Can Marshall's Clusters Survive Globalization?

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I. Introduction

The migration of manufacturing industries from one place to another has been happening since the Middle Ages. The past century and the past few decades in particular have witnessed a number of dramatic mass migrations of manufacturing. New England was one of the world's largest textile producers at beginning of the 20th century—today, it has no textile mills. In 1985, 75% of semiconductor manufacturing capacity was located in either Japan or the US (Maher, Mowery, and Simcoe 2002). By 2009, the US and Japanese share had shrunk to 40%, while Taiwan, Korea, China, and other Southeast Asian countries accounted for 50% of production capacity.[1] Driven by falling trade barriers, the opening of once closed markets (like China, India, Eastern Europe and Russia) and fueled by modularization of production (Baldwin & Clark, 2000; Sturgeon, 2002), declines of long established manufacturing clusters in the US and Europe have occurred in industries as diverse as apparel, automobiles, bicycles, chemicals, consumer electronics, furniture, shoes, sports equipment, shipbuilding, and steel. Migration also occurs within countries. In the US, manufacturing had historically been concentrated in the so-called "manufacturing belt", running approximately from the upper Midwest to the northeast (Krugman, 1991). Today, the Southeastern US—once dominated by cotton and tobacco—has emerged as the new industrial heartland. Overall, the potent forces of globalization have led some to question the future viability of Marshallian industrial clusters (e.g. De Marchi and Grandinetti, 2014).

[1] By 2009, the Japanese share had fallen to 25% and the US share to 14%; Taiwan had grown to 18%, Korea to 17%, and China to 9%. *Manufacturing and Technology News*, February 12, 2012, vol 17, no 3. "US Becomes Bit Player in Global Semiconductor Industry."

Mass manufacturing migration is such a prominent part of the globalization discourse that it is easy to forget that a surprising amount of manufacturing actually stays put (some of it for quite a long time). Tuscany has been a leading center of high quality wool fabric and luxury apparel production since the 13th century (Goldthwaite 2009); Faber-Castell has produced pencils in Germany since 1761; guns have been manufactured in Springfield, Massachusetts since the late 1700s. Boeing first began producing airplanes in Washington State in 1910, close to its current plant in Everett. Despite its well-publicized woes and the rise of foreign transplant operations in the southeast, the Detroit region is still the largest producer of cars and trucks within the United States.[2] Harley Davidson has been producing motorcycle engines in the Milwaukee area since 1903. Like the US, Europe's industrial base has long been concentrated in a 'manufacturing belt'—running from southern Scandinavia through Germany's Ruhr Valley and Eastern France through the northern half of Italy.

Despite the global shift in manufacturing from developed to developing countries, and the growing international fragmentation of production, certain types of manufacturing activities remain entrenched in specific locales or industrial districts. Not only do these manage to survive in a globalizing economy, but they also prosper and remain the loci for innovation development (e.g. Breznitz and Buciuni, 2015). Manufacturing clusters, at least in some contexts, appear to be surviving globalization (Markusen, 1996). However, this trend is not occurring in all manufacturing sectors alike, nor is it involving all the firms competing in a given manufacturing industry. The existence of both across-industry and within-industry variance suggests room for further analysis and triggers a challenging question: *When and why do some manufacturing clusters survive globalization?*

[2] http://www.detroitchamber.com/economic-development-2/chamber-initiatives/michauto-universal-name/the-auto-industry-in-michigan/

The answer matters for several reasons. First, it will help us understand the extent to which lower barriers to trade pose real or imagined threats to specific industries in specific locations. Second, it sheds light on the potential for manufacturing to return to places that have previously de-industrialized. Recently, there has been a spate of optimistic predictions about the re-shoring of manufacturing to the US. Such prognostications are predicated on the assumption that manufacturing capabilities are highly mobile, and that manufacturing moves quickly with changes in factor cost changes. This perspective suggests that as costs rise in places like China, we can expect to see significant "re-shoring" of manufacturing back to the US. We challenge that perspective in this paper. Obviously, factor costs matter, but we also argue that agglomerating forces related to the localization and specialization of know-how can inhibit the mobility of manufacturing and innovative knowledge (Breschi and Lissoni, 20009; Jaffe et al. 1993). Those agglomerating cut both ways. They not only retard the flow of manufacturing away from existing clusters, but they also inhibit the return of manufacturing to places where from which it has already migrated. Finally, managers needing to make long-term commitments toward supply chain configurations can be helped by understanding how location matters to manufacturing performance.

Drawing on primary and secondary data of four Italian long-established manufacturing clusters, this paper assesses and discusses the factors that allow some clusters to survive and thrive despite the centrifugal forces of globalization. Findings reveal that manufacturing activities tend to remain sticky to specific locales when the three following conditions occur:

1 – The presence of "knowledge integrator" firms that both bridge local specialized supplier know-how with global market conditions and drive investment in innovation;

2 – Local suppliers' specialized know-how;

3 – Integral knowledge across adjacent stages of production

While representing three independent sine-qua-non conditions for the sustainability of manufacturing clusters, each of these factors is tightly linked to the others and therefore has to be analyzed through a systemic perspective. Central to the understanding of this process is the role played by *knowledge integrators* (KIs), a type of firm that, by pursuing product and process innovation through the integration of global and local sources of knowledge stimulates the continuous upgrade of local firms' production know-how and helps to bolster the survival of local firms.

This paper is organized as follows. Section II provides some high level trends on the organization and locus of production globally. Section III provides a comparative case study analysis of four 'industrial districts' in Northeastern Italy, all located within approximately 45 miles of one another. The varying patterns of evolution and performance of each region enables us to draw some preliminary conjectures about the three factors driving manufacturing mobility/stickiness. We conclude the paper with a discussion of potential management and policy implications, and open questions for further research.

II. The Globalization of Supply Chains: Aggregate Evidence

The mantra that supply chains have become "globalized" has pervaded both popular and academic writings on competition and operations. Implicitly, this is often meant to convey that distance has become irrelevant and that manufacturing has become highly mobile. A stereotypical picture of today's 'global' supply chain is provided in the opening lines of a Deloitte Touche Tohmatsu (2003) report on global supply chains: "Imagine trying to design, source, manufacturing, sell, and deliver a new product rapidly for a new potentially lucrative market given today's realities: your suppliers are located in North America, Europe, and China; your customers are in the US, Europe and Japan; your factories are in Brazil, Europe, and North America; and

your development engineers are in Europe, India, and North America."[3] The report then goes on to point out that this predicament is not unusual.

From this perspective, companies put their manufacturing operations and choose suppliers in locations that offer the best total cost of production and enable them to serve a broad patch of growing markets. They are able to flexibly adjust their sourcing geographically to take advantage of rapidly changing factor and product market conditions. In such a world, Marshall's clusters seem antiquated at best.

There is, of course, plenty of anecdotal evidence about the globalization of manufacturing value chains or production networks (e.g. Gereffi, Humphrey and Sturgeon, 2005; Coe et al. 2004; 2008). We hear all the time about companies who have shuttered plants in the US or Europe and moved production to China or Eastern Europe. Critics complain that Apple enjoys huge profits in the US but does no manufacturing there (for an analytical perspective see Dedrick et al. 2010). A drive through the industrial heartland of advanced industrial countries (the American mid-west, the British midlands, Germany's Ruhr Valley, Northern Italy's manufacturing districts, etc.) will reveal no shortage of long-abandoned factories. The impression is that places like the US and some parts of Europe have already entered the post-industrial era. But what do the data say?

