs.

Global economic integration involves integration of markets through a sequence of interconnected agents. The position of agents (i.e. countries) is determined by their comparative advantage, their specialisation and their participation in global production networks. Upgrading from this position requires concerted efforts for product / service differentiation, or process development, which depends on strategic investments by firms and policy measures implemented by governments. At the heart of such effort is

⁷⁶ Sturgeon, 2013.

⁷⁷ Humphrey and Schmitz, 2002; Ivarsson and Alvstam, 2010; UNCTAD, 2013a.

⁷⁸ UNCTAD, 2013d.

⁷⁹ Gereffi, 1990.

⁸⁰ Gereffi, 1994.

⁸¹ Humphrey and Schmitz, 2002; Keane, 2008, 2014; UNCTAD, 2013e.

the upgrade of the skills base in the economy, of the effectiveness of the education sector, or what is known as the triple helix of industry-university and government⁸².

3.8. Globalisation theory driven methodologies

Globalisation scholars have identified that GVCs are profoundly shaped by the local institutions and regulatory regimes in which they are situated (Henderson *et al*, 2002). As a consequence, GVCs cannot be simply traced in stepwise fashion from simple inputs to complex final goods and services (Henderson, et al., 2002). Academic work has identified four basic dimensions for GVC mapping: (1) an input-output structure, which describes the process of transforming raw materials into final products; (2) a geographical consideration; (3) a governance structure, which explains how the value chain is controlled; and (4) an institutional context in which the industry value chain is embedded⁸³.

The empirical work by globalisation scholars combines qualitative and quantitative observations of industry value chains and offers insights into the governance of the flow of value added and the driving forces behind inter-firm relationships. Figures 8 and 9 illustrate the type of outcomes from mapping GVCs, including global positioning of interconnected value added activities and actors.

It is acknowledged that the share of services in gross global trade is approximately 22% (for 2010), and many of these are generic complements to the value chains of all manufacturing and advanced technology sectors⁸⁴. The UNCTAD report also acknowledges that the contribution of services to the indicator *value added in trade* raises to 46%, and in terms of attracting inward FDI – the proportion of services mounts to 67%. This suggests that GVCs are becoming predominantly ‘dressed’ in their complementary services, and countries and players that deliver these services, increase their impact on the GVC structure.

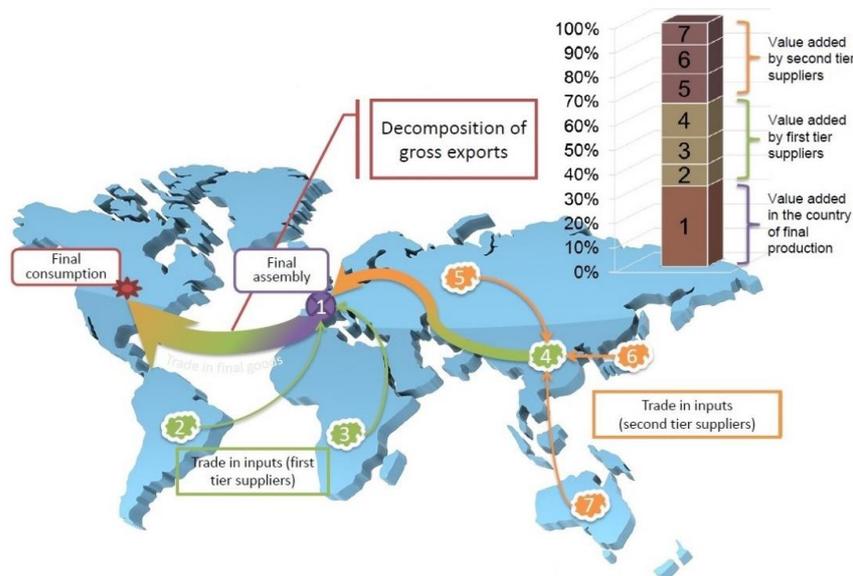


Figure 8. Global agriculture value chain

Source: Adopted from OECD, Trade and Agriculture Directorate.

⁸² Etzkowitz and Leydesdorff, 2000.

⁸³ Gereffi, 1994, 1999.

⁸⁴ UNCTAD, 2013d.

