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STILL STICKY AFTER ALL THESE YEARS: THE RESURGENCE OF MARSHALLIAN DISTRICTS IN A WORLD OF GLOBAL PRODUCTION NETWORKS

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Abstract: In the last two decades many integrated manufacturing districts have declined. The rapid rise of globally fragmented production has increased competition and provided alternate sources of inputs and technology, encouraging regions to specialize in narrow slices of the value chain. Agglomeration of a single production phase is considered valuable, but the benefits of general co-location are no longer as certain. Nonetheless, in parallel to the rise of stage-specific districts, several established districts focused on traditional industries continued to thrive, and new ones, focusing on new industries, have emerged. Drawing upon insights from three schools of thought: the Markusian logic of multiple evolutionary district models, strategic coupling, and the production of semi-public goods, this paper inquires into the conditions under which integrated-production district can continue to thrive and innovate. Utilizing two case studies, an old Italian district focusing on traditional industry – Brenta's luxury women's shoe district, and an emerging district focusing on high technology – Dong-Zhen's smartphone district, we demonstrate that four conditions seem to be critical: lead firms focus on production and process innovation, and not on novel-technology innovation, specific institutionalization of strategic coupling with the leading MNEs, and public-private partnership in the supply of both unique and hard to imitate semi-public goods, such as specialized human resources, as well as the sustainment of the complete chain of production within the locale.

Keywords: globalization, innovation, interfirm cooperation, manufacturing districts, production, semi-public goods

Introduction

In the early 1980s scholars began building on, and revising, Marshall's (1890) work on industrial districts. Marshallian districts, in which industrial organization is marked by thriving local concentrations of interconnected, specialized manufacturers and service providers, offered an alternative model to Fordist mass-production (Piore and Sabel, 1984; Pyke et al., 1992; Sabel, 1989). However, falling transportation costs and rapid advances in information and communication technologies in the 1980s and 90s, led many firms to divide their manufacturing processes into discrete stages, or modules, which were then outsourced and/or offshored (Sturgeon, 2000, 2002). Accelerating global fragmentation, and the rise of global production networks (GPN) with their lower costs and greater efficiencies seemed to undermine the rationale for locally-integrated industrial organization (Coe et al., 2008; De Marchi and Grandinetti, 2014). The economic rationale for fragmented production, scholars argue, diminishes the logic of co-locating firms performing all stages of production (Breznitz 2007a, 2007b; Gereffi et al., 2005; Gereffi and Korzeniewicz, 1994; Sturgeon, 2002).

Researchers point to the decline or collapse of locally-integrated districts like Italy's Manzano furniture and Arezzo gold jewelry districts as evidence for the weakness of the traditional Marshallian district (Buciuni and Pisano, 2018; De Marchi and Grandinetti, 2014). Stage-specific industrial districts are seen as an alternate approach to local industrial organization (Breznitz, 2007a; Breznitz and Murphree, 2011; Buciuni and Finotto, 2016; Schmitz, 1999). The trend of stage-specific concentration is apparent in high technology industries where industrial districts increasingly focus on thinly sliced stages of the value chain including Silicon Valley (R&D and architectural design), Hsinchu in Taiwan (high value component production), and Bangalore in India (software production) (Breznitz, 2007b; Lorenzen and Mudambi, 2012).

Nonetheless, there are both newly-emergent and long-standing locally integrated industrial districts which continue to thrive in diverse high and low-tech industries (Amin and Thrift, 1992; Breznitz and Buciuni, 2015; Murphree et al., 2016; Tang et al., 2016). This presents a puzzle: if the logic of globalization and existence of global production networks encourages industrial districts to narrow their scope and firms to seek global linkages for inputs, markets and knowledge, what accounts for the resiliency and emergence of some locally-integrated industrial districts?

Markusen's (1996) and Amin and Thrift's (1992) research offers the contours of an answer, demonstrating that multiple successful models of industrial districts have always existed. Following this logic, it follows that the rise of GPNs should lead to many different and successful co-evolutionary paths. As in Santa Croce (Amin and Thrift, 1992), local integration may give way to narrow specialization but stage-specific districts are just one possible model. Since we try to understand the resiliency of some modules we also build on research that highlights the importance of tacit cooperation between local government and industry and the provision of semi-public goods for the viability of locally-integrated industrial districts in the globalized economy (Breznitz and Buciuni, 2015; Murphree et al., 2016; Tang et al., 2016). Lastly, we look at the literature of strategic coupling to understand the different logics of global-local interactions within an overall system of GPNs (Coe et al. 2004; Yeung 2016).

Building on those three theories this paper deepens and extends their arguments through structured comparison of two radically different, yet successful, cases of locally-integrated manufacturing districts: China's mobile telephony production district straddling adjoining parts of the cities of Dongguan and Shenzhen (Dong-Zhen), and Italy's Riviera del Brenta (Brenta) footwear district.

Comparison of these cases creates a comprehensive perspective for how locally-integrated industrial districts can thrive in a world of GPNs. Their differences in region, history, development and industry make their commonalities more apparent and likely causal. Four characteristics must be present: 1) A particular mode of strategic coupling that facilitates connection and openness to GPNs for knowledge, demands and inputs, 2) emphasis on production-innovation, instead of novel technology innovation, 3) the supply of semi-public goods provided through public-private cooperation with active understanding and leadership of local government officials, and 4) a locally-integrated production chain which reinforces the firm-level benefits of the other three factors. This paper focuses on how and when this mutually-reinforcing dynamic allows locally-integrated production modes to be sustained within an economic system of GPNs. We call this model Globalized Marshallian Districts (GMD). As this paper demonstrates GMDs thrive because, rather than in spite, of the forces of globalization and locally-integrated production.

In understanding how locally-integrated industrial districts can remain relevant in a world of globally fragmented production, this paper contributes to the recent literature on the continued value of co-location that aims to explain the spatial evolution of firms, networks, and industries using an explicit dynamic perspective (Boschma and Frenken, 2006; Broekel et al., 2015; Hervas-Oliver et al., 2017). We shed light on the micro-dynamics of firm agglomeration in today's economy (Boschma and Frenken, 2011; Cooke, 2005; Narula and Santangelo, 2009) and the co-evolution of firms' strategies and territorial institutions (Boschma and Frenken, 2006).

In this paper, we first provide a background on industrial districts and their evolution in the global economy as well as changing understanding of their role in shaping firm capabilities. Next, we describe our methodology, detailing the fieldwork and comparative approach used to

analyze the cases. We then present the Dong-Zhen and Brenta cases, highlighting their development and defining features. In the discussion, we summarize the results of structured comparison of the two districts, raising implications for public policy and firm strategy and avenues for future research.

Theoretical Background

Economic geographers and international business scholars have long studied the impact of distance on firm behavior and performance, studying, for example, multinational enterprises' (MNEs) location choices for specific activities (Mudambi 2008). Studies of industrial districts in the United Kingdom, Silicon Valley, Portugal, Spain, and Northern Italy have shown that agglomerations of firms in similar industries facilitate knowledge transfer among co-located firms (Basile, 2001; Buenstorf and Costa, 2018; Hervas-Oliver et al., 2017; Marshall, 1920; Saxenian, 1994; Sturgeon, 2003). Integrated industrial districts promote development of unique competitive advantages resulting from creation and sustainment of local networks of final brands, original equipment manufacturers (OEMs), suppliers and supporting industry (lawyers, venture capitalists, human resource managers, etc.). Industrial districts have also been historically characterized – even more so in recent years – by the important role of lead or anchor firms (Buciuni and Pisano, 2015). Co-location of major buyers may even be essential for success of an industrial district (Breznitz and Taylor 2014; Walcott 2003). The local source of demand and local provision of product or technology architecture facilitates the region's "stickiness."