It has become common in both academic and policy circles to equate the relative strength or weakness of US manufacturing with the percentage of GDP associated with manufacturing. Andrew Liveris, author of *Making It in America,* for instance, laments the decline of US manufacturing and draws the following comparison between the US and Germany: "The German government has a keen sense of the importance of manufacturing, and has made investment to support the sector, even as they transition their economy. That's why manufacturing makes ups

[3] Deloitte Touche Tohmatsu (2003) "The Challenge of Complexity in Global Manufacturing." Page 1. https://www.deloitte.com/assets/Dcom-Shared%20Assets/Documents/SupplyChainSurvey(1).pdf

20% of the German economy, but only 11 percent of the US economy. And it's why in the race for a competitive long-term future, German is far ahead of the pack."[4]

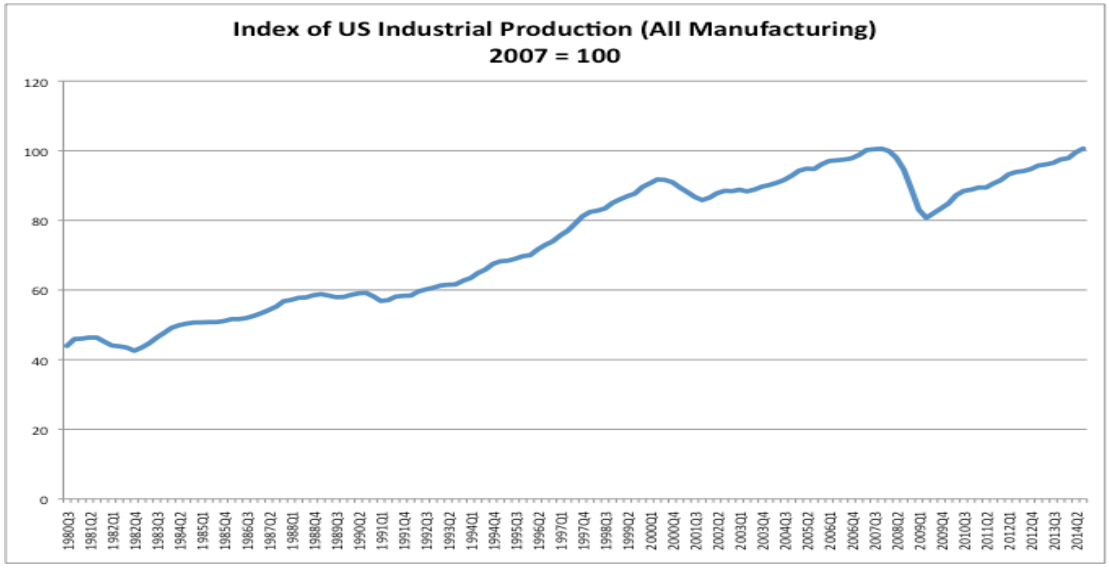
The problem with the much cited "manufacturing as percentage of GDP" figure is that it really does not tell us much about the amount of manufacturing happening in an economy. The actual figure being cited is the percentage of GDP attributable to *manufacturing sectors* like automobiles, apparel, and vehicles. Before globalized supply chains, the domestic output of a manufacturing sector, say cars, was largely generated by manufacturing activities, and thus the overall share of GDP from manufacturing sectors was a reasonable proxy for the amount of manufacturing taking place in the economy. However, with the rise of global supply chains, it is not uncommon for companies in the manufacturing sector to do R&D in one place (say the US) and to source production from a foreign location. Because the profits which flow back to the enterprise become part of the value added of the domestic economy, it is entirely possible for manufacturing activity to decline (due to say offshoring) while value added of a sector increases. This is going to be particularly true in sectors where intangibles, like intellectual property, are a significant source of value.

To get a read on actual production taking place, we need to look specifically at industrial production data assembled by the Federal Reserve[5]. These data are based on surveys conducted by the Bureau of Labor Statistics of individual establishments and are derived specifically from physical counts of production. The advantage of these data is that they tell us something about the amount of physical production in the US economy. The downside is that physical units are difficult to compare across sectors, and thus we cannot compare absolute production levels across sectors or between manufacturing sectors and services. Industrial production data (at the overall economy and at the sector levels) are indices.

[4] Liveris, page 6.
[5] For a description see http://www.federalreserve.gov/releases/g17/current/

Figure 1 below shows the overall trend in industrial production between 1980 and 3Q/2014 (the data are reported every quarter, but for visual clarity the X axis 'ticks' only the 3Q of each year).

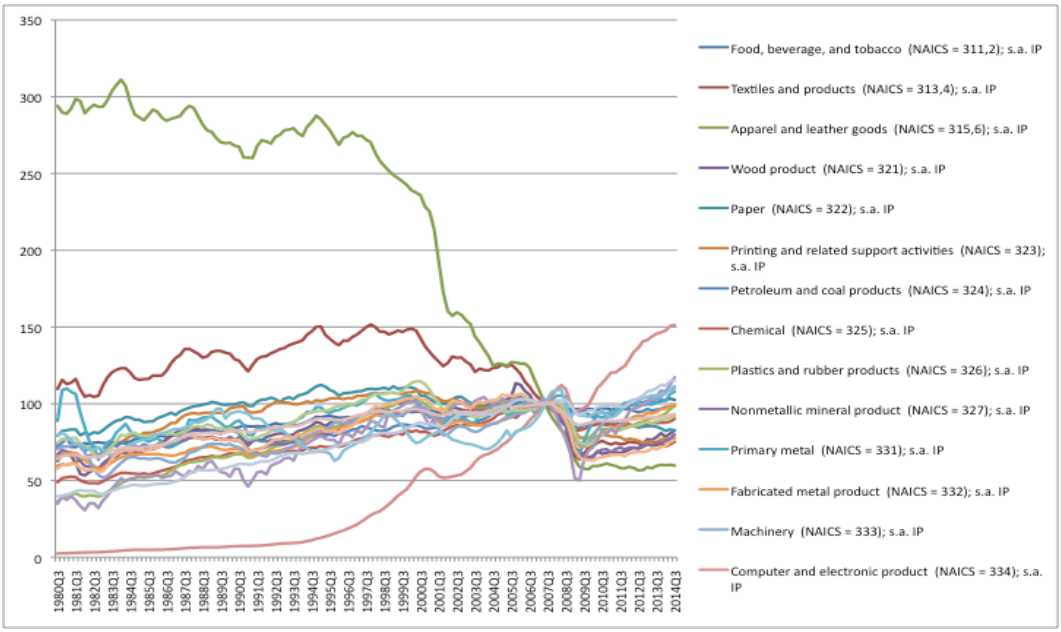
Figure 1 Overall Trend in US Industrial Production Since 1980



Source: US Federal Reserve, Industrial Production and Capacity Utilization – G.17.

This chart makes clear that overall manufacturing in the US economy has not declined. Between 1980-2014, the index of total production increased by a factor of approximately 2.5 (approximately the same multiple as overall US GDP growth). The percentage decline of manufacturing sectors relative to total GDP is largely due to the increase in both private and government services, rather than a decline in total manufacturing activity. However, this aggregate economy-wide measure masks significant cross-industry variation in the growth (decline) of industrial production (see Figure 2).