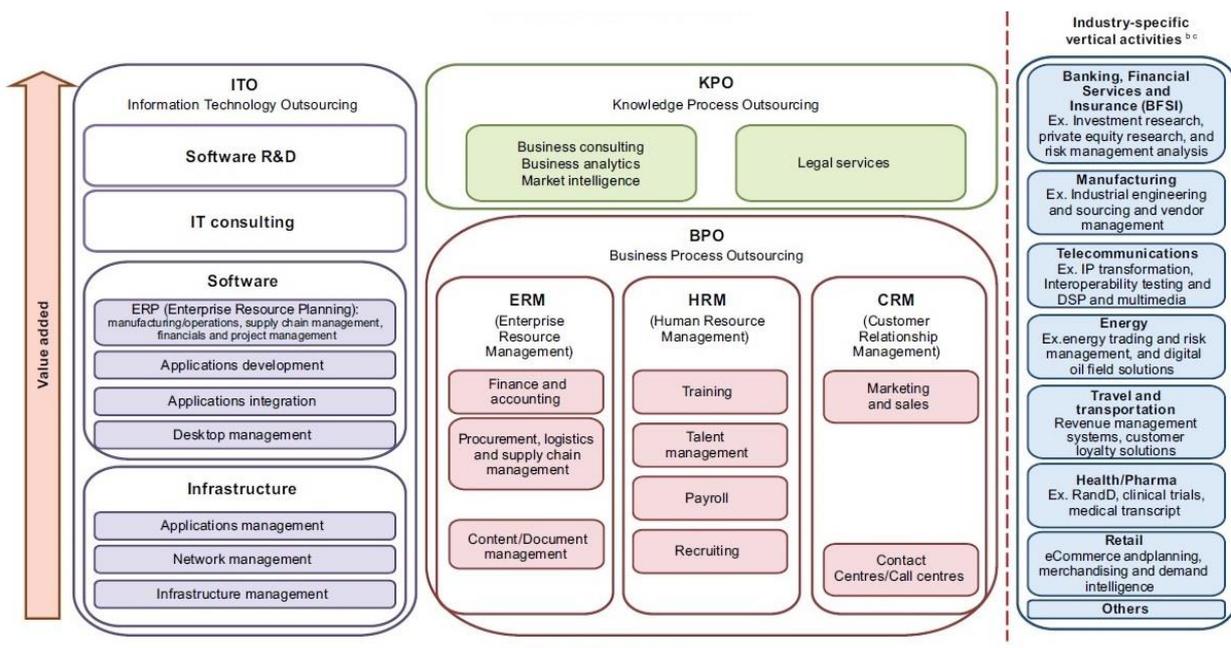


Figure 9. Offshore services value chain

Source: Adopted from Fernandez-Stark, et al., 2011.

Services traditionally are viewed as ancillary to manufacturing, either as direct inputs (e.g. transportation) or as services provided to people who worked in manufacturing (e.g. residential construction, retail sales, etc.). As such, services have been viewed as a by-product, not a source, of economic growth. Thus, data collection on services has historically been given a low priority by policy makers and statistical agencies⁸⁵. As a consequence, measuring trade flows, including the trade of intermediaries, do not capture services.

Box 17: Globalisation and economic development mapping methodologies

The offshore services value chain displays the complexity of complementary value added activities that support traditional manufacturing GVCs and offer upgrade opportunities worldwide, global connectivity, standardisation and professionalization of business linkages, and hence, distort previous classifications of GVC governance, within the same theoretical perspective.

The main criticisms raised by globalisation theorists are the lack comparable data on intra-group trade within MNEs, data on traded services and external international sourcing, and shared statistical data across developed and developing countries⁸⁶. Sturgeon concludes that these data gaps lead to policy gaps that relate to intermediate trade within GVCs. Among the proposed 'remedies' to data shortcomings are to undertake international sourcing survey with MNEs, and new business function classification for mapping core, primary and secondary activities (to complement the current industry classification based on products and markets).

⁸⁵ Sturgeon et al., 2006.

⁸⁶ Sturgeon, 2013.

More recently, GVC analysis is looking at local processes such as SME activities in global clusters, or localised policy incentives - to encourage FDI in particular locations. The economic geography literature has embraced the questions of how regions are connected in GVCs and how regional development and cluster growth can accelerate and demonstrate GVC upgrade.

3.9. Industrial organisation theory

The theory of industrial organisation looks at models that investigate the relationship between different stages of the value chain at an aggregate level, and explores broadly factors that affect that influence firm performance and market structure. This theorising is intrinsically linked to the theory of the firm, acknowledging that there are many critical factors, which are endogenous to firms, such as: sophistication of technology and R&D, or advertising and marketing services. Authors acknowledge that market structure, value chain composition and concentration, or firm performance are essentially related to firms' strategic decisions and choices⁸⁷.