Industrial districts offer a variety of sustainable competitive advantages to their constituent firms. Among the most critical are knowledge spillover and social benefits stimulating new firm formation and collaboration (Buenstorf and Costa, 2018; Hervas-Oliver et

al., 2017). Cooke (2005) finds that regional concentrations of industries and firms remain competitive through knowledge spillovers. Geographic proximity is critical in connecting firms – incumbents and new ventures – with centers of knowledge, such as a university or R&D center, and hence, providing a local source of knowledge and innovation (Lofsten and Lindelof, 2002). Going beyond the general spillover effects from neighboring firms or knowledge centers, industrial districts have been shown to offer a further premium in terms of access to R&D subsidies through helping firms become better embedded in networks of subsidized R&D (Broekel, 2015).

However, not all scholars find unique or non-replicable advantages from industrial districts. Narula and Santangelo (2009) find that co-location of firms may encourage collaboration, but collaboration or alliance formation can also facilitate long term sharing and interaction, even without co-location. Geographic proximity may not be necessary nor sufficient for encouraging collective learning (Boschma, 2005; Tamasy, 2007). Proximity and knowledge spillovers among firms can also produce over-embeddedness, leading to knowledge lock-in and narrow-mindedness (Bathelt, 2004; Boschma, 2005).

Historically, industrial districts contained whole industries (textiles and garments in Lancaster, computers in Boston) with an entire co-located production chain. Yet production of goods and services has significantly changed since the 1980s as industrial organization has evolved into new paradigms. The international fragmentation of production and proliferation of global production networks (GPNs) challenge the Marshallian industrial district model and promote emergence of new models of industrial organization (Arndt and Kierzkowski, 2001; Coe et al., 2008; Ernst and Kim, 2002). Accordingly, industrial districts are becoming nodes

within GPNs – connected by knowledge and trade channels (Sabel, 2004; Mudambi, 2008; Lorenzen and Mudambi, 2012).

Central to the logic of GPNs is the role of lead MNEs' in stimulating and shaping global fragmentation of production (Coe et al., 2008; Gereffi et al., 2005). No longer anchoring industrial districts in their locality, MNEs coordinate global networks of suppliers and subsidiaries. Breaking production into distinct modules and global sourcing led industrial districts to specialize not just in specific industries, such as semiconductors, but in specific stages of production within an industry, such as R&D, fabrication, or assembly (Breznitz, 2007a; Breznitz and Murphree, 2011; Buciuni and Finotto, 2016; Schmitz, 1999). Thus, a new model of narrowly focused industrial districts emerged.

The focus on GPNs controlled by lead MNEs and non-local connections between firms eroded the competitive advantages of locally-integrated industrial districts. With the entry into the global economy of millions of low-wage emerging economy workers, longstanding industrial districts faced decreasing competitiveness from their higher production costs. Perceiving declining competitive advantages gains from integrated co-located production, many traditional districts have declined or narrowed their focus to specific stages of production. Declining or collapsed locally-integrated industrial districts can be found in both developed and developing countries, for example Italy's Manzano furniture and Arezzo jewelry and China's Houjie shoe and Kunshan notebook computer districts (Buciuni and Pisano, 2015; De Marchi and Grandinetti, 2014).

However, stage-specific focusing or decline should not be the only two evolutionary outcomes. A quick survey of production across industries suggests that many locally integrated districts continue to thrive, and new ones have successfully developed. In Italy, locally-

integrated districts specializing in furniture in Brianza and Livenza and eyewear in Belluno have remained competitive (Breznitz and Buciuni, 2015, Buciuni and Pisano, 2015; De Marchi and Grandinetti, 2014). Within the context of GPNs, new locally-integrated districts have also emerged producing garment buttons in Qiaotou, China (Rasiah et al., 2011) and wine in Mendoza, Argentina (McDermott, 2007).

The literature is thus ambiguous, with conflicting perspectives on the viability of locally-integrated districts in the context of GPNs. Much of the literature on industrial districts also studies them in isolation, considering their internal dynamics without considering how their linkages to the global economy shape their internal cohesion and competitiveness. Given the challenges presented by international fragmentation and competition, understanding these forces is critical. Accordingly, this paper provides clarity by exploring how, and under what conditions locally-integrated industrial districts can emerge or endure in a world of GPNs. Building on earlier research on the sustained competitiveness of GMDs (Breznitz and Buciuni 2015, Buciuni and Pisano 2015; De Marchi and Grandinetti, 2014), this paper aims to further understanding of when and why a locally-integrated industrial district can still emerge and thrive, by exploring how geographic proximity with global connectivity is critical for the competitiveness of specific kinds of production and innovation.

Methodology

Existing research has considered the evolution and success, or failure, of traditional established industrial districts; research has also considered the emergence of new districts. Similarly, existing research has considered low technology or high technology industries but rarely in comparison. This paper takes the next step by comparing between these types of

districts: the traditional Brenta and high-tech emergent Dong-Zhen districts. By comparing such different cases, yet those exhibiting a common outcome, we are able to show a more generalizable set of factors leading to continuing or new success for locally-integrated industrial districts. The Brenta case in Italy is an example of successful evolution in response to global pressures, shifting patterns of demand and new patterns of innovation. Dong-Zhen represents a successful Chinese industrial district, one with both global and local leading branded firms, thus representing a district which has successfully moved beyond low-cost agglomerated commodity manufacturing.

The case study method has been found to be appropriate for analysis of specific regional characteristics from a dynamic perspective (Boschma and Frenken, 2006). Studies of industrial districts and practices of geographically proximate firms have long used case studies in examining inter-firm interactions, spillovers and agglomeration effects (Bradshaw and Wallace, 1991; Glaser and Strauss, 1968; Rouse and Daellenbach, 1999). Further, the case method is particularly well suited to structured comparison as fieldwork can yield sensitive and consequential data which might not otherwise be available in public datasets (Rouse and Daellenbach, 1999; Coviello and Cox, 2006; Wright et al., 1988)).

Data was collected from fifty-seven semi-structured interviews, as well as site visits, review of firms' private archives, and secondary publications. We interviewed founders, managers, research institution directors, government officials, and trade groups, split evenly between Dong-Zhen and Brenta. Twenty interviewees granted permission to tour their facilities and observe production, design and business activities. Semi-structured interview data enabled thick descriptions of the product development process and the specific tasks each organization performs, allowing us to construct the local production chains' organization. Documentary

evidence included designs, prototypes, materials bills, and product catalogues, complementing the interviews and helping reconstruct the evolution of innovation trajectories, product portfolios, and value chain management. Table 1 summarizes the data sources.

<<Table 1 About Here >>

Table 1: Data sources and analytical use

Primary data	**Data Source**	**Analytical Use**
Interviews	Semi-structured interviews: Dong-Zhen 4 company founders or presidents 15 company VPs or GMs 6 government officials 2 industry association representatives Riviera del Brenta 16 company founders or presidents 9 company VPs or GMs 2 government or research institution managers 3 industry experts and professionals	Reconstructing historical evolution of companies operating in the districts, their model of innovation and their relationships with established with local actors; triangulating evidence; validating narratives; obtaining a wider representation of product development processes; validating codes
Company visits	Dong-Zhen: 10 production plant/office visits Brenta: 10 production plant/office visits	Understanding operational context; observing innovation processes
Field notes and transcription	Field notes, transcriptions, and recordings of interviews. Verbatim transcription of interviewees explaining their tasks in product development processes.	Producing thick descriptions of product development process and specific tasks each actor performs; in-depth description of local organization of the production chain
Secondary data		
Firms' private archives and industry/market reports	Assessment of firms' designs and product prototypes, bills of materials, and product catalogues	Reconstructing evolution of firms' innovation trajectories, product portfolio, and value chain management

Interviews lasted sixty to ninety minutes and were conducted in Italian or Mandarin per interviewees' preferences. Interviewees elaborated on their areas of expertise and understanding, creating different areas of emphasis and detail depending on the speaker (Gligor et al., 2016; Eisenhardt, 1989; Wright et al., 1988; Yin, 1989). All interviews, however, addressed a common set of research themes allowing for comparability across the interviews: self and firm

introduction, markets and customers, suppliers and vendors, innovation, and government relations.