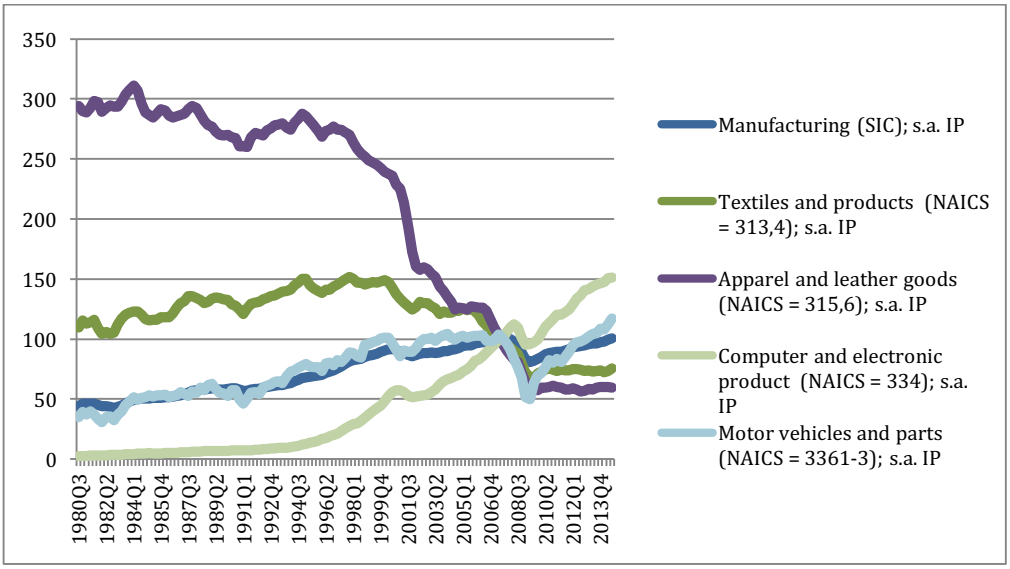
Figure 2: Industrial Production Indexes by Sector (1980-2014)



Source: Federal Reserve, Industrial Production and Capacity Utilization. G.17

Roughly speaking, the growth patterns of US manufacturing fall into 4 categories: absolute decline (textiles; apparel and leather goods); stagnant/weak growth (e.g. food and beverages, wood, primary metals, fabricated metals, furniture, and aerospace); average growth (chemicals, plastics, machinery, and motor vehicles), and hyper-growth (computer and electronic products). Additional visual clarity of these differences can be viewed in Figure 3 that isolates a select sub-set of sectors.

Figure 3: Selected Sector Industrial Production Indices



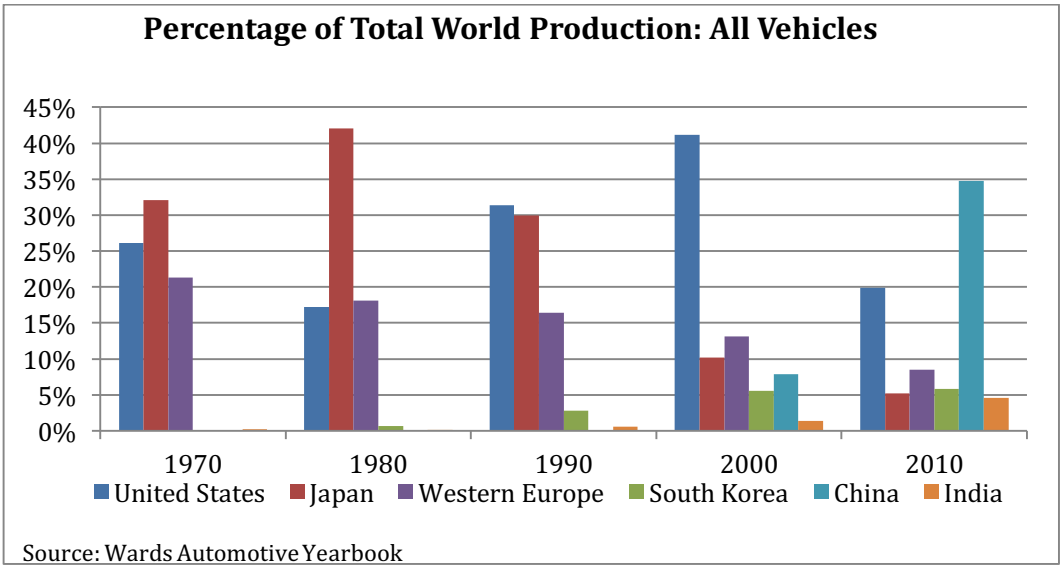
Such turbulence at the sectorial level should not be surprising. One of the attributes of a dynamic economy is the ability to re-allocate resources across sectors in response to changes in factor costs, productivity, and demand. In addition, this is a time of dramatic institutional changes in the global economy reducing barriers to trade. The dramatic declines of textile and apparel production coincide with the approval of the WTO Agreement on Textile and Clothing (Uruguay Round) that went into effect January 1, 1995.

In absolute terms, these data provide a mixed picture. The familiar lament that the US no longer manufacturers is clearly overblown; that said, growth in manufacturing has occurred in only a relatively narrow band of sectors and product areas. Unfortunately, more disaggregated data are not available to further probe within sector differences, but at least, anecdotal evidence suggests significant within sector differences (product level). Intel, for instance, maintains a very large domestic manufacturing capability in microprocessors, but the vast majority of memory chips are now produced outside the US. Even in mature sectors hit hard by foreign competition, like furniture, we see the emergence of specialist producers that continue to thrive based on innovation and customization (Buciuni, Coro, and Micelli 2014). Based on case study evidence, Pisano and Shih (2012) document a number of specific technological capabilities that left US shores over the past two decades.

A clearer picture of manufacturing mobility would emerge with international comparisons of production output. Unfortunately, such data are not available across countries on a comparable basis (there is data on gross output and value added of 'manufacturing' industries, but these data do not isolate the value created by *production activities* per se, and other contributors to value added or gross output such as R&D). Industry-specific data is perhaps the best way to glean insights about how manufacturing capabilities have diffused across countries over time. Some of the best available data come from the automobile industry. Figure 4 below depicts the changing shares of global auto production by country since 1970 as reported in Ward's Automotive Yearbook. Note that these data include all production in a country from both domestic and foreign owned factories. Also, we have included data on both passenger vehicles and trucks/buses given the increasingly blurry distinction between large passenger cars and trucks (e.g. pick-up trucks, sport utility vehicles are classified as trucks).

Several trends are apparent. The first is the relative decline, and then rebound of the US-based production. Two underlying factors drove this trend. The first was the rapid growth of the small truck/sport utility vehicle market in the US. The second was the establishment of American manufacturing plants by a number of foreign producers beginning in the late 1980s and continuing through the early 2000s (Toyota, Honda, Nissan, VW, BMW, Mercedes, etc.). The second trend is the decline of Japanese auto production—this was largely due to the decline of the Japanese market (following the crash of 1997) and a shift toward foreign direct investment by major Japanese automobile companies. And finally, in the latest period, we see the emergence of China as a major producer (virtually all production for domestic consumption). The 2010 data for European and US production are almost certainly severely impacted by the Great Recession of 2008-2010.