Understanding markets and industries in that perspective require a historical analysis which can reveal the impact of personalities (i.e. managers) and institutions, which cannot be modelled using equilibrium models⁸⁸. Although the market structure for industrial economists is associated with measuring product-based concentration and agglomeration of firms, authors recognise the vertical integration inside firms along upstream and downstream processes, and the co-existence of interconnected activities through intermediate inputs, or the horizontal multi-product integration⁸⁹. Vertical integration within or across firms arise from technological economies, associated with production processes for a particular product. Multi-product firms utilise multiple technologies and participate in multiple product markets exhibiting internally both vertical and horizontal integration. On the other hand, specialisation leads to disintegration of technological value chains and the emergence of secondary intermediate markets, governed by business-to-business (B2B) contractual relationships with imperfect information, distorting industrial equilibrium models.

Doraszelski and Pakes (2007) in the same volume acknowledge the fact that strategic activities such as mergers and acquisitions have a long-term impact on the industry structure, which cannot be easily captured. Mergers and acquisitions internalise market structure within large corporate entities, and as such they create complex value chains. These empirical studies explain how MNEs acquire market power and control over GVCs, where regulatory activities in multiple product markets fail to provide transparency and information symmetry⁹⁰. Multi-firm regulation affecting value-added relationships with suppliers is bound by horizontal and vertical asymmetries, as well as fragmentation of impact, as critical suppliers may remain outside of the regulatory framework.

Industrial economists have also confirmed that the R&D intensity is strongly correlated with two-digit industry codes, which indicates that the technology factor varies across industries⁹¹. Product diversification and market structure, hence, carry a strong imprint from the type and sophistication of technologies, specific for the industry. Sutton argues that firm performance and market structure (or value chain) are heavily influenced by the historical path dependency of firms, and their use of sophisticated technologies, as well as by external agglomeration effects such as concentration of market power in the

⁸⁷ Panzar, 1989, Sutton, 1996, Bagwell, 2007.

⁸⁸ Sutton, 1996.

⁸⁹ Perry, 1989.

⁹⁰ Armstrong and Sappington, 2007; Whinston, 2007.

⁹¹ Scott, 1984, Sutton, 1996.

hands of few large players. Ultimately the agglomeration of operational capabilities, the concentration of market power, and the structure of value chains are historically determined by successive strategies adopted by the lead firms, rather than by equilibrium forces.

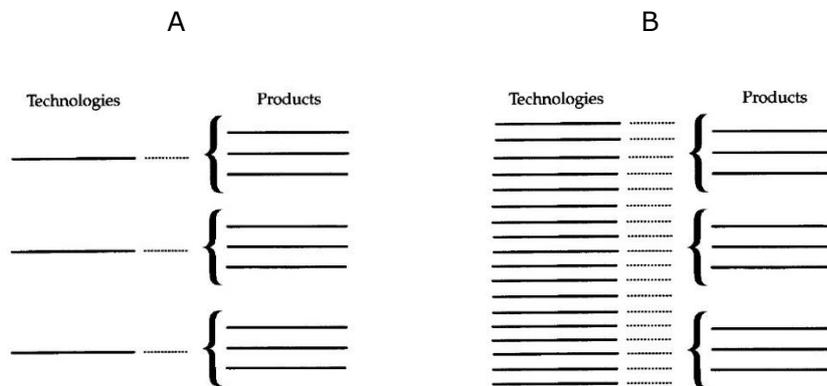


Figure 10. R&D Technologies and Product Set

Note: A: multi-product industrial organisation model (Sutton, 1996);
 B: multi-technology R&D industrial organisation model.

One of the main contributions in this line of argumentation is the notion of MNEs as multi-product, multi-technology and multi-market organisations. As such, MNEs capture efficiencies such as: *economies of scale* (from multi-market operations), *economies of scope* (from integration of upstream and downstream value added activities), and *coordination efficiencies* (from the ability to design and control unique value chains across multiple product markets, to generate internal synergies from sophisticated technologies, and to minimise coordination and transaction costs through intrafirm and intra-value chain trade). Figure 10 exhibits the fundamental shift in strategic development – from a linear multi-product organisation model, to a complex technology recombination environment, where different products and technologies can recombine, and feed into each other’s R&D cycles (Figure 10. B).

Box 18: Industrial organisation perspective on value chains

Both industrial economics and strategy acknowledge that industry structure and GVCs contain agglomerations of firms with their portfolio of activities, technologies, and products/services. They acknowledge also that activities and operations of firms are actually based on a portfolio of capabilities, specific to each company. The structure of industries, regions, GVCs, hence, resemble interconnected agglomerations of capabilities, or inter-linked strategic industry groups of firms each of which specialises in strategically selected segments of the value chain.

