Export-oriented cluster-based production cities in China after the 2008 financial crisis: adaptation and adaptability

-evidence from Datang town, Zhuji county-level city

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Abstract: China has long been regarded as the 'world factory' due to the mode of export-oriented industrialization, but this mode is currently faced with unprecedented challenges posed by the 2008 financial crisis and the rising cost of resources. Drawing upon the evolutionary approach to resilience, this study argues that Datang imbues itself with high resilience in response to changed business environment. Its high adaptation mainly originates from the adjustment of individual enterprises in terms of market reorientation and technological enhancement. Local government plays a supportive role in this regard through constructing a sock characteristic town which aims at promoting industrial agglomeration and innovation. Meanwhile, it also exhibits a certain level of adaptability by exploiting local uncommitted resources to diversify into culture and tourism industries. In all, the crisis serves as an opportunity for internal structural reconfiguration and Datang's economy thus emerges from the crisis on a superior growth path.

Key words: export-oriented cluster-based industrialization, evolutionary resilience, Datang, adaptation, adaptability

Introduction

With the deepening economic globalization, China's manufacturing has gained rapid development since the reform and opening-up, through being embedded in the global production networks (GPNs) (Yeung, 2009a; Yeung, 2009b). The position of China in the global economy as a world factory has been ascribed to regional assets (e.g. cheap labor and land) and favorable institutions (e.g. undemanding customs inspection and environmental regulation) (Yang,2012). But recently, the economic downturn triggered by the 2008 financial crisis and the rising cost of resources simultaneously render many export-oriented production cities in China under the pressure of industrial adjustment (Yang, 2013). It has become a hot issue in both political and theoretical realms how they should proactively respond to the restructuring of GPNs so as to realize dynamic upgrading and sustainable development.

One of the most representative agglomeration economies in Zhejiang Province - Datang town, has long been perceived as the 'global biggest hosiery production base', producing as much as a third of world's hosiery supply (Wang et al., 2005). Along global production networks, the external risk in 2008 was expected to be transmitted to every local firm in forms of shrinking overseas orders, decreasing prices and deferred payment from clients (Ruan et al.,2010). Datang, however, seems to have extricated itself from the low value-added plight according to the fact that it was awarded an honorary title of 'Annual Innovation Cluster of Textile Industry' in 2015 (Zhuji Year Book, 2016). It is thus reasonable to hypothesize that the crisis provides an opportunity for Datang to conduct internal structural reconfiguration and its economy thus moves onto a superior growth path.

The identification of shocks and their corresponding implications for regional economies are associated with the current debate on 'regional resilience' from an evolutionary perspective. It is highly relevant to analyzing dynamics of regional economies: how they respond to and recover from shocks, and what role shocks could play in reorienting their future growth paths (Boschma, 2015; Christopherson et al., 2010; Martin&Sunley, 2014). It is worth noting that despite a wide application of this notion in western countries (e.g. Hervas-Oliver et al., 2011; Elola et al., 2013), specific situations in developing countries exemplified by China are far from adequate empirical exploration. In consequence, this study aims to ascertain whether and to what extent Datang imbues itself with resilience when faced with the global financial crisis and which types of agents prominently stimulate this process, through a comprehensive exploration

of its adjustment from the angle of firm, cluster and region. It not only tackles the gap of current academic research, but also provides practical significance for China's future economic evolution.

The remainder of this paper is organized as follows. Taking the framework of 'resilience' as a starting point, the second section seeks for positive ways export-oriented industrial regions in emerging economies can adjust to different types of shocks and move onto superior trajectories. In the next section, the study area and methodological approaches adopted in the research are introduced. Drawing upon data collected during the fieldwork, the following three sections discuss the adjustment process of Datang at firm, cluster and regional levels respectively in the aftermath of the financial crisis, with focus on the interaction between various agents during this process. The concluding section summarizes the main findings and offers other topics for future research about the resilience of export-oriented cluster-based production cities in China.

Resilience: theoretical perspectives and analytical framework

From an evolutionary perspective, resilience is not only about systems' short-term capability to accommodate shocks, but above all, about systems' long-term ability to adapt and reconfigure internal structures (e.g. industrial, social and institutional structures) to develop new growth paths (Boschma, 2015; Simmie & Martin, 2010; Christopherson et al., 2010). Pendall et al. (2010) perceive shocks as either sudden events that destabilize the original growth path or 'slow-burn challenges' with gradual evolution. The nature, severity and duration of shocks are widely recognized to exert a significant effect on systems' responses to them (Martin & Sunley, 2014). Martin & Sunley (2014) put forward that economic resilience is a dynamic process consisting of four interrelated elements: vulnerability (the sensitivity of an economy to shocks); resistance (the initial influence of shocks on an economy); robustness (the adjustment of an economy to shocks) and recoverability (the recovery degree of an economy from shocks and the nature of new growth paths). In terms of new growth paths, adaptation and adaptability are two conflicting but not exclusive processes underpinning regional resilience. Pike et al. (2010: 62) make a clear distinction between adaptation and adaptability: adaptation concerns changes in former development trajectories, characterized by high connectivity between co-located agents. By contrast, adaptability is about *'the dynamic capacity to affect and unfold multiple evolutionary trajectories, through loose and weak couplings between social agents in place that enhance the overall responsiveness of the system to unforeseen changes'*. Boschma (2015) argues that resilient systems are capable of relaxing a trade-off between adaptation and adaptability.