Figure 4 Geographic Distribution of Vehicle Production



A deeper look at individual companies reveals how heavily globalized vehicle production has become via foreign direct investment. By 1998, most major auto companies (top ten US, European, and Japanese producers) had expanded production outside their home regions. However, even then, just about all did the majority of their production inside their home region (North America for US producers, Western Europe for European producers, and Japan for Japanese producers). According to data compiled by the OICA (http://www.oica.net/category/production-statistics/2013-statistics/). Toyota, for instance, built 68% of its vehicles in Japan; GM and Ford both built 66% of their vehicles in North America. By 2013, Toyota built 41% of its vehicles in Japan; Ford built 51% of its vehicles in North America; GM's North American production volumes had fallen to 34% of its global total (in contrast, GM's production in China alone accounts for 33% of its global production by volume). While Ford built 4.4 million vehicles in North America in 1998, by 2013 it produced only 3.1 million (still a sizable figure in absolute terms). GM experienced a similar reduction in North American vehicle production between 1998-2013.

Yet, even as automobile companies have "globalized" their manufacturing footprints by expanding assembly operations to be closer to more markets, there has been a concurrent tendency to co-locate suppliers in regions with assembly operations. To pursue practices like just-in-time inventory and supply chain management, auto companies have increasingly demanded that

critical suppliers co-locate with their large assembly operations. This has led to the emergence of new clusters in places like the Southeastern US and in Oxfordshire, UK. Paradoxically, while auto companies have expanded their global footprints, their supply chains have continued to be somewhat "localized".

The case of semiconductors has both similarities and differences from the pattern of global expansion found in autos. There has been a modest decline in the global share of US production (from approximately 30% in 1985 to approximately 25% today), but since the overall market is much bigger, the absolute value of semiconductor production in the US is significantly higher today than it was in 1985.[6] Like the auto industry, US companies have broadened their global footprints (Intel, for instance, has plants in the US, Ireland, Israel, and China). However, a significant chunk of the increasing share of Korea, Taiwan, and China as semiconductor producers was driven by the emergence of "home-grown" companies (like TSMC and UMC in Taiwan and Samsung in Korea) rather than by foreign direct investment of US or Japanese companies. Unlike automobiles, semiconductors are small and relatively cheap to ship; thus plant location is not guided by the need to be physically proximate to end markets (as is the case in autos). However, like automobiles though, we also seem some geographic clustering of other parts of the electronics supply chain (e.g. production equipment, packaging and testing operations, electronics assembly operations, etc.). Globalization of the footprint of production has not necessarily meant the end of clusters—in the case of semiconductors, as in autos, it triggered the formation of new clusters (Breznitz and Murphree, 2011).

III. Theoretical background

The aggregate data presented in Section II and the specific examples of autos and semiconductors paint a more complex picture of the global manufacturing landscape that is often portrayed in popular discussions of globalization. The oft-decried de-industrialization of America is a more nuanced phenomenon. There is absolute and deep decline in some sectors (e.g.

[6] Authors' estimate based on annual percentage of revenue from North America of leading semiconductor equipment provider (Applied Materials). Source: Applied Materials 10-K report, 2014.

apparel, textiles, shoes); stagnation in others; and modest growth in some (e.g. automobiles) and explosion growth in at least one (computers and electronics). And in sectors like autos and semiconductors, we see both domestic growth in absolute terms and a decline in relative global share terms. The decline in relative global shares suggests that manufacturing capabilities are mobile. They diffuse to and take root in new geographies over time. Yet, the persistence of many types of manufacturing in places of origin (like Detroit for automobile) suggests, at the same time, a certain degree of "stickiness". Once a manufacturing capability takes hold somewhere, it tends not to leave (and once it leaves completely, it faces an uphill battle to come back).

How can this paradox be explained? There are two general perspectives to explain the location of economic activities (including, of course, manufacturing). The first is rooted in traditional trade theory and emphasizes the role of factor prices and technology 'endowments' of different locations. Such a perspective helps to explain why certain types of manufacturing have moved from high-wage developed countries to the US to low wage developing economies. It is also being used more recently to predict a large-scale return of manufacturing to the US. In a recent report on US manufacturing, for instance, the Boston Consulting Group (BCG) (2011) optimistically forecasts that due to a combination of rising wages in China and falling (real) wages and energy costs in the US, America is likely to experience of surge of "re-shoring". Traditional factor cost analysis, however, assumes that the relevant technological and human resource capabilities required for production are geographically mobile. That is, it assumes away stickiness. Moreover, traditional analyses ignore the fact that any given manufacturing industry is never an island, but is instead part of supply chains featuring other distinct industries. The location choices of any specific (say auto parts) industry depend partly on the choices of complementary upstream (e.g. metal castings, machinery) and downstream industries (auto producers). This suggests that the relevant unit of analysis for considering manufacturing location issues is not the isolated industry, but the supply chain.

A contrasting perspective to traditional trade theory is provided by theories of economic geography. Whereas trade theory is "distance free", economic geography is all about how distance matters. The first theory of geography and location in economics dates back to Alfred Marshall (1890). One of his (many) interests lied in explaining the tendency of firms from the same industry to cluster in the same location (e.g. textile firms clustering in Lancaster, England in the late 19th century). Marshall theorized three reasons why firms from the same industry would tend to locate close to one another: 1) Labor market pooling (e.g. a textile firm has an easier time finding workers with relevant skills in places where other textile firms operate); 2) Common infrastructure (firms in the same industry tend to require similar specialized infrastructure like access to water, rail networks, universities, etc.); 3) Spillovers (cross-firm learning is higher across firms from the same industry). More recent work in the field of economic geography has extended the notion of "agglomerating forces" to include increasing returns, transportation costs, and demand (Krugman 1991). Theories of agglomeration have been used to explain the presence of a wide range of industrial clusters, from Italian industrial districts and Dutch flower industry to Silicon Valley and the Boston's biotechnology sector (e.g. Sabel and Piore 1984, Porter 1990 to mention but a few).

Agglomeration economies are driven by the costs of distance. Distance costs can be rooted in factors like transportation costs and time (still relevant in supply chains like automobiles). Increasingly, the relevant costs of distance have to do with knowledge flows. In both traditional economics and in popular discussions of global supply chains, knowledge is often treated as costless to transmit. This perspective makes location irrelevant. Whether R&D is located 5 meters or 5000 meters from production, or whether two suppliers are next door or continents apart, is all the same. This perspective flies in the face of available evidence. The impact of distance on the costs of transmitting knowledge and coordination depend on the nature of knowledge and information (Teece 1976, Kenney and Florida, 1994, Pisano 1996, Pisano and Shih 2011). Knowledge can be costly to transmit if it is tacit (Teece 1976). Tacit knowledge by

definition is difficult to explain and generally only be transmitted through demonstration, trial and error, and face-to-face communication. Tacitness makes knowledge geographically sticky. Knowledge can be geographically sticky if it cannot be fully separated from knowledge about other supply chain activities. For instance, knowledge about the best way to ferment grapes into wine may require detailed first-hand knowledge of the conditions under which the grapes were grown and harvested. This characteristic is referred to "integrality" (see Pisano and Shih 2011). The converse of integrality is modularity (Baldwin and Clark, 2000). Integrality leads to co-location because it requires a high degree of interchange between people and organizations in adjacent parts of the supply chain (Pisano and Shih 2011). This suggests that geographical clustering will tend to occur in industries characterized by more tacit and integral knowledge bases.

Technology is often taken as a given in both traditional trade theory and agglomeration theory, but recent evidence suggests that distance can also influence technology choices of firms. Fuchs and Kirchain (2010), for instance, find evidence in the optoelectronics industry that U.S. firms that off-shored production were forced to use less advanced product designs than those which kept production in the US. This was caused by the different underlying capabilities of suppliers in each location. This finding implies that firms do not necessarily choose the optimal technology first and then adapt their sourcing location strategies, but in fact, may be doing the reverse: they are choosing sourcing locations and then adapting their technology to fit those constraints.