3.10. Industrial organisation methodologies

The industrial organisation approach incorporates both the notion of product differentiation (or horizontal integration of output markets) and diversification (vertical integration across related sequence of technologies and stages within the value chain). Hence, mapping the internal capabilities of firms and inter-firm connectivity on the bases on interlinked capabilities is used to map the value chain itself. The mapping technique was originally developed comparing US SIC, UK SIC, NAICS and NACE codes and revealing the structure of the regional economy in the South East of England in UK⁹². The regional capabilities were defined by industry codes, without discriminating between domestic and traded operations. The methodology was labelled '*Multi-stage methodology for cluster mapping*' based on a comprehensive database of the entire population of firms in the region with the full profile of industry codes, size and performance data for each firm. The basis of this methodology was cluster analysis technique, where each defined cluster represent a strategic industry group, or a distinctive group of industry capabilities, bundled as related by significant number of firms.

The database of firms for the region South East of England in UK revealed that the region contains a mature economy, populated by diversified firms that have internalised a number of related capabilities across industries, generating a good connectivity map for the region (Figure 11). This network map confirms the strong connection between pharmaceuticals and chemicals, both sharing capabilities in US SIC 2833-drugs-medicals and botanicals, and US SIC 2834-pharmaceutical preparations.

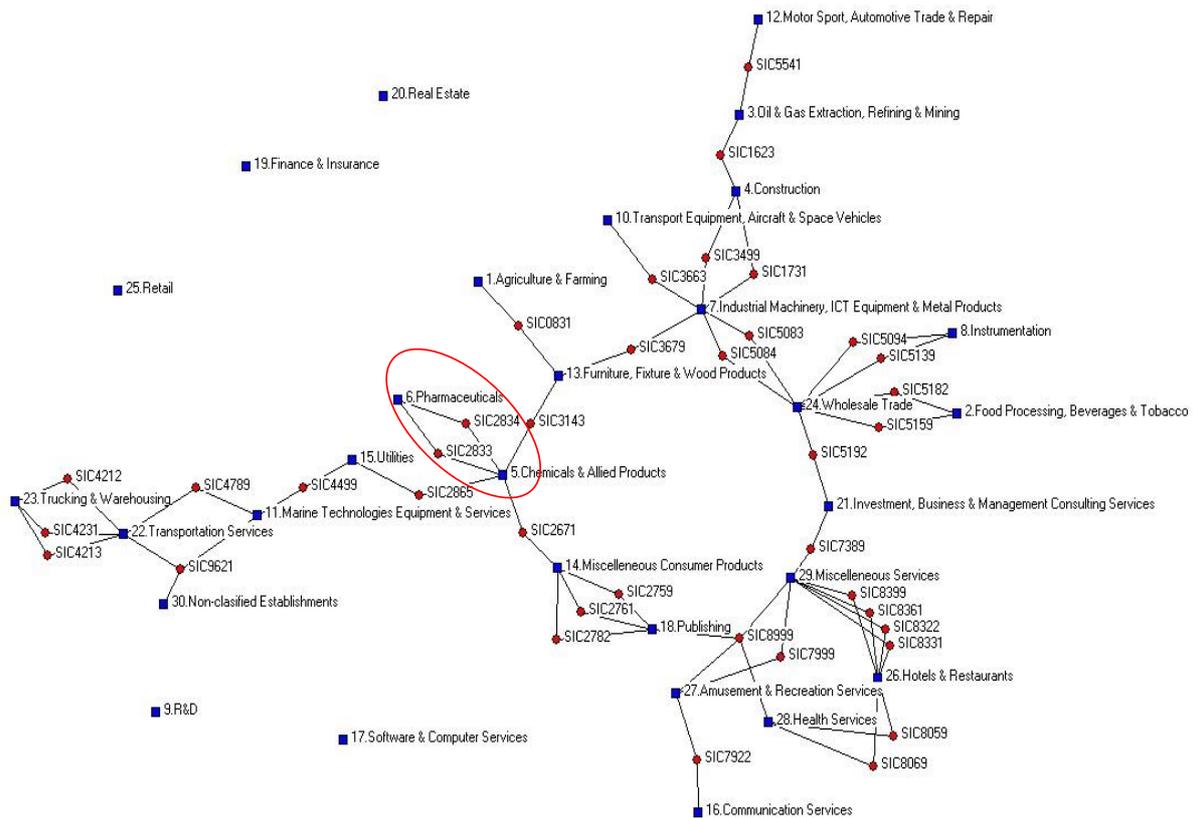


Figure 11. South East of England connected clusters and industries

Source: Adopted from Todeva and Keskinova (2006).