After the interviews, the research team transcribed and translated notes into English. We exchanged interview notes and transcripts so a different scholar from the interviewer would analyze the data, allowing for results to be independently sorted. We sorted quotes by theme categories and then sub-categories determined by their content such as finance, state subsidies, export markets, and alliances. From these sub-categories, the team regrouped the data into higher order themes determined by the interviews' content.

Using the method of similarity we compared the cases. We held the outcome (successful locally integrated industrial district) constant and eliminated areas of difference between the regions, leaving a handful of common variables. The following section details the findings from the field, following the development trajectories of the industrial districts, and introducing their areas of commonality.

The Dong-Zhen Mobile Phone Industrial District

The Dong-Zhen mobile phone industrial district consists of the adjacent cities of Shenzhen and Dongguan in Guangdong Province. The region was agrarian, poor and underdeveloped before China's Reform and Opening (Vogel, 1989). It developed through export-oriented industrialization: producing garments, shoes, toys, sports equipment, handbags, and electronics. Foreign investment drove thirty years of double digit economic growth. Production of mobile phones began in the mid-1990s, accelerating in the 2000s.

Since 2008, Dong-Zhen's manufacturing sector has faced great challenges. Labor costs have risen rapidly. Many MNEs have closed their facilities: Nokia's mobile phone plant closed

in 2015. Samsung shifted most phone production to Vietnam. Many of the more venerable Taiwanese electronics suppliers are struggling; an estimated thirty percent of the 400 leading Taiwanese firms closed or relocated between 2012 and 2016. Firms contracting with MNEs have seen orders reduced by up to ninety percent. Nonetheless, mobile phone production remains robust. Dong-Zhen remains home to the world's 2nd, 3rd, 7th, 8th, and 10th largest mobile phone brands or producers: Foxconn (Apple), Huawei, ZTE, Oppo and Vivo. In 2017, mobile phone output increased five percent, exports increased over thirty percent, and mobile phone and computing FDI increased nearly twenty percent. The comprehensive local production chain, upgraded through meeting sophisticated overseas clients' demands, focus on incremental and production innovation and reliance on focused local government support, has sustained the industrial district over time.

Mobile phone production requires integration of thousands of components from hundreds of suppliers, amassing and assembling components in a single location with extremely tight deadlines and very low error tolerances. Smartphones utilize technologies from multiple sectors including wireless communications (digital signals processing chips, receivers, antennae), computers (CPUs, PCBs), material science (screens, cases, glue), and software. Final assemblers or brands draw upon sub-system suppliers (motherboards, screens, batteries, power supplies) working for multiple clients. Sub-system suppliers rely on an even larger network of electronic and plastic components producers making discrete, often commoditized, parts. The highest single value-added components are the integrated circuits from specialized firms like QUALCOMM and MediaTek.

Dong-Zhen's electronics industrial district began in 1979 with establishment of Hong Kong electronics firms' first assembly plants. Taiwanese firms such as Primax followed in the

late 1980s. Producing components and peripherals for the personal computer industry, Taiwanese manufacturers encouraged or demanded that their suppliers follow. Most notably Delta, a maker of power supplies and one of Apple's core suppliers, mandated 300 of its Taiwanese suppliers co-locate in Dong-Zhen. As one Taiwanese supplier explained: "Between thirty-five and forty percent of our total sales go to Delta so we had to come here. In 1998, we closed our factory in Taiwan and moved here completely."

In the 2000s demand began exceeding these relocated firms' capacity. Individual entrepreneurs utilize this opportunity by establishing component suppliers and contract manufacturers to pick up overflow orders. The rush to establish these firms was so great, that a government official noted:

> The mid-2000s were epic. In 2005 and 2006, every day new foreign investors arrived seeking investment permits for Chang'An (a township in the region). The population exploded. On Sundays outside the factory buildings, you couldn't see the road, just people.

The local system further matured as experienced workers also started turning into entrepreneurs. A founder of a mobile parts company explained his journey from assembly line worker to factory owner:

> I started work at a Taiwanese electronics factory in 2000. After five years, I left the factory to start my own business doing the same thing I did on the line. My former boss liked me so we cut a deal to subcontract plastics production work to me. Basically, what allowed me to become an entrepreneur was that I became his subcontract OEM.

By the 2000s, Dong-Zhen mobile telephones manufacturers could source almost any electronics component from producers within a three hours travel radius. The region had developed a complete electronics production chain of MNEs and domestic firms. This was the specific intention of local government officials who came to see the completion and perfection of this local production chain as central to their regional competitiveness strategy. In an interview a top official stated:

> It is not policy per se that makes companies wish to invest here. Rather the location for investment is determined by the production chain and supplier network. Dong-Zhen has a nearly complete computer production system which means investors want to set up here. The suppliers and customers for component manufacturers are close. This is why we focus on ensuring that the complete production chain exists and is sustained here.

Small, large, and foreign factory owners all agreed:

> In Dong-Zhen, the production chain is excellent. If you are looking for some component, it is here. Some specific service, it is here. Anything you need, it is here. Even things you cannot think of in advance, they are already here. (Small Indigenous Component Manufacturer)

> Looking around China at the electronics industry, Dong-Zhen's production chain is the most complete. The advantage is that it is between Hong Kong and Guangzhou – in the middle of the Pearl River Delta region. This is the center of the electronics production chain. So for the next five years at least, the Dong-Zhen electronics sector will still be in good shape and able to keep developing. (Large Contract Assembly Firm)

> Whatever you want to make, you can find the parts immediately in this area. If our factory was in Vietnam, the components would not be there. This would be bad for a firm like ours. General production might be able to go to Southeast Asia but R&D, new product manufacturing, this is the best place to be. The chain is complete. (Foreign Component Manufacturer)

Utilizing the electronics supply chain, mobile phone production began in the 1990s. Labor and component availability motivated leading contract manufacturers Foxconn (1994) and Flextronics (1994) to invest. Samsung (1992) and Nokia (1995) opened Dong-Zhen's first global mobile phone brand factories. Local telecommunications hardware firms Huawei and ZTE started producing mobile phones in the late 1990s. Other indigenous electronics brands followed in the 2000s, even when government officials were not convinced that local firms could compete in branded phone production. A manager of what became one of the world's top brands explained the transition his company took:

> Until 2008, we manufactured DVD players but sales were falling. We saw that the mobile phone market had a lot of potential after conducting a market research survey. So we started making phones. Government visitors to our factory thought this was a stupid idea because 'No one will buy a domestic branded phone'.

From 2008 to 2012, Dong-Zhen's Huaqiangbei area was the center of production for *shanzhai* (pirate) mobile phones. These used standardized chipsets from MediaTek and standardized internal configurations, differentiating themselves through peripheral hardware innovations. Made by small companies – sometimes a handful of young engineers assembling the phones themselves – *shanzhai* phones incorporated variegated hardware innovations: multiple SIM technology to reduce user costs by automatically switching between SIM cards depending on the caller's network, large keyboards for senior citizens, lights for the hearing impaired, broadcast radio and TV receivers, and even counterfeit money detectors.