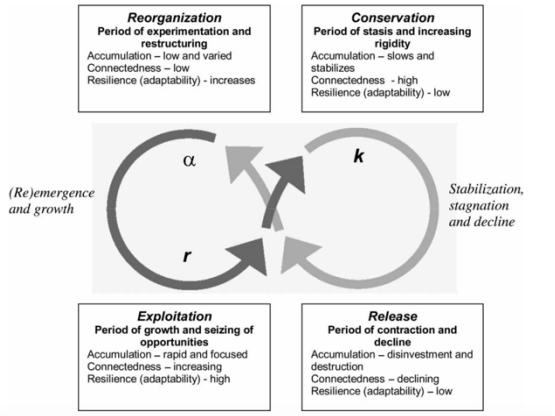

Fig. 1. *Adaptive cycle model of the evolution of a complex system*

The contradiction between connectivity and resilience is further elaborated by a four-stage adaptive cycle developed by Simmie & Martin (2010) (Fig. 1). As systems develop through these stages, connectedness among components progressively increases, while resilience of systems correspondingly declines due to increasing structural rigidness. Lowest resilience at the end of the conservation phase is expected to manifest itself, especially in the face of shocks, leading systems to the release phase. Based on the adaptive capacity, systems may either reconfigure resources to enter a new cycle, or never recover from the recession. Crucial to the reconfiguration process is the conception of 'path dependence', which tends to be positively

perceived in the resilience literature as preconceived resources set the scope for reorienting industries, technologies and institutions, thereby shaping new growth paths (Martin & Sunley, 2006; Martin, 2010).

Martin & Sunley (2014) point out that regional economies are complex adaptive systems, of which the reactions of heterogeneous economic agents strongly determine the regional-level responses to shocks. Taking existing economic development paths into consideration, the general patterns of adjustment of export-oriented regions in developing countries can be caused by three firm-level reactions. What comes first is building technological capabilities. High technological capabilities are not only restricted to high-tech industries such as ICT, but also exist in low-tech industries like textiles (Schiller & Kroll, 2013). As stated by Yeung & Coe (2015), suppliers of intermediate or final products in emerging economies can optimize cost-capability ratio, namely, controlling low cost with nurturing innovative capabilities, so as to become a strategic supplier or even a global lead firm. This process largely depends on a firm's current resource endowment and future strategies regarding market orientation.

Market reorientation is another aspect firms are supposed to commence with. The gradual shift of market from the Global North to the South and the rise of new markets in emerging countries serve as an opportunity for suppliers from these areas to develop into new global lead firms (Yang, 2013; Yeung & Coe, 2015). As they are enabled to approach and utilize domestic production networks and consumer market, their position is likely to be enhanced in GPNs. Indicative of this approach is Huawei company, which originated in China but has become a lead firm in the field of ICT. The last entrepreneurially induced reaction is industrial structural change, that is, shifting to industries with higher productivity. Existing expertise, skills and technologies can be applied to other technically relevant industries which offer more profitable opportunities (Frenken et al., 2007; Martin, 2010). In studying the resilience of the North Staffordshire Ceramics, Hervas-Oliver et al. (2011) discovered that diversification is one strategy implemented by many firms. The application of ceramics products outside the standard industrial classification, such as X-ray equipment, yields much higher profits for them. All the firm-level adjustment can be facilitated by regional and local authorities through optimizing local institutional environment, e.g. great business culture, innovation-related policies, research-oriented universities and advantageous financial structure (Martin, 2000).

These firm-level actions are largely intertwined with collective factors of the whole cluster, mainly the relationships of constituent agents (Martin & Sunley, 2011; Suire & Vicente, 2014). Local production networks concerning traded interrelationships among co-located economic actors exert an influence on the adjustment and resilience of clusters. Several types of local production networks with high interrelatedness of firms have been perceived by scholars as less adaptable and resilient (Martin & Sunley, 2011). One is a cluster with a detailed horizontal division of labor between firms. In this case, one firm is unlikely to adjust in terms of role, technology or product if no corresponding adjustment happens across other firms. Another potentially inflexible and rigid production structure is 'hub-and-spoke', which is composed of a dominant firm and numerous suppliers providing specialist components. Without the change of the former, the latter will be gradually locked in the role of component suppliers.

knowledge networks are considered as another factor crucial to the resilience of cluster. There has been a consensus among scholars that the combination of 'local buzz' within respective clusters and external knowledge inflows through 'global pipelines' can better facilitate innovation and breaks lock-in (e.g. Bathelt et al., 2004; Maskell et al., 2006; Fitjar & Huber, 2014). Due to the existence of local collective languages, cultures and trust, local buzz carrying information and knowledge is derived from the trade and non-trade linkages amongst internal firms, promoting higher productivity and innovation (Bathelt et al., 2004). But it is increasingly emphasized by scholars that external relations to competitors or collaborations contribute more to cluster innovation, especially when local technological level is relatively lower in comparison with them (Yeung, 2009). One factor crucial to the construction of 'global pipeline'

is ‘technological gatekeeper’, which is defined as actors who own technical and financial strength, who can build connection to worldwide technology-leading enterprises (institutions) and who are expert at diffusing advanced technology into local clusters (Rychen & Zimmermann, 2008; Giuliani, 2011). Empirical studies have confirmed that the role of ‘technological gatekeeper’ of industrial clusters in developing countries is predominately undertaken by TNCs or their branches, local technology-leading enterprises or influential universities and research institutions (Zhao & Zeng, 2013; Wang et al., 2015).

level	strategies	agents
Firm-level	Market reorientation Building technological capability Industrial diversification	Firms, governments
Cluster-level	Adjusting local production networks Optimizing the innovation networks	governments
Regional-level	Industrial diversification Related and unrelated diversification	governments

Table 1. *the coping strategies at the firm, cluster and regional levels*

At the regional level, a large body of resilience literature stresses the necessity of industrial diversification, by which regional economies can escape from lock-in (e.g. Martin & Sunley, 2015; Boschma, 2015). On the grounds that specialized regions are more likely to damage large parts of economies once hit by shocks, regions are advocated to diversify into other industries, especially those with little input-output linkages but skill-related, which is beneficial to accommodating sector-specific shocks (Boschma, 2015; Martin & Sunley, 2014). Moreover, the concurrence of ‘related variety’ and ‘unrelated variety’ is regarded as the ideal way of reconfiguring local economy, as it achieves the trade-off between adaptability and adaptation. It secures adaptation due to a supportive local environment derived from the presence of plenty of related industries, and meanwhile, adaptability is strengthened as industrial diversity provides recombinatory resources for the emergency of new industries (Frenken et al., 2007; Boschma, 2015). Boschma (2015) put forward three ways of industrial diversification for specialized regions: (1) exploiting local uncommitted resources; (2) diversifying into related industries based on existing specialism; and (3) combining resources from other areas with local resources to promote innovation. To achieve this, a loosely coherent institutional framework is necessary which allows the emergence and needs of new industries (Boschma, 2015).