⁹² Todeva and Keskinova, 2006.

Note: Data from Amadeus (2005); network map is based on 10% of ties, or > 20 firms.

The multi-stage methodology for cluster mapping has enabled researchers to identify groups of interconnected value chain groups (VCGs), or strategic industry groups (SIGs) - based on synergies from intra-firm and inter-industry operations. The most common inter-industry linkages internalised by firms are represented in Figure 11 as the most dominant value chain relations⁹³.

This methodology requires a proprietary dataset of firms selected within particular geographic boundaries, and with comprehensive data on firm operations and activities. This methodology enables researchers to produce *connectivity maps* containing value chain groups of firms. Each individual value chain group (VCG) comprises bundles of interconnected industries, internalised by firms as chains of complementary of value-added activities. The label for each VCG derives from the firm data and represents a distinctive industry value chain segment containing related diversification of firms. According to this methodology, connectivity across industry codes is a representation of the value chain in particular industry.

Figure 11 represents the connectivity across all industry sectors in the Greater South East of England, UK, using a two-mode network. The VCGs on this represent shared capabilities that generate value added across multiple industry segments. The isolated nodes, such as R&D or finance, appear as isolates, as they are generic service activities that are connected to multiple others cluster groups, and as such, do not exhibit preferential affiliation and position in the value chain.

The same methodology has been applied for mapping of the biomedical technology cluster in the same regions where the proprietary database contained the entire population of firms within the set geographic and industry boundaries of bio-medical and biopharma sector in the Greater South East of England, UK. The empirical analysis of this data produced a distinctive map of related diversification of firms across the entire biopharma value chain, enabling to discover distinctive segments, such as the two differentiated R&D groups of firms –generic *biopharma R&D* and *drug development support*, incorporating R&D activities such as laboratory testing and medical research⁹⁴.

Box 19: Industrial organisation mapping methodologies

The diversity of graphical representations of GVCs, that are inspired by the industrial organisation theory demonstrate the efforts of scholars to go beyond the simplistic visual representation of a hypothetical chain of value added activities, and to offer a synthesis of complex interlinked bundles of products, technologies and actors.

Similar approaches have been adopted at the [European cluster observatory](#), and the [US cluster mapping initiative](#), where analysis highlights the deep connection of biopharma to the university system (education and knowledge creation activities, upstream and downstream chemicals, paper and packaging (or miscellaneous products), and food processing and manufacturing⁹⁵, as well as to health and beauty products, specialty chemicals, drug and related wholesale, containers, packaging, instruments and laboratory apparatus, surgical instruments and supply, dental instruments and supply,

⁹³ Todeva, and Keskinova, 2006.

⁹⁴ Todeva, 2008.

⁹⁵ European Cluster Observatory, 2014 a, b, c.

medical equipment, diagnostics, ophthalmic goods, research organisations, patent owners and lessors⁹⁶.

The two methodologies for cluster mapping by Todeva and Keskinova⁹⁷ and Delgado, Porter and Stern⁹⁸ are similar as they rely on a combination of industry codes, rather than single industries. The main difference between the two methodologies is that Todeva and Keskinova adopt a bottom-up approach, building proprietary databases of population of firms, using firm data, and mapping patterns of diversification as criteria for industry combinations. In contrast, Delgado, Porter and Stern apply a top-down approach using initially expert knowledge, and subsequently – external criteria for measuring inter-industry relatedness, based on co-location patterns of industries across regions, national measures of Input-Output links, and a national measure of labour occupational relatedness among industries. Delgado, et.al use standardised cluster definitions for comparability, while Todeva and Keskinova derive at cluster definitions through firm database analysis, where each cluster represents a diversification pattern that occur in the dataset. Both methodologies use cluster analysis algorithms as a lead categorisation technique.

Another major distinction between the two methodologies is the question of separation of clusters into traded and local. From the point of view of employment and agglomeration of capabilities, the geographic co-location of traded and local clusters reinforces the strength of the regional economy, its comparative advantage, and the localised entrepreneurial discovery process, capturing spill-overs.

4. Conclusions

One of the main sources of competitive advantage for European regions is their openness, internationalisation and position in GVCs. The stronger the capabilities within a region, the higher their contribution to value added. The current measure of comparative advantage of regions and countries is the extent to which they are integrated into the European and the global economy, and this is measured by the trading of intermediaries, including *GVC participation, foreign value added in export, and contribution of value added trade to GDP*.