The *shanzhai* phenomenon collapsed as quickly as it emerged. However, the same conditions that enabled small firms to make *shanzhai* phones, supported the ongoing and increasingly sophisticated efforts of large electronics companies and former *shanzhai* firms to launch independent smartphone brands. A founder of a *shanzhai* firm – now a leading global brand – explained:

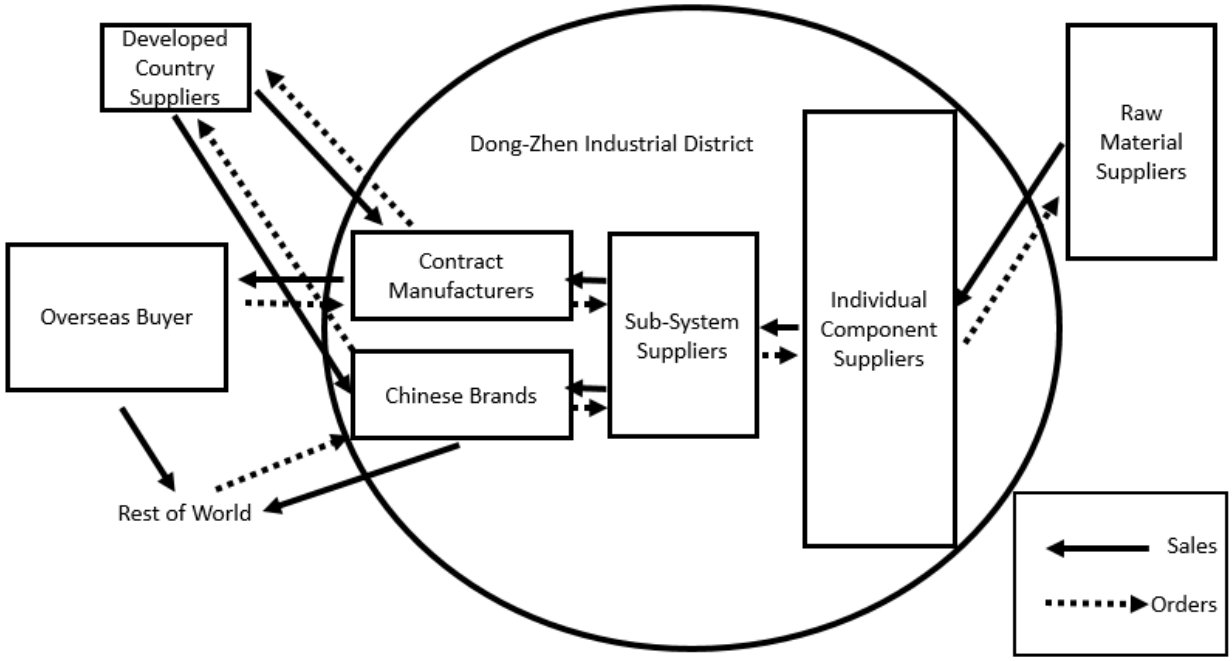
> In 2009, the local branded phone market took off under the influence of the hardware-based *shanzhai* phones. But with the arrival of smartphones, this quickly changed. We found out, however, that our technology was good enough and we were able to start making "real," meaning not just *shanzhai*, smartphones.

Interviewees explained how smartphone production works in Dong-Zhen. As shown in Figure 1, all the components and inputs, apart from raw materials such as plastic pellets or metal ingots and specific high-end components such as integrated circuits sourced from global leaders (Intel, AMD, ARM, QUALCOMM, MediaTek, Samsung), are produced and traded within Dong-Zhen. Leading domestic smartphone brands (Huawei, ZTE, Oppo, Vivo) and major contract assembly firms (Foxconn, Huabel, and Flextronics) perform final assembly. Dozens of first tier suppliers such as Delta Power Supplies, Janus Precision Components, and Aocheng PCB produce sub-systems for brands and contract assemblers. Hundreds of individual

component suppliers make the specific parts on which sub-system suppliers draw. For example, Lasing Technology produces USB adaptor power plugs, GEM Terminal Industrial Company makes the teeth and grooves of plug connectors, and He Kang Technology produces the metal and plastic parts for plugs.

<<Figure 1 About Here >>

Figure 1: Supply Chain and Production in Dong-Zhen Industrial District



All interviewees highlighted the benefits from a complete local supply base: delivery time, quality control and availability. However, firms and government actors did not passively wait for the benefits from the locally-integrated supply chain to accrue. All actors actively seek to promote their own, and the region's, capabilities.

Further, all are acutely aware of the importance of global strategic coupling. Since so much demand flows from overseas buyers, many of the component or sub-system manufacturers in the district make their output to their exacting specifications. Foreign brands drive many of the

development trends in terms of mobile phone architecture and materials. A publicly-traded sub-system supplier explained:

> We make components like cases, backing, antennas, switches, buttons, and glass for Samsung, Huawei, Oppo, Meizu, ZTE and TCL and are trying to get into Apple's supply chain. Due to the demand of our foreign customers since late 2013 we have been shifting our product lines from plastic to metal. This then immediately translated to local brands purchasing metal (which is of higher value and more difficult to make). So global demands force the local system to constantly upgrade. Indeed, think about the impact in related industries – to facilitate the change to metal we've purchased 3,000 domestically produced computer numeric controlled machines.

Meeting foreign requirements requires constant upgrading of Dong-Zhen's suppliers' quality to meet global standards. Upgraded suppliers sell their improved components to other customers since most components are standardized. As a result, local smartphone makers have access to the same components and technology as the most advanced global firms. A local smartphone firm explained:

> Everything we need to make phones is here. We do design some of our own core hardware but we buy a lot of our components from the market. For example, we use the same mobile phone glass company as Apple. The suppliers here have to work under the strictest customer requirements of the leading global technology companies. This raises everyone's capabilities.

As the transformation from *shanzhai* to smartphones demonstrates, firms in Dong-Zhen rapidly respond to market stimuli and successfully employ incremental and process innovation. This strategy works especially well in mobile phones as these have a standardized platform architecture. Dong-Zhen's indigenous smartphones – from leaders like Oppo and niche brands like Anycool – are all based on the Android OS, ARM's CPU, and Qualcomm or MediaTek chipsets. Dong-Zhen brands, like their *shanzhai* predecessors, innovate atop these platforms. Representatives from a manufacturer's association explained this business model:

> Real core innovation or platform development, like making a CPU, most of which are ARMs, or a Mobile OS like Android, is really hard. Few companies in the world can do it. So our companies do second, third or fourth generation innovations atop these platforms.

A top local brands' vice president elaborated:

> We don't care about developing our own chips. Let those firms who are good at doing those things do that. It is very difficult for newcomers to jump into chip design because they lack experience, R&D capacity, and capital. So, we focus on integrating existing technology into a good product. China is good in the application of technology, but it does not have a lot of capabilities in fundamental technology because the timeline for such projects is long and the investment requirements are high. We focus on business models that utilize what China's innovation capabilities excels at.

Improvement and recombination of existing technologies and components forms the basis of product innovation. A Dong-Zhen mobile phone industry association representative gave an example he particularly liked:

> One local innovation was the 'Apple skin' – a device which could turn an iTouch into an iPhone. This product consisted of a shell, battery and chip which completed the package. When attached to the back of an iTouch, it could be fully used as a phone. This was developed and produced by a company here.

A key emphasis was on speed and turnover of new, incrementally differentiated, phone models. Lest imitators challenge a market niche, brands opt to release many models in relatively short times. A small brand explained its approach when it first began producing smartphones:

> Our strength is rapid speed and ability to tack on extra capabilities for a phone. We develop between twenty and thirty models a year, all of which make it to market. About two-thirds make money and one-third fail. At this speed, even if someone copies your phone, you already have the next model ready. This keeps you on top of the market.