Study area and research design

Study area

Datang is situated in the southwest of Zhuji county-level city. As the administrative center, Datang unites with 12 surrounding towns, forming a hosiery cluster (Akoorie&Ding, 2009). The hosiery cluster plays a formative role both in regional economies and at the global scale, accounting for 70% of Datang's industrial output value and 35% of the world market (2015, Zhuji Year Book)

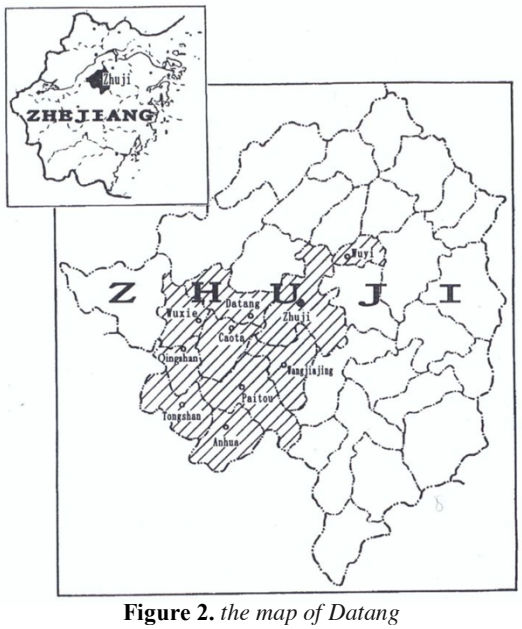

Figure 2. *the map of Datang*

This cluster is predominantly comprised of small and medium-sized enterprises (SMEs), the percentage of which could be even 90 percent (Wang et al.,2005). It has formed a production network characterized by specialization and cooperation as a result of the process of self-organization (Wang et al.,2005). The complete industrial chain is vertically disaggregated into the following interconnected links: raw materials, machinery, knitting, sewing, dyeing, shaping, packaging, and sales (Wang et al., 2005). Most SMEs undertake only one or two links, whereas some large enterprises integrate all these links (Wang, 2007). Collective efficiency achieved through the flexible specialization, by which production capabilities can be easily adjusted and diverse products can be simultaneously produced within a short period, is regarded as the competitive advantage of hosiery industry of Datang (Akoorie&Ding,2009; Wang,2007). Local dense interpersonal networks are substantiated to promote knowledge spillover among heterogeneous agents in the cluster (Zhang et al., 2011). Despite the existence of common features such as numerous SMEs, cooperation and competition and knowledge spillover, Datang cluster was always perceived by scholars as embryonic 'Italianate industrial districts', as it was on a development path based on low cost rather than innovative capabilities (Akoorie&Ding,2009; Wang et al.,2005).

China has become one of the largest consumer market worldwide (Mckinsey and Company, 2012). Recognizing the unsustainability of the export-oriented industrialization, national government has engaged in stimulating domestic consumption since 2000, and this action is further strengthened after the 2008 financial crisis (Yang, 2013). With regard to Datang, it was awarded an honorary title of 'Annual Innovation Cluster of Textile Industry' in 2015, which suggests that the hosiery cluster has evolved from the low-cost path to the innovation-based path.

Thus, it is reasonable to hypothesize Datang exhibits strong 'resilience' in the face of the 2008 financial crisis, undergoing a positive process of adaptation and adaptability. 1) At the firm level, industrial structural change, technological capability building and market reorientation are three aspects of entrepreneurially induced actions. 2) At the cluster level, local government is engaged in optimizing innovation networks through constructing 'local buzz' and 'global pipeline'. 3) However, at the regional level, industrial diversification might not be nurtured as the mere existence of hosiery cannot provide recombinatory resources for new industries to emerge.

Research methodology and data

The empirical study is dependent on recent fieldwork and interviews carried out during the period from September to November in 2016. And interviews were undertaken with four groups of agents.

First, interviews were conducted with senior executives in 26 enterprises. These firms were introduced by means of either 'gatekeeper' (i.e. local officials) or 'snowballs' (i.e. previous interviewees through personal contacts). In order to identify divergent responses of differing enterprises to the changing environment and crucial problems common to firms during the adjustment process, different categories of firms in terms of size, product and market were selected (Fig. 3). The interview covered issues of four aspects:1) the effect of the financial crisis on individual enterprises; 2) the entrepreneurial adjustment with respect to industrial structure, technological upgrading and market orientation after the crisis; 3) the changing networks of collaboration within and outside local cluster; 4) difficulties and challenges encountered during the adjustment process and future operation strategies.

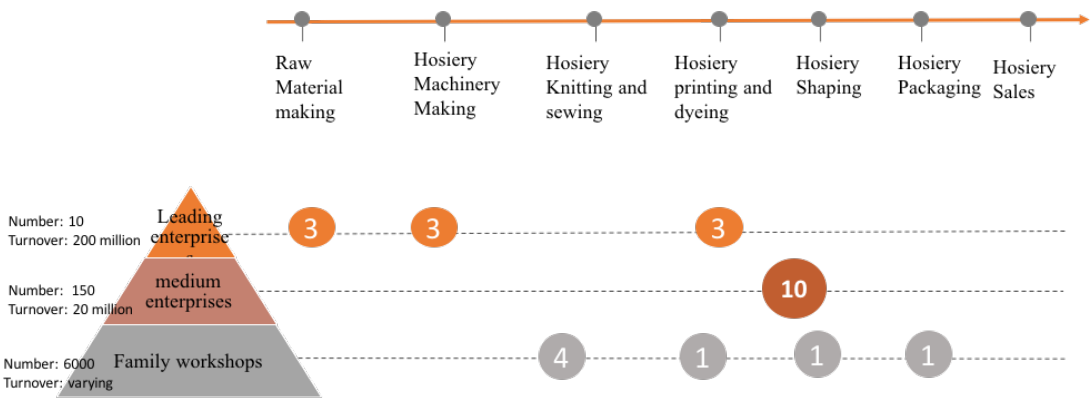

Fig. 3. *the distribution of interviewees*

The second group of interviewees were government officials and policy-makers from Datang township-level government: one from Industrial Development Offices and the other from Propaganda Department. The major objective of official interviews was to understand how policies on industrial dimension were formulated and put into practice. Correspondingly, the interviews were structured in terms of 1) the effect of the financial crisis on local cluster as a whole; 2) actions taken by local government to promote adjustment, respectively, at firm, cluster and regional levels; 3) difficulties encountered during the implementation process and future planning.