There is nothing inconsistent with theories of location decisions based on factor costs and those based on agglomeration. They represent forces pushing and pulling in the opposite direction. Factor price differentials in a global economy are a centrifugal force, pushing manufacturing from one location to another. Agglomerating forces are centripetal, pulling manufacturing back to existing clusters.

Geographic stickiness of manufacturing depends on the relative strength of agglomerating forces relative to factor cost differentials. A big enough difference in costs may well lead companies to forgo the value of being inside an existing cluster. A firm may break away from the cluster, and in so doing, the lay the seeds for a competitive cluster to form in a new location. As Krugman (1991) points out, once a cluster begins to erode, it can collapse relatively quickly due to the (negative) consequences of increasing returns.

Most discussions of agglomeration and trade take place at the "industry" level (in varying degrees of disaggregation, 2 digit, 3 digit, 4 digit, NAICS). This is a helpful assumption. However, in reality, production in any given industry typically takes place in multiple linked stages, not all of which are from the same industry classification. Take for instance the production of automobiles. Automobiles are assembled from a diverse array of parts, including fabricated metal products (e.g. the bodies, understructure, etc.), precision-machined parts (e.g. engines, etc.), molded plastics (bumpers, trim), semiconductors, electronics, fabrics (interior), chemicals (adhesives, paints, etc.), glass, and advanced materials (to name just a few). Moreover, a broad range of equipment is used to not only assemble the final vehicle, but also to make the various kinds of parts. To complicate matters further, many of the capabilities and processes required to make any given component are shared with other industries. Precision machining used to make engine parts is also a capability required for the production of aircraft, medical devices, scientific instruments, industrial equipment, and many other products. Clustering is much more complicated than, say, automobile companies locating near each other. Supply chains cross industry lines. Pisano and Shih (2012) referred to such shared supply chains and knowledge bases as "industrial commons" and cite several examples. Firms may choose to locate near others who are not necessarily in the same "industry", but draw from common knowledge bases and capabilities. Advanced display producers (like the type used in high definition TV or smart phones) and semiconductor producers tend to cluster in the same regions in Asia because both utilize similar underlying process

technologies and the same capital equipment suppliers.[7] This suggests that agglomeration forces may operate at the capability level, rather than at the industry level. We further discuss this assumption in the following section.

IV. Why Some Clusters Thrive in the Face of Globalization

Differences at the capability level seem to underpin the intra-industry variability marking the degree of manufacturing stickiness of two couples of "twin" clusters located in the same region, notably Northeast Italy, and competing in two mature yet distinct manufacturing industries: furniture and footwear.

Despite competing in the same industry (furniture) and being separated by only 30 miles, the Livenza and Manzano furniture clusters followed radically different trajectories over the past fifteen years: while the former retained most of its production activities and became Ikea's main production hub in Europe; the latter progressively disappeared from the map of European furniture clusters. Although marked by industry-specific differences, a similar phenomenon took place in the regional footwear industry, where the neighboring Montebelluna and Riviera del Brenta poles experienced divergent evolutionary paths: in past two decades the former eroded its long-established manufacturing competences by outsourcing the production of sport footwear (above all sky boots) offshore; the latter increased the competitiveness of its manufacturing base by drawing investments from several global fashion *maison* and emerged as a global benchmark for the production of upscale women's footwear.

Departing from the recognition of this phenomenon, and aiming at advancing the state of the art of both cluster theory and the geography of manufacturing and innovation knowledge, the objective of this section is to provide a meaningful answer to the questions driving this study. In this section, we compare the recent histories of two pairs of manufacturing clusters all located

[7] Pisano and Shih, 2012, page 50

within a 50km radius of northeastern Italy: 1) sport shoes (Montebelluna) and women's fashion shoes (Brenta Riviera); 2) chairs (Manzano) and case goods (Livenza). Italy is well known as an economy organized around industrial districts (clusters). It is thus an ideal laboratory in which to investigate the competitive dynamics driving cluster survival or decline. We chose this particular region because it is one of Europe's most industrialized regions (Eurostat 2014) and home to numerous Italian industrial districts that have been heavily impacted by global competition. These four clusters—sports shoes, women's fashion shoes, chairs, and case goods—offer four very different patterns of response and performance, despite being from the same region (this allows us to hold constant o 'region-specific' factors—such as wage changes, workforce shifts, taxation, etc.—that might influence cluster performance).

A Tale of Two Boots

Separated by just 50 kilometers, the Montebelluna and Riviera del Brenta have long represented Italy's most prominent loci for the development and manufacture of two specific types of shoes: professional sport shoes, including ski boots and hiking boots (Montebelluna) and women's luxury leather shoes (Riviera del Brenta). The production pole of Montebelluna developed thanks in part to its proximity to the Dolomites; in the late 1800s, local artisans began producing hiking shoes for mountain enthusiasts. During the 1900s, production expanded to other athletic shoes, including sneakers and ski boots. During the 1980s, Montebelluna gave birth to numerous globally renowned sport brands, like Tecnica, Nordica, Lotto, Diadora, and started drawing investments from major international brands like Nike and The North Face.

Like Montebelluna, the beginning of the leather shoe production in Riviera del Brenta dates back to the late 1800s, when a handful of artisanal laboratory settled down in the town of Stra (just south of Venice). Similar to the majority of the Italian industrial districts, the Riviera del Brenta flourished in the second half of the 1900s thanks to the growing domestic demand for consumer

goods items and strong exports to Germany, France, and the US.

While the origins and development of these two production hubs share significant similarities, the way they adapted to the global economy over the past two decades followed divergent trajectories. On the one hand, lead firms in Montebelluna started offshoring production to lower cost economies (first in Romania, later in China) while focusing on R&D, marketing and distribution; R&D became decoupled from production. In the Riviera del Brenta, not only did production of leather shoes remain stable, the region became a magnet for investments from several global fashion brands like Armani, Prada, Dior and Louis Vuitton. It is estimated that 90% of women's luxury shoes (priced approximately $500 and above) are produced in the Riviera del Brenta. Not only does the region manufacture shoes, but producers typically undertake a significant amount of R&D and engineering there as well.

The distinct supply chain strategies pursued by these two sets of lead firms had different effects on both the competitiveness and the size of the local production systems. This divergence is corroborated by data on the number of establishments and jobs from 2006 to 2012 in Montebelluna and Riviera del Brenta that we analyzed from the ISTAT. In order to gather detailed and accurate statistics of two very specific production hubs, we examined data from single municipalities[8] for a number of selected ATECO codes – the Italian equivalent of the U.S. NAICS code. The ATECO codes we considered in the analysis are ATECO 152 (shoes production – which we used for both the Montebelluna and Riviera del Brenta productions) and ATECO 3230 (fabrication of sport equipment – which we only used for the Montebelluna cluster). The decision to focus on the 2006-2012 period was dictated by the availability of data from the ISTAT. However, this time frame allowed us to include in the analysis data from before the 2007 crisis

[8] For each of the four production hubs, we created a list of municipalities that we deemed relevant in terms of their economic contribution to the specific regional industry we took into account. Single municipalities were selected thanks to historical data on employment and production activity that we obtained from several institutional sources, including Confindustria (the Italian association of manufacturing firms) and different labor unions.