Although these measures enable comparison of countries, there is a common understanding that the aggregate level data raises more questions than provides answers and policy directions for individual countries. The aggregate country measures, for example, do not explain whether the value added is in manufacturing capabilities, or in services⁹⁹, or what type of participation takes place – *market supply, hierarchical or modular* relationship in the form of intra-firm trading within a MNE value chain, captive supply relationship, dominated by a lead firm, or relational participation that includes knowledge end technology sharing, along-side, learning, innovation, and new opportunities for upgrade¹⁰⁰.

At the same time, detailed cases of value chains in specific industries provide invaluable insights into actors and processes, but offer little information on measures for optimisation and efficient coordination of the resource flows within the value chain. Value chain optimisation takes place as part of the implementation of global strategies of MNEs, aiming to exploit upstream economies of scale, downstream economies of scope,

⁹⁶ Porter, 2003.

⁹⁷ Todeva and Keskinova, 2006.

⁹⁸ Delgado, Porter, and Stern, 2014.

⁹⁹ De Backer et al., 2015.

¹⁰⁰ Radosevic and Stancova, 2015.

leveraging core assets and synergies from multi-product and multi-technology operations, learning from foreign market activities, minimising coordination costs and collecting rents from the established connectivity under their control¹⁰¹. Such value chain governance and optimisation, puts pressure on developing countries, regions, or clusters for low-cost or high value added supply, and hence raising barriers or generating opportunities for upgrade¹⁰². Smart specialisation of regions, hence, can create comparative advantage only if it builds upon the public and the private sector capabilities in that region, embodied in the triple helix of industry, university and government. Smart specialisation strategies at a regional level need to be not only sector specific, but have to co-align with the lead businesses, and to mobilise the entrepreneurial potential for innovation.

Most mappings of GVCs are illustrative and conceptual representations, and are lacking comprehensive evidence and a comprehensive list of firms or agglomeration of capabilities in a region. Although trade indicators for value added inform policy makers of current strategic and structural position within GVCs, firm operation data is essential for the mapping of regional capabilities. Yet, the most important element of GVC mapping is to identify the sources of these capabilities within firms and within knowledge providers. Mapping regional capabilities and GVC require firm data, where the capabilities reside.

The European smart specialisation policy framework requires mapping methodologies that produce evidence of concentration of regional and industry capabilities in strategic groups of firms – as flagship resources. Each country/region should be able to identify relevant linkages and flows of goods, services and knowledge, revealing possible patterns and pathways of integration with partner regions and complementary businesses. GVC mapping is envisaged as enabler in the policy implementation process, collecting evidence both for the supply and the demand side in the region, and the lead business actors that can drive the value chain integration.

It has been established that innovation in manufacturing and services are complementary, and hence, the selection of lead value chains for regional co-alignment can encompass all possible upstream or downstream avenues for growth. The current policy framework in support of the [Circular Economy](#), requires regions and countries to follow the proposed by ILO framework of – 1) selection of lead value chains; 2) market system analysis, intervention design, implementation, and monitoring and result measurement¹⁰³. The International Labour Organisation (ILO) and the Smart Specialisation Platform both confirm that the intervention design has to involve multi-stakeholder coalitions, including lead business, as value chain decisions are commercially driven¹⁰⁴. In addition, the ILO guide for value chain development goes further and identifies the factors that drive value chain development, such as: product / service differentiation and quality, system efficiency, social and environmental standards and enabling business environment. Internationalisation scope is essential complementor to the development of the market system at regional level, including regulatory and support functions, such as infrastructure, skills, capacity building, innovation and technology potential, and related services¹⁰⁵. The ILO guide for value chain development explicitly calls for a step-by-step approach that include careful selection of the value chain to be developed, followed by mapping of the value chain using a flow chart, a comprehensive inventory of all market players (local and international), identifying opportunities and constraints in the current value chain, identifying future potential markets, that can create emergent opportunities for upgrade, and identifying an

¹⁰¹ Kogut, 1984.

¹⁰² Kaplinsky et al., 2002.

¹⁰³ ILO, 2012.

¹⁰⁴ Foray et al., 2012; ILO, 2012.