The third set of interviewees was the leader of the Association of Hoisery Industry, with the purpose of collecting collective opinions on the overall evolution of hosiery industry and on the implementation of changing institutions. Last but not least, two major Research & Development centers in Datang - World Hosiery Design Center and Zhejiang Hosiery Textile Research Institute, were interviewed to investigate dynamics of both local and non-local innovation networks. In general, each interview lasted for one hour and was conducted on an anonymous basis. In addition, a review of Statistical Yearbooks and government reports also provided valuable information, in particular some statistical data.

The identification of external shock

Different from expectations, the favorable environment for Datang's export processing industry has encountered unprecedented challenges mainly not because of the financial crisis, but due to the keen competition arising from Southeast Asia. Interviews reveal that there was little loss of coupling between Datang and global lead firms in the wake of the financial crisis despite its high reliance on the external markets. This finding is further supported by post-crisis exports in Datang, which overall exhibited a steady growth trend with an average growth rate of 26.9% by 2011 (Fig. 4). Besides its strong production capacity and market influence, the attribute of socks plays a critical role in lowering its vulnerability to the financial crisis. As argued by an entrepreneur, *'socks belong to daily necessities so that the demand for them is rigid. After the*

outbreak of the financial crisis, few people would cut down the cost of socks even when their income declined.'

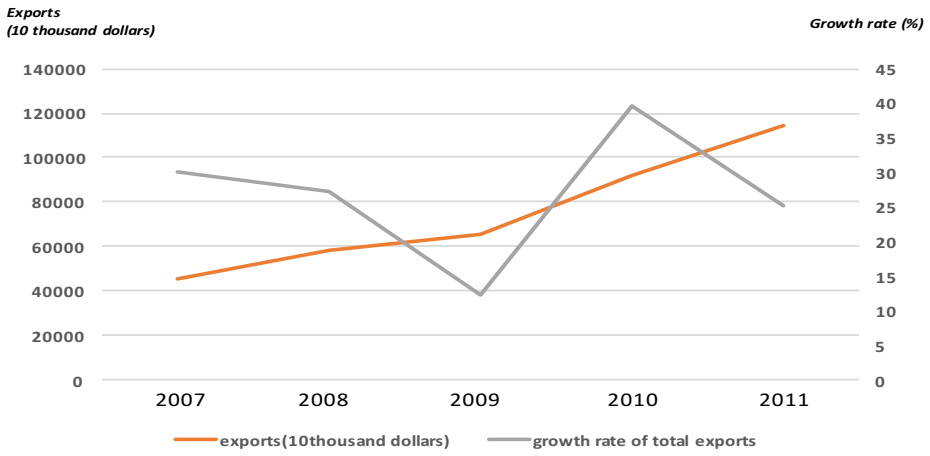

Fig. 4. *Datang's exports and its growth rate in the course of the crisis*

However, the rapid and profound development of Southeast Asia typified by Vietnam is gradually evolving into an external shock confronting Datang. It is distinct from the financial crisis which is sudden, unpredictable and out of the ordinary, instead it is slow-burn pressures. In China, notably costal regions, the low-cost era is drawing to a close as a result of the rising production cost. By contrast, Vietnam has prominent advantages in terms of labor cost, taxes and trade barriers (table 2).

It is confirmed by interviewees that Southeast Asia has exercised a preliminary influence on Datang's economy. On the one hand, plenty of overseas orders, predominantly low-end orders have flowed to Southeast Asia, but fortunately the majority of medium and high-end orders are

Term	Vietnam	Datang(China)
Labor cost (Monthly wage)	1000-1800 yuan	5000yuan
Value added tax	20%, 10%in several areas	25%
	Tax free in first four years Half tax in the later 9 years	
	5%	
Import Tariffs: Japan	Tariff exemption	7%
Import Tariffs: Australia	Tariff exemption	5%
Import Tariffs: America	14%, after the TPP, tariff exemption	14%

Table 2. *the comparison between Vietnam and China*

retained in Datang as supporting facilities and production technology in Southeast Asia still lag behind. One the other hand, an increasing number of machinery produced in Datang have been exported to Southeast Asia due to its optimal combination of high performance and low price. Taking two leading machinery enterprises as an example, their proportion of exports to domestic sales has reached 4:6 and 5:5 respectively and is expected to keep growing by their executives.

The entrepreneurially-induced coping strategies

Results from recent investigation indicate that Datang has adapted to the intensifying external competition and the adjustment and recovery process to a large extent is reliant on individual enterprises, large and medium enterprises in particular. Most leading and medium enterprises have been long engaged in OEM services and thus are equipped with strong scale advantages

and technical bases. By contrast, small-scale family workshops possess low-level technology and weak financial strengthen. Nevertheless, they are indispensable to local cluster as they predominantly provide outsourcing services for enterprises of the first type.

Large and medium enterprises: the backbone of industrial upgrading

The coping strategies of export-oriented processing enterprises prove to be affected largely by their former experiences and fortunes, but in general, there are three main measures.