Component producers seek competitive advantage through production process R&D. Interviewees noted they receive patents in production organization, automation, and materials – or specific skills such as mold making – not for the standardized components themselves. Others observed that since development of the components themselves was done elsewhere, particularly Taiwan, reducing production time and cost per unit was the major focus for R&D. A component manufacturer explained:

> Most of our new product research is done in Taiwan. Our major focus here is on production innovation. For us, it is great if we can increase the number of pieces per minute coming off the line. Our product work is mostly incremental development. We just do development or production improvement so it doesn't count as innovation if you

> look at official statistics, but then again we care about the market, not the Ministry of Science and Technology's innovation metrics.

For innovation and competitive support, Dong-Zhen firms have come to rely on polices from local governments. Interviewees emphasized three major areas in which local authorities have provided significant assistance: real estate and facilities, subsidies, and human resource development.

Since 1978, authorities have constructed and leased factory buildings and industrial parks. Even today, startups rely on renting government-owned industrial space. All startups we interviewed rent their production space from local governments. Even top brands such as Vivo rent much of their production and laboratory facilities from the local government. Additionally, local authorities have provided policy certainty to encourage firms to build their own facilities. With unclear formal property rights in China, particularly in the 1990s, local authorities' assured firms they would have locally enforceable property rights. This convinced some foreign, especially Taiwanese, firms to make long-term commitments:

> In 1995, the township government offered to let us buy the land and build the factory. This was a big incentive to invest. In the future, we will stay here. We bought and built this factory so we will stay here for the long-term. It would be a waste to move.

Government planning also makes space available. Interviewees cited the recent provision of contiguous undeveloped land for Huawei in Songshan Lake High Tech Park and Oppo's new campus in Chang'An as evidence of such planned development. These allocations enabled the firms to build massive integrated engineering and production complexes. In the surrounding neighborhoods, authorities issuing permits give preference to manufacturers supplying the anchor companies. Virtually all firms in Wushali village, which abuts the Oppo and Vivo complexes, supply these firms. Township officials estimate thirty percent of Chang'An's entire electronics industry is Oppo and Vivo suppliers. Local authorities aim to reduce transportation

costs and improve knowledge transfer throughout the local supplier network. A local official explained:

> Firms here are mostly electronics components firms in the Oppo and Vivo supply chain. Molding and parts firms need to be closely linked together so it is easy for us to rent out factory buildings. All of our available space is rented out and we are still getting requests at the village office for space to open more factories. Firms in the companies' supply chain really want to be here, closer to the customer factory.

Higher level Dong-Zhen authorities actively provide targeted financing and subsidies to support the mobile phone industry. While the absolute amount of financing is small, it encourages firms, especially smaller component producers, to begin R&D by reducing their financial risk from doing so. A district government official explained:

> We offer small grants and investment matching. These must be used for R&D, to pay researchers' salaries, or to set up cooperation with universities or labs. Mobile phone firms can also receive tax rebates. While we cannot force firms to relocate, we also strongly encourage any firms making phones or components to move into specific areas of the district, to encourage innovation and interaction.

Firms acknowledged the subsidies and grants they received and how they have applied this to improving their products:

> The development zone in which we are located gives some support. We have received small investment grants of 200-300,000 RMB to support small innovations like phones able to support both GSM and CDMA, where the system switches based on the number being called, and dual GSM and PHS phone – a technology only we offer.

Local authorities also take an active interest in upgrading Dong-Zhen's human resource capabilities. As firms have become more sophisticated and automation-intensive, their demand for skilled technicians, designers, and engineers has grown. Local authorities have since established four new universities and three two-year technical colleges to help provide skilled workers. The government also sponsors human resource development within firms by sponsoring joint private sector-academic initiatives, such as the post-doctoral center at Janus Precision Components which offers a competitive salary jointly provided by government and the company. ZTE hosts a post-doctoral research program and sponsors collaborative projects with China's

telecommunications and engineering universities examining future telecommunication trends. The skills developed in these market-facing research institutes have continually helped upgrade the production, process and incremental innovation capabilities of firms in the mobile phone district.

The Riviera del Brenta Footwear District

Riviera del Brenta is one of Italy's oldest traditional industrial districts. It includes adjacent areas in Venezia and Padova provinces along the Brenta River. As the center of Italian luxury footwear production, Brenta is globally renowned for upscale women's shoes, chic local brands, and the design, sourcing and assembly bases for top global brands such as Louis Vuitton, Prada, and Armani. The district is one of Italy's most successful and has become a benchmark for traditional industrial districts seeking to upgrade their design and production capabilities.

Although the Italian economy experienced sustained crisis from 2005 to 2015 and many venerable industrial districts contracted, Brenta has thrived. According to Italy's Istituto Nazionale di Statistica (ISTAT – the public agency responsible for collection and publication of demographic data), Brenta's number of production units and shoe workers declined by only 0.1% (744 to 738) and 0.4% (6531 to 6277), respectively, between 2005 and 2014 (Buciuni and Pisano, Forthcoming). The footwear sector endures even as other footwear production districts such as Vigevano decline.

Over the past two decades, three factors have been critical in sustaining Brenta's competitiveness: the upgrading strategies of local producers, MNE investments, and the co-development and improvement of local firms and semi-public goods such as Italy's oldest school for footwear producers. Global brands have taken advantage of Brenta's production capacity and the technical knowledge necessary for luxury footwear innovation. Prada acquired local firms

and Armani and Louis Vuitton established their own facilities, enhancing the brands' reputations by leveraging the 'Made in Italy' identity. Global fashion brands' commitment to production and sourcing in Brenta sustains small specialized suppliers, many of which have initiated a process of 'learning by supplying' (Fifarek and Veloso, 2010). Fashion brands' investments and upgrading of local suppliers has resulted in the co-location of several stages of production and global firms' *in sito* product development.

Production of luxury footwear differs from that of mass-market shoes. Luxury brands produce very short runs of unique high-quality, high-cost shoes. Designers create multiple collections per year, with the summer and winter collections being the most important showcases for presenting new models. A single large fashion brand introduces up to 400 new models of women's luxury shoes per year, each requiring *ad-hoc* product development. Shoe production involves design, modeling, test production, raw materials processing and sourcing (leather, dye, heel and sole glue, heavy thread), cutting, stitching, assembly, distribution and marketing. Thanks to GPNs, only a few firms are now fully integrated producers. Rather, major brands and design houses often handle upstream (design) and downstream (marketing) services with specialized contractors performing remaining activities.

Brenta's tradition of footwear production dates back to the Venetian Republic. Artisanal production gave way to industrialization in the 19th century. With industrial production, Brenta shoes could be marketed across Italy and Europe, building a reputation for Italy as the location to source or purchase shoes. Industrialization spurred specialization. Lead firms increasingly subcontracted stages of production to smaller specialized firms – unlike the low-volume integrated artisanal workshops of the past – creating an ideal-type Marshallian district. Industrial

production firms served as OEMs for foreign brands and retail stores, particularly in Germany, producing on demand.

As exporters on demand, Brenta firms were exposed to competition within Italy and beyond. Firms had to compete with similar OEMs from low-cost locations. In the 1980s, contract shoe manufacturing began moving to Asia, initially Korea and Taiwan and later Southeast Asia and China. Production of branded athletic footwear (e.g., Nike and Adidas) moved almost entirely to Asia and is now handled by large vertically-integrated firms such as Yue Yuan. Eastern European countries' entry into the global economy in the early 1990s put even more cost pressure on Brenta's firms which needed to match the costs and efficiencies of Asian and Eastern European competitors.

The OEM business model during Brenta's first opening to GPNs limited the scope for upgrading design, marketing and distribution. Firms were relegated to the lowest value-added supply and assembly tasks in direct competition with low-cost producers abroad. Some observers questioned the wisdom of local producers' OEM strategy, noting a downgrading of local firms' capabilities – losing the design capabilities they once had as artisanal or small volume producers (Rabellotti, 2004). Further, Brenta firms could not match low-cost competitors' prices. Continuing to rely on mass market orders through GPNs might have undermined the district, as occurred in other Italian industrial districts.