¹⁰⁵ ILO, 2012, Radosevic and Stancova, 2015.

implementation path, or ways by which innovation products can reach their new markets. The value chain research under this framework encompass the entire process – from policy objectives and rationale, to investigation of the market system and the driving forces in the region, followed by the adoption of systemic solutions. Among these systemic solutions can be listed the internationalisation orientation, and the complementarity of manufacturing and related services, where value added, connectivity and upgrade can come from both of them¹⁰⁶.

Mapping GVCs can assist regions in multiple ways – from capability audit, to identifying new opportunities for growth, implementing their industrial renaissance and innovation strategies, or the development of their smart specialisation strategy for capturing inter-regional collaborative advantage and sustainable growth.

Hence, there is a need and scope for developing a new GVC mapping methodology and analytical procedure that enables policy makers to identify geographic concentration of capabilities, and sources of competitive advantage in specific industry segments of their strategic priorities for smart specialisation. The third paper in this sequence elaborates on the industrial organisation of global biopharma using data of the GVC internalised by multinational enterprises.

¹⁰⁶ ILO, 2012, Radosevic and Stancova, 2015; De Backer et al., 2015.

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List of web-links to resources

- Capturing the Gains: Economic and Social Upgrading in Global Production Networks - <http://www.capturingthegains.org/about/index.htm>
- Centre on Globalisation, Governance and Competitiveness, Duke University - www.cggc.duke.edu/index.php
- Cluster Policies - <http://ec.europa.eu/DocsRoom/documents/16903/attachments/1/translations/en/renditions/native>
- EU Circular Economy - http://ec.europa.eu/growth/industry/sustainability/circular-economy/index_en.htm
- EU Cluster Internationalisation - http://ec.europa.eu/growth/smes/cluster/internationalisation/index_en.htm
- EU COSME Programme for Small and Medium-Sized Enterprises - http://ec.europa.eu/growth/smes/cosme/index_en.htm
- EU Enterprise Europe Network - <http://een.ec.europa.eu/>
- EU Entrepreneurship and SME Support - http://ec.europa.eu/growth/smes/access-to-markets/index_en.htm
- EU SME Access to market - http://ec.europa.eu/growth/smes/access-to-markets/index_en.htm
- EU Framework Programme for Research and Innovation - Horizon 2020 - <http://ec.europa.eu/programmes/horizon2020/>
- EU Industrial Policy, DG GROWTH Internal Market, Industry, Entrepreneurship and SMEs: Towards an Industrial Renaissance - http://ec.europa.eu/growth/industry/policy/renaissance/index_en.htm
- EU Industrial Renaissance Policy - http://ec.europa.eu/growth/industry/policy/renaissance/index_en.htm
- EU Innovation Union Strategy - http://ec.europa.eu/research/innovation-union/index_en.cfm
- EU Keu Enabling Technologies Observatory - <https://ec.europa.eu/growth/tools-databases/ketsobservatory/about>
- EU Regional Policy - http://ec.europa.eu/regional_policy/index_en.cfm
- EU Smart Specialisation Platform - <http://s3platform.jrc.ec.europa.eu/home>
- EU SME Internationalisation Portal - <https://ec.europa.eu/growth/tools-databases/smeip/>
- European Cluster Collaboration Platform - <http://www.clustercollaboration.eu/>
- European Cluster Observatory - http://ec.europa.eu/growth/smes/cluster/observatory/about/index_en.htm
- European Strategic Cluster Partnerships - <http://www.clustercollaboration.eu/eu-cluster-partnerships>
- Global Value Chains Initiative, Duke University - www.globalvaluechains.org
- GTAP Data Base (Global Trade Analysis Project, Purdue University) - <https://www.gtap.agecon.purdue.edu/databases/default.asp>
- GTAP Database - <https://www.gtap.agecon.purdue.edu/about/project.asp>

IDE-JETRO International Input-Output Analysis - <http://www.ide.go.jp/English/Research/Topics/Eco/Io/>

ITCS: International Trade by Commodity Statistics - <http://www.oecd.org/trade/its/itcsinternationaltradebycommoditystatistics.htm>

OECD Databases - <http://www.oecd-ilibrary.org/statistics>

OECD, Input-Output Tables - <http://www.oecd.org/sti/ind/input-outputtables.htm>

OECD, Measuring Trade in Value Added (TiVA) (An OECD-WTO joint initiative) - <http://www.oecd.org/sti/ind/measuringtradeinvalue-addedanoecd-wtojointinitiative.htm>

Measuring TiVA - <http://www.oecd.org/sti/ind/measuringtradeinvalue-addedanoecd-wtojointinitiative.htm>