Market reorientation

First, there is a growing tendency for export-oriented enterprises to return to the domestic market, breaking the trap of exports. 8 enterprises, of which 3 are leading and 5 are medium, have engaged in domestic sales by way of OBM. Reasons for this trend can be traced back to two aspects. For one thing, the rise of China as the world's largest emerging market is regarded as the most prominent market incentive that appeals to them. For another, the uncertainty and instability of overseas orders stimulate the desire of enterprises to seize the initiative.

Interviews with entrepreneurs indicate that successful adaptation to the domestic market is underpinned by two imperatives: brand building and marketing channels. Establishing niche markets proves to be the effective approach to brand building. In addition to the disorderly low-cost competition of similar-type products, the need to establish niche markets is also triggered by well recognition of the rising demand of consumers for functional and health-care socks. In consequence, an increasing number of enterprises shift to the high-end area and specialize in respective branches (e.g., sports socks, anti-varicose veins compression stockings, and antibacterial socks) without mutual interference and aggression. Despite the decreasing economies of scale, net benefits can be generated from being an influential player in a relatively smaller piece of the wider industry. One medium enterprise (Suofeiya) has become a niche player in the field of technical stink-prevention socks and hence occupies over half of the domestic market.

In terms of marketing channels, the Internet era serves as an opportunity for Datang's enterprises to exploit the market. Besides traditional marketing channels, such as shopping malls, supermarkets and agents, Taobao and Wechat, which are the prevalent online shopping instruments in China, have been increasingly seized on by local enterprises as a tool to exploit customer resources and to extend market influence. More than half interviewed enterprises have operated online shops, realizing the combination of offline and online sales, and 2 of them even become completely committed to online marketing. In this regard, the construction of an 'e-commerce park' initiated by local government, where plenty of enterprises involved in online retailing assemble, fully mobilizes local idle resources and gives an impetus to local economic development. Numerous e-businessmen without processing plants place orders to local plants (normally family workshops) and then attach their own brands, which can be referred to as localized OEM. Their enthusiasm is further aroused by a series of preferential policies formulated by local government, for example, settlement in the 'e-commerce park' is exempt from rent of the first three years, and online shops with annual sales over 5 million yuan are able to enjoy financial incentives.

Market reorientation enables these enterprises to shake the passive situation off and enhances their capability to resist risks as the terminal market is held by them. Nevertheless, it is worth noticing that most enterprises can only be a combination of OEM and OBM in the long term: the universal ratio of exports to domestic sales is 7:3, which reveals that they are still largely dependent on overseas market. As admitted by these entrepreneurs, income from overseas orders affords them capital to sustain the ongoing transformation and upgrading, and this demonstrates that path dependence can sometimes furnish opportunities for regions to transform rather than lock them in previous paths.

Increasing technological capabilities

Second, increasing innovation capabilities and striving to be higher-level suppliers have become the main pursuit of a portion of enterprises. In the realm of hosiery, product innovation contains both appearance design and functional design. The former means using fashionable patterns and shapes to beautify socks, mainly for women who have diverse demands and desire to highlight individuality, while the latter refers to using high-tech materials and shapes to realize particular functions.

These large and medium enterprises not only internally establish the R&D department equipped with high-tech research personnel, but also assimilate external knowledge through innovation networks. At the global level, the R&D capabilities of local enterprises are relatively weak in comparison with those in western countries and thus innovation in local enterprises predominantly arises from 'learning effects in exports' and 'secondary innovation effects after introducing technology and advanced equipment'. There is no distinct gatekeeper for the whole cluster, but almost all large and medium enterprises possess their respective global pipelines via OEM. It was said by an entrepreneur, *'in order to guarantee both the quality and quantity of orders, it is easy for us to acquire technical guidance and personnel training from overseas lead firms in terms of production process, product quality and management mode, which continuously contribute to our R&D capabilities'.*

At the cluster level, it is distinct that enterprises collaborate closely along the vertical industrial chain with clients or suppliers rather than horizontally with peer enterprises. Due to the fact that hosiery is a highly mature industry, peer companies are faced with a common market and interest conflict renders it difficult to build informal linkages based on trust and reciprocity. By contrast, interests of suppliers and clients are much more consistent, and good cooperation enables them to achieve a win-win situation. 13 large and medium hosiery enterprises all have formed this kind of linkage with co-located raw materials and machinery enterprises, with the latter two incorporating manufacturers' demands into the innovation and optimization of products. Moreover, interviewees remarked that their technical exchange and cooperation are often not subject to contractual constrains, but in the form of informal linkages based on long-term cooperation and trust.

With the decreasing cost-capability ratio, these enterprises succeed in narrowing the difference of international labor division and become higher-level suppliers or even strategic suppliers for global lead firms. 5 of the 13 large and medium enterprises have already entered the phase of ODM. Taking one firm whose overseas orders fell by 30% in 2013 as an example, it then shifted focus onto the innovation of a range of functional sports socks (e.g. basketball, football, running). Currently, it offers a series of advanced services for overseas clients (e.g. Disney and Dickies), including designing products in accordance with clients' brand characteristics, constructing pricing structures and providing after-sales services. In addition to the considerable increase in profits, high value-added products ensure enterprises the stability of orders as the advantages in R&D bring them more capital to negotiate with foreign clients.

Product diversification

Last but not least, although few, there still exist enterprises having experienced industrial diversification. This kind of enterprises are equipped with certain financial strengthen and technical bases, and diversification is mainly based on technical relevance. 2 hosiery enterprises have extended to the related industry-underwear on the basis of original equipment and technology from hosiery. The motive prompting them to adopt a diversification strategy is that compared to the rather low profit of hosiery, nurturing value chains with more growth potential seems more sensible. They argued that industrial diversification not only significantly reduces the risks of production and sales, but also builds a solid foundation for them to create stronger brands. Although many enterprises meeting the above standards exist, industrial diversification

has not identified by them as an idea way of adapting to competitive markets. It suggests that this process may demand for external institutional support which allows the development of new industries.

In all, adjustment of large and medium-sized enterprises is not restricted to a single path, but often covers several paths. Among the surveyed hosiery enterprises, 4 are situated in the transition period combined by OEM, OBM and ODM, whereas only one has completely abandoned OEM and engaged in both OBM and ODM.