During the 1970s, however, some of Brenta's producers had begun focusing on designer women's footwear. A handful of local producers initiated a 'learning by supplying' process, beginning the transformation from general production to specialization in high-end footwear. Aiming to expand sales globally and differentiate their customer portfolio, manufacturers such as Sergio Rossi began travelling to France to meet with fashion brands like Dior (Buciuni and

Finotto, 2016). They began offering OEM services to global fashion brands. Brands provided designs that Brenta firms would translate to manufacturable products and produce at scale.

Providing OEM services for luxury brands placed Brenta manufacturers on a different trajectory. By focusing on the highest-end footwear and capitalizing on the existing value of the 'Made in Italy' identity, these firms were able to increase their added value. As an alternative to the 'cost leadership' strategy (Porter, 1980) of other shoe OEMs, Brenta firms contracting with global brands began going upstream and taking responsibility for more complex and high-skilled activities. Brenta firms increasingly specialized in manufacturing sophisticated designer footwear and focused on absorbing market and innovation knowledge from the global brands.

Brenta firms had access to the best global "buzz" – trends in fashion, materials and techniques at the cutting edge of luxury footwear. This pressured district firms to adhere to the most demanding requirements in order to remain the preferred sourcing destination. This 'learning by supplying' process spread throughout the Brenta supply chain as contractors and suppliers all had to meet the exacting standards of high quality, low volume, high value production.

Brenta could thus offer a unique resource: locally-based, highly specialized high-quality producers and technicians. Specializing in high end footwear contracting had made Brenta suppliers uniquely qualified to supply the types of skills necessary for producing designer footwear. Local companies possess high quality, not easily replicable, capabilities for specific services including design and test production. Accordingly, rather than just sourcing manufacturing services, Louis Vuitton, Prada, Armani and other global brands established their own facilities in the 1990s. Tapping into local design, test production and sourcing skills, global brands enhance their innovation capabilities and link their brand and market reputation to the

'Made in Italy' identity. As commented by a director of Brenta's association of footwear producers:

> Most of the world's fashion brands want to be here because of our reputation. They might produce parts of their collection in Eastern Europe or China, but when it comes to luxury shoes they need to show that these are made around here. However, without our unique competencies, we will have no reputation, this is happening because of both.

Narrow specialization in supplying luxury shoes has evolved into Brenta's current business model in which luxury branded footwear firms either provide only designs – or even source designs from their Brenta contractors – and remaining activities are handled by the contractors. This process was confirmed by the head of a global brand's production unit:

> When you delegate the production of a new model to a Brenta supplier you know that he'll take care of the whole process. He knows all the suppliers in the area, knows who can do this and who can do that. He knows the costs involved in each production phase and therefore what is the right pricing for each item we're going to use eventually.

As in Dong-Zhen, increased local capabilities developed through contracting with global brands has led leading local firms to launch their own brands. They continue to contract with global leaders but also produce under their own name. A firm with a nascent independent brand explained:

> We only started selling our branded products in recent years after we realized we were ready to go into the market on our own. This was a huge step for us and partially changed our business model. Naturally we remain private-label producers for big brands since this is what we do best, but at the same time we want to propose our designs to final customers. At this stage we think we can say that we know how to do it.

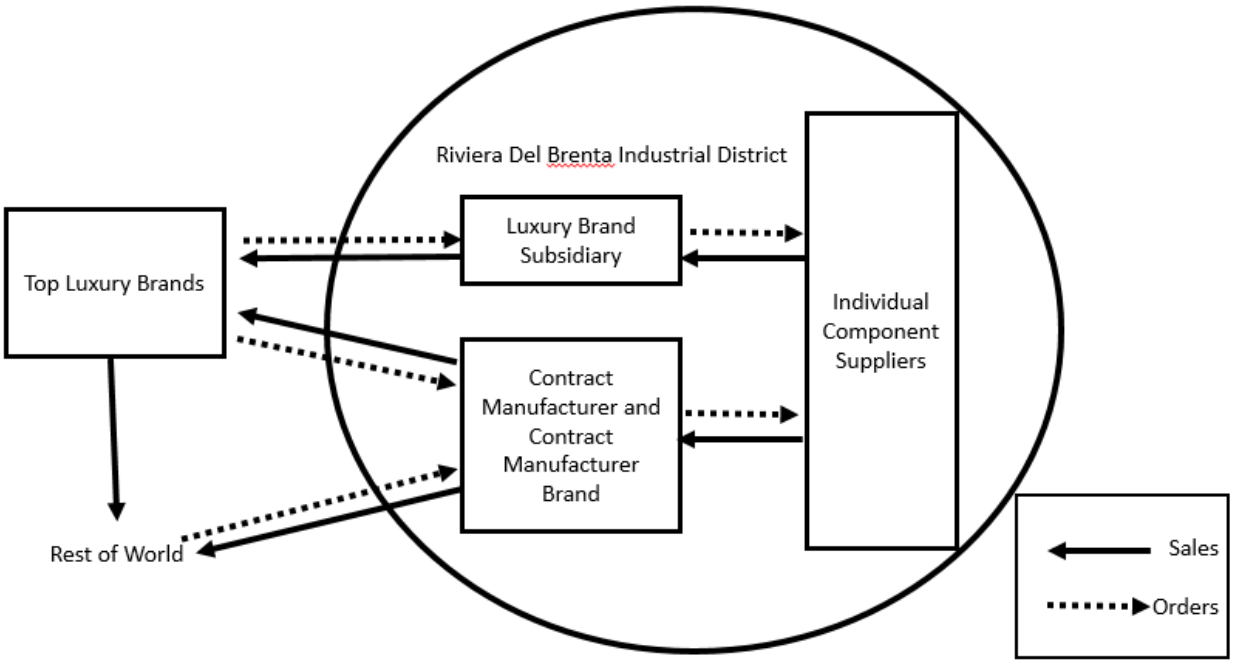
One of Brenta's prominent local producers reflected on these historical transformations, which allowed him to develop an independent brand:

> As the founder and current chairman, over the time I saw a real opportunity to create our own branded collection and penetrate new markets. I knew we had the production knowledge already in house, and when I realized that through the many years working with the big brands we had learned how to design and bring upscale designer shoes to the market, I understood we were ready to give it a try and go alone.

Figure 2 details the production system, highlighting the complete local production chain and – importantly – sources of demand and knowledge. Global luxury and store brands provide demand for Brenta capabilities and products. They also transfer knowledge on fashion trends and styles which local firms digest and incorporate into their skill set. Availability of specialized capabilities has led increasing numbers of global luxury fashion houses to move their operations to Brenta. It also enables local firms to offer their services to geographically distant buyers.

<<Figure 2 About Here>>

Figure 2: Supply Chain and Production in Riviera Del Brenta Industrial District



Brenta's specialized production capabilities enable innovation in the luxury footwear industry, making global brand firms highly reliant on the district. Product innovation in the luxury footwear industry is 'process-embedded', taking place through all the steps of the production process: from leather cutting to sewing and assembly (Pisano and Shih, 2012). This is a specific feature of luxury footwear: to obtain the necessary quality with sufficient quantity, there must be specialization in distinct skilled firms. But since innovation requires all stages to

innovate in tandem, these firms necessarily must be co-located for efficient transfer of tacit knowledge. In contrast, mass market footwear where artisanal skill is not required can be done in vertically integrated firms which simply receive and fill orders to brands' specifications. Their innovation is entirely at the front end.

The positive loop between the availability of specialized suppliers and the innovation strategy of high-end fashion brands attracts MNEs to Brenta and makes the region 'sticky'. A global fashion brands' Brenta production plant director explained the dynamics underpinning this process:

> Although the design of new models mostly occurs in Milan, our designers travel here often to work with the technicians that give shape to their designs. Working together is a fundamental part of product development since it allows designers to understand the actual feasibility of their ideas and to refine them according to production logics. Having a plant in this area facilitates their job and makes our innovation process run more efficiently.