OECD, Trade and Agriculture Directorate - <http://www.oecd.org/tad/>

OECD: STAT - <http://stats.oecd.org/wbos/default.aspx?DatasetCode=TISP>

PhRMA - <http://www.phrma.org/economic-impact>

RECONFIRM Initiative for Regional Co-Operation Networks - <https://ec.europa.eu/easme/en/tender/8029/regional-cooperation-networks-industrial-modernisation-reconfirm-initiative>

Smart Regions conference - http://ec.europa.eu/regional_policy/en/conferences/smart-regions/

Smart Specialisation Platform - <http://s3platform.jrc.ec.europa.eu/value-chains>

STAN Bilateral Trade Database by Industry and End-Use (BTDiXE) - <http://www.oecd.org/trade/bilateraltradeingoodsbyindustryandend-usecategory.htm>

The Atlas of Economic Complexity - <http://atlas.cid.harvard.edu/explore/stacked/export/usa/all/show/1995.2014.2/>

The World Bank: Logistics Performance Index - <http://lpi.worldbank.org/>

The World Bank: Open Knowledge Repository - <https://openknowledge.worldbank.org/discover?query=value+chain&scope=%2F&submit=Go>

UN Comtrade Database - <http://comtrade.un.org/>

UN Service Trade - <http://unstats.un.org/unsd/servicetrade/default.aspx>

UNCTAD-Eora-MRIO (multi-region input-output GVC database) - <http://worldmrio.com/>

US Cluster Mapping Initiative - <http://clustermapping.us/about>

WTO-Trade in value-added and global value chains: statistical profiles - https://www.wto.org/english/res_e/statis_e/miwi_e/countryprofiles_e.htm

List of figures

| | |
|--|----|
| Figure 1: Global value chains, commodity chains and production networks | 9 |
| Figure 2: The chain of value added | 14 |
| Figure 3: Business value networks of multinational enterprises | 16 |
| Figure 4. Inter-industry global connectivity measured through monetary flows | 17 |
| Figure 5. Nutella global value chain (Ferrero Group) | 19 |
| Figure 6. Network analysis of export flows | 21 |
| Figure 7. The network of countries and products and the two possible projections | 22 |
| Figure 8. Global agriculture value chain..... | 24 |
| Figure 9. Offshore services value chain | 25 |
| Figure 10. R&D Technologies and Product Set | 27 |
| Figure 11. South East of England connected clusters and industries..... | 28 |

List of boxes

| | |
|---|----|
| Box 1: Drivers of value added flows..... | 4 |
| Box 2: Value chains as policy targets..... | 5 |
| Box 3: Value chain definition | 6 |
| Box 4: Determinants of value chains | 7 |
| Box 5: Firm level value chains | 9 |
| Box 6: Policy directions for integration of European value chains..... | 10 |
| Box 7: Definition of firm capabilities | 11 |
| Box 8: Strategy perspective on value chains..... | 12 |
| Box 9: Definition of regional capabilities..... | 13 |
| Box 10: Definition of industry capabilities..... | 13 |
| Box 11: Strategic approach to value chain mapping and capability analysis | 14 |
| Box 12: International business perspective on global value chains..... | 17 |
| Box 13: International business approach to global value chains | 18 |
| Box 14: International trade perspective on value chains..... | 20 |
| Box 15: Shortfalls of the international trade methodologies | 21 |
| Box 16: Globalisation and economic development perspective on value chains..... | 23 |
| Box 17: Globalisation and economic development mapping methodologies..... | 25 |
| Box 18: Industrial organisation perspective on value chains | 27 |
| Box 19: Industrial organisation mapping methodologies..... | 29 |

List of abbreviations

| | |
|--------|--|
| COSME | European programme for the Competitiveness of Enterprises and Small and Medium-sized Enterprises |
| FDI | Foreign Direct Investment |
| GTAP | Global Trade Analysis Project |
| GVC | Global value chain |
| ICT | Information and Communication Technologies |
| ISIC | International Standard Industrial Classification |
| JRC | Joint Research Centre |
| KET | Key Enabling Technology |
| MNE | Multinational Enterprise |
| NACE | European Classification of Economic Activities |
| NAICS | North-Atlantic Industry Classification System |
| OECD | Organisation for Economic Cooperation and Development |
| R&D | Research and Development |
| S3 | Smart Specialisation Strategy |
| SIC | Standard Industrial Classification |
| SIGs | Strategic Industry Groups |
| SME | Small and Medium Enterprises |
| UNCTAD | United Nations Conference on Trade and Development |
| VCG | Value chain group |
| VCGs | Value Chain Groups |
| WTO | World Trade Organisation |

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