Lock in?

The left 5 large and medium enterprises are still locked in the previous road of OEM. Reasons why they are unwilling or unable to make adjustments are consistent with the challenges and difficulties encountered by enterprises during the adjustment period. One crucial factor is the availability of finance. Evidence exists in interviews to indicate that financial institutions hold a negative attitude towards providing loan finance to local enterprises, in particular small and medium-sized enterprises, in that hosiery is perceived by them as a low-level high-risk industry without growth potential.

A deficiency of ability to absorb talented persons also militates against its resilience and recovery. Talents prefer to struggle in big cities like Shanghai rather than in small towns without superior living conditions. Several large and medium enterprises have searched for fine universities on a national scale and Xian Polytechnic University is their most prominent cooperative partner. These enterprises, however, expressed complaints about this long-distance cooperation that professionals from those universities are incapable of promptly solving problems confronting enterprises, resulting in the interruption and delay of innovation process.

Last and surprisingly, the frequent internal circulation of knowledge arising from geographic proximity and dense interpersonal linkages suppresses local innovation climate and business confidence. Due to the low threshold of technology and a serious lack of intellectual property protection, innovation can be easily plagiarized, which again triggers the low-price competition of high-end products. Interviewees involved in domestic sales are all filled with alert and precaution when facing neighboring firms.

We almost have no technical cooperation and exchange with peer enterprises in Datang. Other enterprises are like us, they don't want to establish linkages of knowledge and technology with outside world. You know, new ideas are hard to come up with, but they can be easily imitated especially when competitors are around you. If the new things we rely on were leaked, we would lose market opportunities and we would live very hard.

----a large enterprise

Small family workshops: following up the steps

Under the pressure of cost, many family workshops were in the form of 'three-in-one', that is, the first floor for production, the second floor for warehouse and the third floor for living. They are viewed negatively by local government as they not only lead to excess capacity, causing the low-price competition, but also produce numerous low-quality products, harming the whole reputation of Datang. Although encountering great bottom-up resistance, Datang government in 2014 resolutely shut down these 'three in one' family workshops, decreasing its number from 6500 to 3202. With hindsight, sudden elimination of substandard family workshops in Datang where competitive advantage arises from specialization and collaboration is a venturesome action. As one family workshop complained,

We had many processing orders at that time, both from local big enterprises and overseas clients. But the government shut down our workshops and hence we couldn't finish the orders. One the one hand, we had to compensate the clients, and on the other hand, many orders flowed to other areas, promoting the development of those areas.

However, the exit of backward production methods and the consequent alleviation of low-end competition prove beneficial to the development of new technologies and products. As remarked by one entrepreneur, the closure of many high-pollution dyeing mills increased the price of ordinary yarn, narrowing its price difference from environmentally-friendly non-dye yarn, and consequently enterprises showed more willingness to buy non-dye yarn.

In addition, the change of external demand characterized by the outflow of low-end orders to Southeast Asia further facilitates the upgrading of remaining family workshops through the redistribution of resources within local cluster. The labor, capital and customer resources become more concentrated on enterprises with a larger scale and higher technological capabilities while the orders family workshop can get from foreign trading companies largely decrease, which is conducive to the formation of 'quasi-hierarchical governance' structure. It is claimed by the leader of Hosiery Association, *'80% of family workshops provide outsourcing services for co-located large and medium enterprises, while the rest 20% accept orders from foreign trade companies or sell their own products domestically'.*

5 of the interviewed 7 family workshops belong to the former category. In order to compete for subcontracting orders, they have to follow the step of large and medium enterprises to achieve product upgrading and process upgrading primarily through replacing old machines. The remaining 2 interviewees instead has realized functional upgrading via brand establishment, though not famous. For lack of technical and financial strength, they mainly produce socks of basic styles and compete at low prices as a result of product homogeneity.

Hosiery cluster: striving to be an innovation-based cluster

During the restructuring process of individual enterprises, the role played by local government has so far proved generally supportive and cooperative. Difficulties mentioned above has been well recognized by local government and are in the process of resolution.

Construction of 'characteristic town'

Relevant to this process is the notion of 'characteristic town', which originated in Zhejiang Province in 2005 and has gained great popularity throughout China since the beginning of 2016. It refers to a new mode of urbanization that builds a comprehensive development project with definite industrial orientation, cultural connotation, tourism resources and certain community functions, relying on local characteristic industrial and environmental resources (Government report, 2016). Characteristic town that is rooted in local industries could be regarded as the revival of local declining industries. In 2016, Datang was selected in the first patch of national-level characteristic towns. Local government plans to invest 5.5 billion yuan and builds a 'hosiery town' in three years, with the purpose of constructing the world's most advanced manufacturing center, the world's top hosiery culture center and the world's sole hosiery travel destination. Three functional blocks, namely, 'Intellectual Silicon Valley', 'Fashion Market' and 'Public Innovation Space', are core projects.

'Intellectual Silicon Valley' is favorable to the optimization of local production organization and further promotes the cross-fertilization of knowledge, through constructing 3 industrial parks respectively for hosiery raw materials, machinery and manufactures. It was argued by the policy-maker that this rearrangement can improve the relationships and connectivity between peer enterprises so that firms can absorb more knowledge from neighbors and strengthen the horizontal collaboration. Nevertheless, there is still a degree of ambivalence among local

enterprises towards horizontal ties conducive to knowledge spillover and innovation. Therefore, the production organization is a necessary condition but not sufficient, instead regional and local institutions favorable for innovation enterprises to protect profits are necessary.

'Public Entrepreneurship Space', which consists of 'College students pioneering park' and 'E-commerce park', is a vibrant settlement for youth who strive to build a career, continuously rejuvenating local economy. 'Hosiery think tank' that belongs to 'Fashion Market' is perceived as the heart and engine of the innovation of hosiery industry. In the 'Hosiery think tank', World Hosiery Design Center and Zhejiang Hosiery Textile Research Institute are two core district-wide initiatives involved in innovative activities.