(i.e. 2006-2007), whose effects were not visible in Italy until 2008, as well as data for the years after the deepest part of the crisis.

Data for the ATECO 152 shows a substantial decline in the number of jobs in the Montebelluna area between 2006 and 2012. The size of the local workforce fell by 15% percent over this time frame (from 5283 to 4508 employees). This downsizing was particularly sharp between 2008 and 2009 in coincidence with the financial crisis break out. During these two years almost 1000 jobs were laid off. The effects of the economic crisis on the size of the local workforce are also visible in Riviera del Brenta: a total of 472 workers were laid off between 2006 and 2008, accounting for 7% percent of the total workforce. However, in the Riviera del Brenta, employment growth accelerated over the three-year period 2010-2012 (an increase of 200 jobs or 10% growth of the overall Riviera del Brenta workforce). In contrast to sport shoe firms, shoe firms in the Riviera del Brenta continued to produce locally and seldom switched to foreign suppliers.

The divergence of the two production hubs is even more evident if we focus on the fabrication of sport equipment (ATECO 3230), Montebelluna's most distinctive activity. Between 2007 and 2012, the number of workers employed by local manufacturing firms decreased by 52% percent, moving from 910 to 432 employees. The sharpest downsizing occurred between 2009 and 2011 (during which time, employment in the Brenta area increased by 10%).

The decline of production in Montebelluna is relatively easy to explain through the lens of the trade theory. Driven by the aim of decreasing production costs, lead firms organized production in modules which they then relocated abroad. As a result, the structure of the supply chain shifted from cluster-based to fully global. This shift was enabled by characteristics of the production process and market. Athletic shoe production and ski boots are high volume processes utilizing relatively unskilled labor. Component production—like soles or the outer casing of the boot—utilize molds, which once produced can be shipped anywhere. The modularity of shoe

technology and the high degree of process codification enables lead firms to outsource production to lower cost regions like Slovakia, Romania, and China.

However, what seems to be harder to explain is why leather shoes manufacturing remains so much anchored to the Riviera del Brenta region. While it is true that such shoes are produced in smaller volumes using relatively highly skilled workers, such characteristics are by no means a guarantee against cluster decline. Italy has witnessed the decline of other similar districts in the face of global competition, including fine glass (Murano), upscale fashion clothing (Biella), design leather sofas (Puglia-Basilicata), and professional road bicycles (Veneto). Accordingly, our question is not why production in Montebelluna has gone or whether it would ever come back, but rather why Riviera del Brenta has managed to retain the bulk of manufacturing locally and has even increased its competitive advantage compared to other footwear industrial regions in developed economies, While the Montebelluna district, like many others, dwindled as a result of change in the supply chain strategy of global lead firms (Gereffi, 1994); the risk of declining for the Riviera del Brenta cluster comes from a cluster-to-cluster competition. In the case of leather footwear, competition doesn't come from lower cost regions such as China or the Far East, rather it stems from European locales specializing in footwear production, like the U.K., Portugal, and Spain.

To understand how this long-established district managed to survive and become a hotbed for innovation in the women's footwear industry, we focused on the global supply chains of upscale leather shoes and addressed the strategies of the lead firms operating in the Riviera del Brenta. By doing so, we narrowed the focus of our analysis from an industry to a firm-level perspective. In addition to providing us a finer grained spectrum of the actual dynamics underlying the evolution of the Riviera del Brenta region, focusing on lead firms' supply chain strategies allowed us to include in the analysis factors from both the local and global environments.

Our tentative hypothesis from our field research highlights the importance of three factors we identified in the introduction as well as the role played by *knowledge integrators* (KIs). A KI represents a type of firm that integrates and orchestrates different forms of knowledge from distinct geographical contexts in order to constantly develop product innovation. By exerting a direct control over the entire supply chains, a KI is able to coordinate and integrate distinct forms of knowledge that are essentials in sustaining the firm competitive advantage, as well as the competiveness of its supply chain partners. Since the type of innovation a KI pursue is typically process- or product-embedded, establishing tight connections with skilled manufacturers is a necessary condition.

While relying on skilled suppliers for the development and production of new items, a KI has a stable presence in the global market. This characteristic allows the KI to constantly receive inputs from globally dispersed sources of knowledge – like designers, R&D laboratories, sophisticated clienteles, and trendsetters – which stimulate and trigger the development of new products. Once the KI collects relevant inputs for product innovation, it transfers them to specialized producers that have both the manufacturing competences and the in-depth product knowledge to translate them into concrete new items. As a result, a KI operates as a knowledge carrier in a fragmented innovation development, collecting and bonding together different types of knowledge fundamental in the generation of innovation. KIs' continued commitment to innovation and active presence in both the district and the global market represents the first necessary condition for the survival of a manufacturing cluster.

In addition to sustaining KI's competitive advantage, product and process innovation stimulate the continuous upgrading of local producers' production know-how. More precisely, by constantly coping with new technical requirements and design specifications, local suppliers have no option but to further specialize in narrow production tasks if they are to remain the *translators* of fashion brands' innovative ideas. This process fosters the development of task-specific knowledge, which

we termed specialized know-how. Specialized know-how represents the second necessary criteria a cluster must possess to remain competitive in the globalizing economy.

Linked to this second factor is the third essential aspect we outline in this paper: the integrality of knowledge. Being highly specialized in narrow production tasks, local suppliers possess unique know-how that needs to be integrated in order to generate innovation. In addition to collecting innovative ideas globally, an effective KI is required to efficiently orchestrate a different yet fundamental type of knowledge: specialized production know-how. Since this type of knowledge is frequently fragmented and distributed among several local players, the KI must have a stable presence in the territory and possess an adequate knowledge of the production process and innovation cycle.

The description of KIs and the illustration of the role they played in encouraging the development and preservation of these three essential factors are further analyzed by the discussion of the Riviera del Brenta and Livenza districts.

In the case of the Riviera del Brenta, the two main types of knowledge at stake are the production know-how of skilled workers and suppliers and the design ideas conceived by global designers. While these two categories are today tightly connected, and they indeed thrive on a continuous exchange of knowledge. The KI integrates these two bodies of knowledge by having access to both the designers and the skilled work force and suppliers. This clearly emerges in the case of Alpha (a pseudonym), a globally renowned fashion brand which has been developing and manufacturing its upscale female leather shoes in Riviera del Brenta since the late 1990s. Headquartered in Milan, Alpha set up a production branch in Riviera del Brenta in order to take advantage of the local availability of skilled labor force. In addition to improving its production capabilities, the establishment of the Riviera del Brenta production branch allowed Alpha to foster its innovation capabilities. Local skilled workers play a crucial role in translating the design

sketches conceived by global designers in actual prototypes, which represents the basis for any product innovation. While this strategically sustains the competitive advantage of Alpha, it encourages local suppliers to further specialize in distinct production tasks, hence improving their production capability and allowing them to remain ahead from foreign competitors catch up. As much as global designers need skilled workers to translate their drawings into real artifacts, the Riviera del Brenta production system needs to continuously improve its production capabilities by dealing with challenging and heterogeneous requests from global designers. Fulfilling diverse and challenging requests, which could hardly be attracted locally without KIs, represents a chief ingredient for the survival of the manufacturing district. Not only it stimulates the specialization of local producers and their overall competitive advantage vis-à-vis other clusters, but it also makes it difficult for global brands to codify production and innovation knowledge. This creates the premises of knowledge integrality, a factor that sticks a variety of distinct production processes to the Riviera del Brenta.