The linkage between production skills and global fashion brands' innovation models has had a profound impact on local semi-public goods. Rather than developing sequentially, private firms' capabilities and public local assets have co-developed over time. Recognizing the bond between production and innovation, local authorities such as the "Associazione Calzaturifici della Riviera del Brenta" (ACRIB – the organization representing local shoemakers) work to further the production skills and their ability to promote them. According to the director of a local institution dedicated to training and professional development, improvement of suppliers' technical skills is a key aspect of the organization's agenda:

> We clearly understand how innovation develops in this industry and are aware that we and our firms need to do more to integrate the two supply chains co-existing in the district: the project and product development chain and the production chain. The further they are integrated, the more fashion brands will need to invest here, and the more local firms will learn from them.

In the same co-development pattern, as local firms connected to GPNs and new requirements emerged, local public and private-public institutions adjusted their focus and strategy. To support the integration of producers and designers and encourage foreign luxury brands to continue to deepen their engagement with Brenta, local authorities are taking active steps. Local officials promote Brenta brands and regional shoe design and production capabilities abroad. Supporting this strategy, in 1976 ACRIB established the "Consorzio Maestri Calzaturieri del Brenta" (Consorzio Maestri), an institution dedicated to the global promotion of the district, mostly through participation in international tradeshows, sourcing events and advertising campaigns. An organization head explained Consorzio Maestri's purpose and scope:

> We work very closely with several firms in the district to organize their joint participation at international events and fairs. This is especially useful for smaller firms that can't afford to organize and coordinate such events alone. We take care of every aspect of the process and make sure all they need to do is to go to the event and promote what they do best.

Second, government authorities also provide specialty training for shoemaker technicians. ACRIB and the "Politecnico Calzaturiero" run Italy's oldest school for shoemakers. Established in 1923 under the name of "Scuola di Disegno per Arti e Mestieri" the school attracts students from all over Italy and is a key source of skilled labor. The director of the school described its mission and role in the district:

> The program we coordinate is unique in Italy. It is a strategic piece of the local puzzle that has been developed here. The school offers a number of services, but what we do best is providing firms in the district with new skills they can utilize to attract global buyers locally. To do that, we had to internationalize our business and adjust our offers accordingly. I believe this is a necessary step we had to take to keep getting better and hopefully become the world's best school for luxury footwear producers over the next years.

In addition to creating new skilled technicians, other skill-development programs include training for prototype developers. An organization leader explained that ACRIB supports the

upgrading of small suppliers which have yet to participate in global firms' product development by teaching them how to acquire new product development skills:

> Today our programs focus increasingly on the product development side of the production process. We know that production is key but product development is the real competence that makes our local suppliers attractive and suitable for international partnership with global buyers.

The goal is to expand the number of firms able to develop new products for global brands and, hopefully, generate independent products. By targeting smaller firms, most of which currently specialize in narrow stages of the supply chain, ACRIB aims to support the competitiveness of the entire supply base. To help upgrade local producers, the Politecnico Calzaturiero created a cooperative training and experiential venture with the Parsons School of Design of New York in the mid-2000s. Established to connect local producers with young international designers, the program aims to facilitate knowledge transfer between these key nodes of the footwear industry chain. Students from the Parsons School of Design work closely with footwear manufacturers in development and production of their shoe designs. Local producers are exposed to new ideas and market trends which they use to understand and predict future requirements from global buyers and proactively update their capabilities.

Third, Brenta has developed a specialized financial system which consists of numerous small local banks—called *banche di credito cooperativo* (BCCs). The BCC system was developed by local bankers to facilitate new specialized new venture formation, often by skilled workers formerly employed in larger organizations. The system addresses the challenge of access to capital by small-scale and highly specialized local entrepreneurs, who are generally ignored by the large banks, as explained by the head of the local industry association:

> BCCs played a fundamental role in the historical growth of the local district and in general in the development of many of the SMEs in this region. These are 'family banks' who would know all the entrepreneurs by name and that have personal ties with most of them.

Discussion

In applying the method of similarity to analysis of these two cases, it is possible to first eliminate differing variables. While these are part of the unique context of these districts, that the cases do not share them suggests they are not essential for a successful GMD. Table 2 summarizes several areas of difference from the cases:

<<Table 2 about here>>

Table 2: Areas of Difference between the Cases

Difference	Dong-Zhen	Riviera del Brenta
Location	Emerging Economy	Developed Economy
Establishment	1990s: GPNs already widespread	18th-19th century: predating GPNs
Industry	Mobile Phones - high technology, recent product	Footwear – low technology, traditional product
Business Model	Standardized mass produced platform technology with incremental improvements seeking niche and mass markets	Unique small batch luxury products for elite consumers

That both districts have been successful despite these differences suggests that the causal variables highlighted below are effective even in radically different regional, industrial, or business environments. This increases the generalizability of these findings by suggesting the causal mechanisms for how GMDs may emerge and be sustained are not limited to idiosyncratic national or industrial environments.

Table 3 shows a summary of the common variables from the cases. Three key theoretical conditions which help account for the common outcome become clear. A fourth commonality is the underlying condition which enables the other three conditions.

<<Table 2 About Here>>

Table 3: Results of Structured Comparison of Similarities

Similarity	**Dong-Zhen**	**Riviera del Brenta**	**Theoretical Condition**
Outcome	Success: increasing exports, increasing value added, growing number of indigenous startups	Success: stable employment, increased investment from luxury brands, developing indigenous brands	
Connection to GPNs	Foreign Direct Investment, emphasis on exports, use of foreign standardized technology	Emphasis on exports, contract manufacturing of foreign designs, foreign direct investment, strategic educational ventures	**Strategic Coupling**
Innovation	Emphasis on improvements to existing technology, efficient manufacturing, hardware additions to established technology	Emphasis on "process-embedded" innovation, co-development, design for production	**Industry-Appropriate Innovation**
Government Action	Facilities provision, subsidies, Human Resource development	International marketing, Human Resource Training, Specialized Financing	**Semi-Public Goods**
Value-Added through Integrated Local Production Chain	90% of components and materials produced locally, rapid prototyping, asset-light investment	100% of production local including design capabilities and facilitating co-development for production	**Mechanism of coupling, innovation and directing semi-public goods provision**

In both cases, the integrated local production chain facilitates the connections to GPNs, and industry-appropriate innovation, as well as guiding government action. The connections to GPNs benefit multiple firms, raising collective competitiveness as a result of their co-location and integrated production. Innovation occurs across the production system, often through co-

development or shared industry trends. This requires co-location for efficient sharing and upgrading. Finally, government action encourages integration and completion of the local supply chain as well as upgrading of it. This is a recognition by local authorities of the value the co-location of suppliers offers to the local economy as well as the need to improve the operating environment for these firms so their value-added to global buyers remains strong.

The first common condition is known as "strategic coupling," the knowledge and resource transfer benefits found at the intersection between local and global forces (Coe et al. 2004; Yeung 2016). Bathelt et al. (2004) described strategic coupling as the intersection between "local buzz" and "global pipelines." In traditional Marshallian districts, dense networks of locally-based interfirm relationships provide new technology and knowledge; such industrial districts risk becoming "over-embedded" and isolated from new innovative ideas and resources (Granovetter, 1985; Maskell and Malmberg, 2007; Uzzi, 1997).

In Dong-Zhen, the initial dominance of foreign invested enterprises engaging in export processing tied the district into the global economy. Products have been made in accordance with established international standards and use off-the-shelf core components. In Brenta, the initial connection to global luxury fashion was through seeking orders from French designers. Exports today account for 90% of Brenta's sales. More recent FDI from global luxury brands has expanded integration with the global economy. In both cases, the emphasis on exports and needing to meet foreign demand and trends, as well as the presence of foreign lead firms producing in the region couples the industrial district to the global economy.