World Hosiery Design Center is a publicly funded design base built jointly by universities and local government. Xian Engineering University, as the Secretary-General Unit, works in alliance with more than 20 famous domestic universities relevant to textile and art design. At monthly intervals, 20 designers will be delegated here to undertake the mission of hosiery visual, shape and functional design. In consequence, local enterprises are able to select design directly from this center rather than invest high costs on respective design teams. Hosiery Textile Research Institute is more a research institution. This platform cooperates with first-class experts, both at home and broad, establishing a strong R&D team with respect to textile materials and machinery. It offers local enterprises technological services in terms of technology consulting, inspection and testing, product development and personnel training. In 2015, this center applied for two research projects at the provincial level, signed 8 service projects pertaining to technological development and technology transfer with local enterprises, as well as introduced 3 technological achievements from abroad. Both institutions facilitate cross-fertilization of ideas and are gradually playing the role of 'technological gatekeepers'.

Moreover, 'Hosiery think tank' as well makes a contribution to firm's performances in terms of finance. Relying on the hosiery development fund set up by Zhuji government, Datang government has successfully constructed an investment and financing service platform. The operation of Zhuji Service Center of Tianjin Equity Exchange and the introduction of Beijing Hongtaijiafu fund company effectively tackle the difficulty and expensiveness in securing financing by individual enterprises. So far, 2 enterprises have been listed in the stock market, and 20 enterprises are actively undertaking the listing work. The reconfiguration of local existing resources and the integration of high-end elements have exercised a preliminary influence on activating local industry.

Interconnection between neighboring clusters

Another aspect worth efforts is to strengthen the interconnection between neighboring clusters. This has not been identified by local government but is revealed by the interviews. One local enterprise succeeded in combining the freshwater pearl cluster in Zhuji with the hosiery cluster by applying the care function of pearls to normal socks. The ultimate product of 'space socks' provides a solution for both low-end pearls and socks, with price rising to 60 yuan per pair. This demonstrates the necessity to strengthen the connection to neighboring clusters as the combination of neighboring resources can enable the emergence of innovation or even new industries (Boschma and Capone, 2014). In all, Datang is jumping the vicious circle of 'high yield but low efficiency'. As shown in Table 3, despite a downward shift in outputs, output value experienced an increase in 2015.

	2014	2015	Trend
Output (100 thousands pairs)	85.1	80.2	−5.7%
Sales volume (100 thousands pairs)	82.8	79.3	−4.2%
Output value (100 thousand yuan)	74.7	77.6	+3.8%

Table 3. *the output value of Datang in 2014 and 2015*

Regional economy: a process to industrial diversification?

Two other functional areas that belong to 'Fashion Market' - 'Leisure culture corridor' and 'Art village' are constructed to exploit local uncommitted resources. With the investment over 500 billion yuan, local government plans to build a waterfront landscape belt characterized by the combination of leisure and culture. This project integrates landscape engineering on both banks of Guanshan Stream, renovation of historical building in old villages, urban agronomic display and distinctive industrial tourism. The development of tourism and cultural industries outside hosiery industry aims to satisfy diverse consumer demand in contemporary society.

With hosiery as the core industry, the cultivation of tourism and cultural industries could be referred to as unrelated diversification, and thereby Datang overall exhibits a certain level of adaptability.

Conclusions

This paper unravels what underlies the strong resilience of Datang in face of both the financial crisis and the emerging competition from Southeast Asia through comprehensive investigation of the adjustment process from the angel of firm, cluster and region. Although it has shrunk in size and importance, it has managed to undergo adaptation and adaptability, out of which a more sustainable growth path emerges. Its high adaptation mainly originates from the adjustment of individual enterprises in terms of reorientation to domestic markets and technological enhancement (Yueng, 2015). Local government plays a supportive role in this process through introducing high-end elements to reconfigure and innovate the hosiery cluster, demonstrating that internal structures of clusters exert an influence on firm-level performances (Martin & Sunley, 2011). Meanwhile, Datang exhibits a certain level of adaptability by activating local uncommitted resources to develop unrelated tourism and cultural industries, verifying that specialized regions can achieve industrial diversity (Boschma, 2015). Individual enterprises, to a much lesser extent, also show a tendency to industrial diversification but this phenomenon is ignored by local government. This empirical study advances the theoretical debate on evolutionary approach to 'resilience', through demonstrating that resilience needs refinement to the specific contexts. The resilience of developing countries which are embedded in the low-end links of global production networks differ markedly from that of developed countries.

It also provides implications for formulating policies to adjust the export-oriented cluster-based industrialization in China and Zhejiang Province in particular, so as to enhance their economic resilience in an unpredictable and risk-prone world. First, local government is supposed to improve institutional arrangements to facilitate firm-level upgrading and adjustment, including great business culture, innovation-related policies, research-oriented universities and advantageous financial structure (Martin, 2010). Second, there is a need to draw more attention to the reorganization of internal structures of clusters, especially the horizontal linkages among economic actors, in order to promote collective actions on innovation. In this respect, a sound system of intellectual property rights protection which is favorable for enterprises to monopoly profits through technical patents is necessary. Third, horizontal linkages among neighboring clusters should be nurtured and strengthened to accelerate two-way knowledge flow, with the purpose of enhancing the possibility of new combination and breaking 'lock-in'. Last, local government should sufficiently exploit and activate local uncommitted resources to diversify into other industries, by which regions can escape from lock-in and show a continuous growth (Boschma, 2015).

Admittedly, as sufficient and successive data regarding exports and output values are difficult to obtain in China, this research is largely dependent on interviews conducted with four groups of participants, and hence policy implications derived from this case are relatively general and broad. As regions more or less differ in economic and social characteristics, their contradictions and constraints during the adjustment process are not quite similar. Thus when formulating detailed institutional arrangements, government should pay attention to region-specific situation and take actions that suit local circumstances. Future research could adopt comparative studies in order to explore why regions, cities and clusters differ in vulnerability and recoverability to shocks. Does their constituent industries and technologies matter more? Or the connectivity and relationships among and between enterprises matter more? What aspects can regions undertake in order to break lock in and move onto a new road?