Fundamental in the integration of different forms of knowledge – whether intangible from global designers or tangible from local specialized SMEs -- is the role of Alpha. Alpha acts as connecting platform for the different agents that participate in its global process of innovation development and ensures that the entire innovation process is conducted and integrated in an effective manner, from the development of design drawings and product prototypes to the introduction to the final market. Without Alpha's knowledge-integrating function, producers from the Riviera del Brenta would struggle to keep pace with the ever-changing fashion trends and would miss the opportunity to challenge and stimulate their distinctive production capabilities.

KIs currently operating in Riviera del Brenta are typically global brand-name firms, a category which comprises both Italian and foreign companies. Some of these companies were founded in Riviera del Brenta; some others joined the district over the past decade. External firms settling down in Riviera del Brenta brought investments and created new jobs, above all in the

prototyping and manufacturing functions. Furthermore, and perhaps more importantly, their presence allows local players to be inserted into global processes of value creation, thus improving their production knowledge and advancing the edge of their competitive advantage.

Going Global to Stay Local—The Cases of Seats and Furniture

Like the Montebelluna and Riviera del Brenta manufacturing clusters, the origins of the Livenza (furniture) and Manzano (chairs) hubs date back to the late 1800 when the first shops were established by local artisans. The early development of both areas was sustained by the proximity to strategic sources of raw materials: woods from the Alps (Livenza[9]) and wild canes from the Northern Adriatic lagoon (Manzano), which were used to manufacture woven seats. The two industrial areas grew remarkably between the 1960s and the 1990s, thanks to the boom of the domestic construction industry and the growth of foreign markets. Sustained by the devaluation of the domestic currency (the Italian Lira) and the production flexibility of regional production systems, exports to Germany, the U.K. and the U.S.A. during the 1980s marked the beginning of the internationalization of the furniture industry in Northeast Italy. As of the mid 1990s, one third of the chairs sold in the world were manufactured in the Manzano industrial region (Lombardi, 2013). Twenty years later, the production of chairs in Manzano has essentially almost disappeared.

The industrial data we gathered from the ISTAT indicates that the number of workers employed by Manzano chair producers decreased by 44% between 2006 and 2012, moving from 7744 to 4372 employees. Data for the most important ATECO code for furniture production (ATECO 310 -- fabrication of furniture, including case goods, chairs, and upholstered items) reveal how the downsizing of the local employment base primarily occurred in manufacturing-related activities. In this precise ATECO code, the size of the local workforce decreased by 43% with a total of 2764 jobs laid off in only seven years.

[9] Livenza is actually the name of the river through which local woodworkers sourced woods from the neighboring mountains.

The downsizing of the Manzano cluster is even more evident when we compare the evolution of this production hub to the other major regional pole for furniture production, the Livenza cluster. Located just sixty kilometers away, the production of case goods in the Livenza area remains one of the key activities for the local economy and is home to numerous innovative firms, including IKEAs largest European supplier. While severely confronted by the effects of the economic crisis, which is still affecting Italian furniture producers, the size of the Livenza furniture hub, measured by employment, remained stable between 2006 and 2012. The number of local workers involved in the ATECO 310 moved from 17553 to 17257. With approximately 300 layoffs registered in seven years, furniture production in the Livenza region proved to be resilient to both the drastic downsize of the domestic demand and the increased global competition.

How can the production of two similar items within the same geographical region follow such different trajectories? And what allowed the Livenza area to maintain local manufacturing activities alive while the neighboring chair production in Manzano was losing ground to foreign competitors? We found answers to these questions in the analysis of the supply chain strategy of local lead firms. As in the Riviera del Brenta, our field research suggests that the competitiveness of the Livenza industrial hub has been sustained by the presence of *knowledge integrators* and their impact on the development of three essential factors: lead firms' continued commitment to innovation, local suppliers' specialized know-how, and integrality of knowledge.

This process is best depicted by the case of Beta (a pseudonym), IKEA's European largest supplier and a strategic partner of the Swedish company. Beta is a manufacturing company located in the heart of the Livenza area that has been producing wooden furniture components (e.g. panels) for forty years. Before 1998, Beta was a small company (approximately 20 million euros in sales). In 1998, Beta first began supplying IKEA based on an innovation production

process for making high quality laminated woods. Beta's sales increased twentyfold over the next 15 years (Beta is now the second largest furniture company in Italy).

The tight cooperation established with Ikea encouraged the company to improve the efficiency of its production system and enhance its prototyping and innovation competencies. In addition to fueling the company's learning process, Beta's internationalization remarkably impacted on the competitiveness of the entire Livenza industrial region. In fact, Beta is still tightly linked to the local environment as it relies on some twenty specialized local suppliers and constantly hires workers from declining companies or from the local "Scuola del Mobile", Italy's oldest professional school for furniture makers. Beta sits at the intersection between global and local supply chains – namely between IKEA and small specialized suppliers operating in the Livenza area. As in the case of Alpha, Beta is responsible for connecting global sources of design knowledge to local sources of manufacturing and technical know-how, which are often difficult to codify and therefore are not readily accessible for global players like IKEA. In addition to feeding the whole local supply chain, Beta constantly encourages its regional suppliers to enhance their production know-how in order to meet the heterogeneous requirements from demanding global customers. Like in the case of Alpha, local producers are constantly asked to fulfill new requirements coming from global designers or customers, frequently developing *ad hoc* solution for specific projects. This stimulates a continuous process of specialization, which in turn creates an incentive for Ikea to keep sourcing from the district. Thanks to the innovative inputs brought to the district by Ikea (via Beta), local suppliers keep upgrading their production know-how and remain ahead from lower costs European competitors (above all Polish furniture producers). Like in the Riviera del Brenta, the more local firms specialized in narrow production tasks, the lower the likelihood of having local firms integrating vertically. As a result, each piece of specialized know-how necessary to give shape to product innovation is controlled by distinct, independent small firms. While on the one hand this requires Beta to constantly marshals locally fragmented sources of knowledge; on the other, it prevents Beta and other local lead firms from sourcing abroad. Again, Beta's commitment to product and process-embedded innovation and direct access to the global market

(Ikea) encourages local suppliers to keep specializing and upgrading their production know-how. This eventually strengthens the Marhsallian's logic of the local division of labor and specialization. Overall, these conditions represent the glue that sticks the KI (Beta) to the local production system.

While being recognized as the Livenza's largest furniture company, Beta doesn't represent the only KI in the region. IKEA in fact works with two other major companies in the Livenza, which can be considered KIs too. The Livenza furniture hub is also home to many other smaller brand-name firms that compete in the global marketplace – mainly by exporting their products to foreign markets. While marked by different business models – these companies manufacture and sell final goods under their brand name – the role played by these firms in the Livenza resembles that of Beta. On the one hand, they establish and manage complex relationships with global designers and interior decorators – which are both their customers and their first source of design inputs – on the other hand, they coordinate and marshal a local network of highly specialized suppliers.