Contributing to understanding of strategic coupling, we contend that for GMDs to develop under conditions of rapid globalization, they must be able to effectively tap into nonlocal flows of knowledge. Nonlocal flows of knowledge and resources include not only new

innovations, technologies, and capital but also intangible knowledge such as design, marketing and distribution, and heterogeneous market demand, which require the differentiated product solutions in which a GMD excels. Integrating with global pipelines can supply local ecosystems with valuable inputs and resources not readily available locally, as well as allowing local specialized producers to find consumers that value their particular innovation and production capabilities.

However, for a GMD to reap the benefits, relationships with global firms need to be institutionalized. Only by routinizing strategic coupling with global actors can the continuous transfer of globally dispersed knowledge flows and resources to the local manufacturing ecosystem be assured. Central to this process is the role of local lead firms and private-public institutions and their ability to act as knowledge integrators (Bathelt et al. 2014; Buciuni and Pisan, Forthcoming). This is done directly through foreign investment by global lead firms, sourcing by the same firms with local contract manufacturers, and – especially in the Brenta case – non-profit organizations actively promoting the region to foreign buyers, keeping the region connected to shifting patterns in foreign demand and technology.

The cases offer a second condition based on the role of industry-appropriate innovation. Most scholarly and managerial studies of innovation focus on breakthrough developments or disruptive innovation (Christensen et al., 2015; Colombo et al., 2015; Wan et al., 2015). This is "novel-product" innovation, in which the "innovator" develops an entirely new technology, product, or industry. However, this emphasis does not cover the full extent of innovation. Taking a novel idea or invention from concept to market requires a range of innovations, such as those seen in the continual improvements in automobile transmissions, together with innovations in production processes. Industry-appropriate innovation encompasses the improvements in how

goods and services are designed, produced, distributed, differentiated, and serviced based on the unique characteristics of different products or industry sectors.

Firms in Dong-Zhen actively choose to use existing core technologies, preferring to innovate at the edges, building new products using established chipsets or adding and improving the functionality of foreign-developed software operating systems. Firms engage in integrative innovation by combining existing technologies to create cost-effective phones with unique hardware capabilities. R&D investment and protected IP are mostly in upgrading manufacturing processes and technology and improving the quality and quantity of output.

In contrast, the luxury shoe industry has an integrative innovation process in which the initial design and various stages of production must all be upgraded in tandem in order to produce a valuable product. Whether receiving product designs from foreign or local designers, Brenta firms innovate in how these designs are translated into production models and how the production process takes place. Upgrading the quality and capabilities of the materials used is a simultaneous process necessary to realize the visions of designers. This innovation does not fundamentally change the underlying product, but produces greater value-added and improves the competitiveness of all firms in the district, not just the initial creator.

It is here, as Schumpeter (1961) observed, that the major impact on economic growth occurs. Scholars explaining the German manufacturing districts success emphasize their strength in incremental and process innovation appropriate to skill-intensive engineering (Culpepper and Finegold 2001; Herrigel 1994; Streeck 1992, 1997). Studies of industrial districts more broadly have similarly emphasized the importance of incremental and process innovation (Buciuni et al., 2014; Piore and Sabel 1984; Pyke et al. 1992). Depending on the product in question, innovation should be interpreted broadly: whether that means incremental improvement on existing

technologies or assisting in co-development of new products. Even if the innovation output is not directly patentable or otherwise subject to traditional innovation metrics, it adds value to all firms in the district, increasing collective competitiveness.

Improvements made at a specific node in the local production chain are easily transferred to others, enabling a systemic process of innovation and upgrading. This occurs because lead firms or contract manufacturers must have quality inputs in order to sustain their competitive advantage in global markets. Sharing or disseminating new capabilities or foreign demands with suppliers improves local lead firms' market position.

It is exactly at this point – looking at production-innovation strategies – that we can gain an understating of the different evolutionary logics. When lead firms base their competition on novel production innovation, the move toward globally fragmented production, in which each district increasingly specializes in specific stages of production, makes sense (Shin et al. 2012). However, when lead firms base their competitive advantage on industry-appropriate innovation which may necessitate transfers of tacit knowledge or collective upgrading, co-location can be the basis of significant competitive advantage as neighbors provide sources of innovation and the upgrading of neighbors makes the lead firm more competitive as it draws upon regional production, design or component capabilities (Breznitz and Buciuini 2015; Buciuni and Finotto 2016). Under these conditions, which Pisano and Shih (2012) called innovation that is embedded in the production process, the geographic and cognitive proximity between R&D and manufacturing is a necessary condition for innovation.

Finally, the comparison of the two cases suggests the importance of an active role for government and civil society/non-firm actors: provision of semipublic goods. Studies of production-based innovation suggest the critical importance of a continuous supply of

semipublic goods or 'industrial commons' (Breznitz and Cowhey, 2012; Pisano and Shih, 2012). It is through availability of semi-public goods that local networks of small and medium-sized, enterprises can excel in production-based product innovation. Semi-public goods have been shown to be crucial in the case of incremental and process innovation including shared production facilities, training, and the co-development of non-patentable innovations (Breznitz and Cowhey 2012; Breznitz and Buciuni 2015), fostering networks (Breznitz 2005; Buciuni and Finotto, 2016; Tomlinson 2010), and specialized financing (Evans 1997; Ostrom 1990; Schrank 2011).

The specific types of these semi-public goods should differ among GMDs based on historical conditions and industry-specific characteristics. In Dong-Zhen, government authorities have long provided production facilities for rent, from wholly shared spaces to industrial buildings or parks which can be rented at low cost. The government also provides human resource training and cultivation through embedded post-doctoral centers in enterprises and university creation. Financing tailored towards the short term and lower cost needs of incremental innovation is provided through grants and subsidies which tend to be small but help incentivize further investment by SMEs. In Brenta, non-profit organizations like ACRIB and Politecnico Calzaturiero serve to connect regional firms to foreign buyers, and promote local skills development. Specialized financial organizations encourage new enterprise formation, helping skilled workers contribute as entrepreneurs, adding further strength to the local production network.

Conclusion

We argue that even in a world of global production networks, locally integrated industrial districts can still be a critical source of competitive advantage for manufacturing firms. The

Dong-Zhen and Brenta cases allow us to elucidate on how such districts can remain competitive in the context of GPNs. The cases show that in both high and low technology industries, a locally-integrated industrial district can be competitive if it is strategically coupled into the global economy, engages in industry-appropriate innovation, and has access to a constant supply of varied semi-public goods.

Policy makers considering how to support an existing industrial district or seeking to create a new one can utilize these findings. There is no single combination of "correct" policies to yield a GMD. However, there are clear policy areas necessary for building or sustaining a district: strategic coupling with GPNs, promotion of appropriate production-focused innovation, and provision of semi-public goods.

Qualitative comparative research has certain limitations. Most importantly, this study compares only two districts – each specializing in a specific industry. As such, there may be industry or technology-specific features which may have impacted the findings. It is also possible that other types of industries, such as chemicals or automobiles with longer product development life cycles and high barriers to entry may exhibit other characteristics in their evolving or emergent industrial clusters. Further research on other industries and cases is necessary to see whether industry or region-specific variables may influence the emergence, or failure, of locally-integrated industrial districts. In particular, work should analyze how shifting patterns in global demand and the possible backlash against international trade, and the progress of automation technologies, will shape the approach to, and internal mechanisms of, locally integrated industrial districts. This promises to be a rich field for future scholarly work, helping develop understanding of the causal factors underlying the successful emergence of a Globalized Marshallian District.

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