As much as knowledge integrators contribute to foster the performance of the Livenza region, the almost complete absence of this type of firms has undermined the competitiveness of the Manzano industrial hub. Despite being celebrated by local policy makers and entrepreneurs as the chair capital of the World as late as the mid-1990s, the failure of this local industry reflects its incapacity to produce knowledge integrators. Born as OEMs, local chair producers never updated their business models and failed to move from being mere chair manufacturers to becoming knowledge integrators. While Beta remarkably invested in new production technology to meet and even anticipate the challenging requirements from IKEA, or other Livenza's brand-name producers invested in developing relationships with global designers, chair producers in Manzano kept working as OEMs for larger global buyers. Once wooden chairs went out of fashion and other materials – above all plastic – entered the market, global buyers turned to suppliers specializing in different production process. The absence of knowledge integrators prevented the

Manzano chair hub to understand the emergence of new trends in the final market and therefore to adapt existing production logics to new manufacturing paradigms. The importance of knowledge integrators is confirmed by the fact that the largest and most successful company in the Manzano area is a company that managed to complete this transition. Charlie (a pseudonym) is a manufacturing firm specialized in the production and sale of contemporary furniture, including chairs and tables. Unlike the vast majority of local firms, Charlie has been significantly investing in distribution and retail over the past three decades. This strategy allowed the company to develop a global network of retail stores, which ultimately connect the company to interior designers and customers in general. While moving "downstream", and therefore establishing a permanent dialogue with the final market, Charlie maintained a stable presence in the Manzano area where it develops and produces customized products either in-house or through specialized suppliers. As in the Alpha and Beta cases, it is the company's ability to integrate and manage different forms of knowledge that ultimately sustains its competitive advantage in the global marketplace and the overall capacity of a mature industrial region to adapt itself to the ever-changing nature of international competition.

Other research on other Italian industrial districts has echoed similar themes. Lorenzoni and Ornati (1989) were among the first to highlight the key role of "leading-firms" in orchestrating the technical and operations of smaller sub-contractors inside Italy's industrial districts. In a later study of Italian districts producing shoes, leather goods, clothing, and furniture, Lazerson and Lorenzoni (2008) found that the most successful lead firms in the district were generally focusing on building distribution and marketing capabilities in global markets, even while shifting a growing share of production outside the local districts. They were, in the words of Lazerson and Lorenzoni, 'escaping the manufacturing cage." Lazerson's and Lorenzoni's "leading firms" share in common with our knowledge integrators a connection to the market. However, as the case of Beta (furniture) shows, access to the market does not necessarily have to occur through direct integration, but may well be achieve via partnerships with existing multi-nationals (such a strategy

comes with obvious transaction cost hazards). And unlike Lazerson's and Lorenzoni's "leading firms", our knowledge integrators are deeply focused on building local manufacturing capabilities through collaboration with and investment in local suppliers.

The contrast between "leading firms" (who focus on accessing markets) and *knowledge integrators* (KIs) (who attempt to connect global markets with local clusters) is also illustrative of how different supply chain strategies may impact cluster performance. The strategies of sport shoe firms in Montebelluna followed closely the "leading firms" model presented by Lazerson and Lorenzoni (1999). They focused on design and marketing, while outsourcing production to low cost locations; the manufacturing cluster atrophied not because another cluster became more competitive, but because the supply chain shifted from cluster-anchored to global (through the actions of firms). In contrast, in both Riviera del Brenta and Livenza, knowledge integrators have thus far played a key role in both accessing global markets and deepening capabilities inside the local manufacturing cluster. Whether manufacturing is geographically sticky depends, at least in part, on whether firms make it that way.

V. CONCLUSIONS

Can clusters survive globalization? The analysis contained in this paper suggests if agglomeration forces are strong enough, we should still expect to see supply chains that cluster geographically. Tacit knowledge, complex coordination requiring fast adaptation between suppliers-buyers along the supply chain (such as one see with JIT systems), and the need for frequent face-to-face problem solving, all create a cost of distance. These forces protect existing clusters, but they by no means guarantee the survival of a specific cluster. Agglomerating forces,

like factor costs, are dynamic. As technologies and processes mature, knowledge may become more standardized and codified, reducing the advantage of close proximity between players along the supply chain. In some instances, firms pursue strategies specifically to reduce agglomerating forces to enable a more competitive, global sourcing strategy. This was the case in the Montebelluna sports shoe district in Italy. Lead firms focused on designs and processes that enabled the supply chain to be disaggregated.

But even where agglomerating forces persist, an existing cluster can still be destroyed by the emergence of a new, competitive cluster elsewhere in the world. This is not a new phenomenon. Perhaps the most recent example occurred in the consumer electronic industry. The US and Europe in the post-war period fostered strong consumer electronics clusters (specifically television, radio, and stereo equipment). As the technology matured, and market growth stagnated in the 1960s, US firms began to outsource some component production to Japan (at first) and other parts of Asia (later). Eventually, Japan, Korea, and China developed their own strong consumer electronics clusters that achieved a competitive advantage over the American and European clusters. The US and European clusters declined not because co-location became unimportant, but because new stronger clusters beat them.

Our study is highly preliminary and clearly more works needs to be done to understand the dynamics of cluster rise and decline, and cluster-cluster competition. Our case studies offer some illustrations of how clusters in one specific region have risen and declined, but more cross-sectional, longitudinal analysis of large data sets are needed. Creating such a data set would be a big step forward, and we hope in our future work to tackle this challenge.

Our implications for policy and management at this stage can only be very tentative given the preliminary nature of the work. While offering all the usual caveats, we believe our analysis highlights a number of issues for policymaker and managers to consider. The first is that cluster

decline is not an inevitable consequence of globalization. Manufacturing can be sticky geographically. However, given global competition, manufacturing capabilities cannot be static. Investment in process know-how, infrastructure, worker skills, and other critical elements of the local 'industrial commons' (Pisano and Shih 2012) are essential for any cluster to remain vibrant. Access to a strong cluster can be a source of advantage for firms with global market access. Preserving the industrial commons supporting the cluster may not only be good for the local economy, but can be a competitive advantage for the firm as well.

Second, once an industrial commons has eroded and a supply chain has disaggregated, it is very difficult to rebuild. Currently, there is discussion in US policy circles and in some US companies about the importance of "rebuilding" American manufacturing. Various cities and regions (including Detroit) have launched local manufacturing initiatives. Detroit is now home to several social entrepreneurs who are trying to rebuild the manufacturing base there through manufacturing start-ups (e.g. Shinola Watch Manufacturing). Our analysis suggests that such initiative require two things to be successful. The first is access to a large market (fortunately, for US based firms, the US market is often large enough to achieve the necessary threshold). The second though is a local base of suppliers and skilled workers who *together* provide a unique set of capabilities. The power of the cluster is in the integration, not in the separate pieces. Government policies should be careful not to focus on "local" manufacturing in contexts in which the required capabilities are not local. A good example is the US Federal Government's current National Institutes of Manufacturing Initiative, which seeks to establish focused manufacturing "hubs" in a variety of regions, each focused on a specific type of manufacturing process (e.g. 3D printing in Youngstown, Ohio). Considering that that the capabilities in many new manufacturing technologies are highly diffused geographically, it is a mistake to use these institutes to build local manufacturing networks. Local only has an advantage in the face of deeply embedded knowledge and high agglomeration forces.

As we saw from our case studies, the preservation of a cluster is not completely exogenously determined by changes in factor prices or by changes in technology. Firm strategies make a difference. In particular, knowledge integrators are needed to build a bridge between global market access and local embedded knowledge. Early writings on clusters (e.g. Sabel and Piore 1984) focused on the internal cohesion and deeply embedded social ties. But our case studies along with those of Lazerson and Lorenzoni (1999) suggest the opposite: to survive, clusters cannot be insular. They need to be externally focused on global markets and be open to technology and innovation from elsewhere. Bringing this global focus to the local cluster is the critical job of the knowledge integrator.

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