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References

Akoorie, M. E., & Ding, Q. (2009). Global competitiveness in the Datang hosiery cluster, Zhejiang. *Chinese Management Studies*, *3*(2), 102-116.

Bathelt, H., Malmberg, A., & Maskell, P. (2004). Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation. *Progress in human geography*, *28*(1), 31-56.

Boschma, R. (2015). Towards an evolutionary perspective on regional resilience. *Regional Studies*, *49*(5), 733-751.

Christopherson, S., Michie, J., & Tyler, P. (2010). Regional resilience: theoretical and empirical perspectives. *Cambridge journal of regions, economy and society*, *3*(1), 3-10.

Elola, A., Parrilli, M. D., & Rabellotti, R. (2013). The resilience of clusters in the context of increasing globalization: The Basque wind energy value chain. *European Planning Studies*, *21*(7), 989-1006.

Fitjar, R. D., & Huber, F. (2014). Global pipelines for innovation: insights from the case of Norway. *Journal of Economic Geography*, *15*(3), 561-583.

Frenken, K., Van Oort, F., & Verburg, T. (2007). Related variety, unrelated variety and regional economic growth. *Regional studies*, *41*(5), 685-697.

Giuliani, E. (2011). Role of technological gatekeepers in the growth of industrial clusters: Evidence from Chile. *Regional Studies*, *45*(10), 1329-1348.

Hervas-Oliver, J. L., Jackson, I., & Tomlinson, P. R. (2011). 'May the ovens never grow cold': regional resilience and industrial policy in the North Staffordshire ceramics industrial district–with lessons from Sassoulo and Castellon. *Policy Studies*, *32*(4), 377-395.

Maskell, P., Bathelt, H., & Malmberg, A. (2006). Building global knowledge pipelines: The role of temporary clusters. *European planning studies*, *14*(8), 997-1013.

Martin, R. (2011). Regional economic resilience, hysteresis and recessionary shocks. *Journal of economic geography*, *12*(1), 1-32.

Martin, R., & Sunley, P. (2006). Path dependence and regional economic evolution. *Journal of economic geography*, *6*(4), 395-437.

Martin, R., & Sunley, P. (2011). Conceptualizing cluster evolution: beyond the life cycle model?. *Regional Studies*, *45*(10), 1299-1318.

Martin, R., & Sunley, P. (2014). On the notion of regional economic resilience: conceptualization and explanation. *Journal of Economic Geography*, *15*(1), 1-42.

Martin, R. (2010). Roepke Lecture in Economic Geography—Rethinking Regional Path Dependence: Beyond Lock-in to Evolution. *Economic geography*, *86*(1), 1-27.

Menzel, M. P., & Fornahl, D. (2009). Cluster life cycles—dimensions and rationales of cluster evolution. *Industrial and corporate change*, *19*(1), 205-238.

Pendall, R., Foster, K. A., & Cowell, M. (2010). Resilience and regions: building understanding of the metaphor. *Cambridge Journal of Regions, Economy and Society*, *3*(1), 71-84.

Pike, A., Dawley, S., & Tomaney, J. (2010). Resilience, adaptation and adaptability. *Cambridge Journal of Regions, Economy and Society*, *3*(1), 59-70.

Ruan, J. Q., Zhang, X.B., & Wei, L.B. (2010). Crisises and the upgrading of manufacturing industries—research on Zhejiang industrial clusters*. Management world,* (2), 69-79.

Rychen, F., & Zimmermann, J. B. (2008). Clusters in the global knowledge-based economy: knowledge gatekeepers and temporary proximity. *Regional Studies*, *42*(6), 767-776.

Schiller, D., & Kroll, H. (2013). The Global Economic Crisis as Leverage for Emerging Regional Growth Paths? Differentiated Evidence from China—Three Years Onwards. *Clusters and Economic Growth in Asia*, 85-118.

Simmie, J., & Martin, R. (2010). The economic resilience of regions: towards an evolutionary approach. *Cambridge journal of regions, economy and society*, *3*(1), 27-43.

Suire, R., & Vicente, J. (2014). Clusters for life or life cycles of clusters: in search of the critical factors of clusters' resilience. *Entrepreneurship & Regional Development*, *26*(1-2), 142-164.

Treado, C. D. (2009). Pittsburgh's evolving steel legacy and the steel technology cluster. *Cambridge journal of regions, economy and society*, *3*(1), 105-120.

Wang, J., Zhu, H.S., &Tong, X. (2005) Economy: the case of Datang sock and stocking industry in Zhejiang, China. *Proximity, Distance and Diversity*, Chapter(3)

Yang, C. (2012). Restructuring the export-oriented industrialization in the Pearl River Delta, China: Institutional evolution and emerging tension. *Applied Geography*, *32*(1), 143-157.

Yang, C. (2013). From strategic coupling to recoupling and decoupling: Restructuring global production networks and regional evolution in China. *European Planning Studies*, *21*(7), 1046-1063.

Yeung, H. W. C. (2009a). Regional development and the competitive dynamics of global production networks: an East Asian perspective. *Regional Studies*, *43*(3), 325-351.

YEUNG, H. W. C. (2009b). Transnational corporations, global production networks, and urban and regional development: A geographer's perspective on Multinational enterprises and the global economy. *Growth and Change*, *40*(2), 197-226.

Yeung, H. W. C., & Coe, N. (2015). Toward a dynamic theory of global production networks. *Economic Geography*, *91*(1), 29-58.

Zhao,J.G., & Zeng, Gang. (2013). Research on technological flow of industrial cluster based on technological gatekeeprs- Zhangjiang integrated circuit industrial cluster. *Economic Geography,* (2), 111-116.

Zhang, G., Xu, Q., & Liu, X. (2011). Knowledge diffusion within the Datang sock-manufacturing cluster in China. *Regional Studies*, *45*(7), 977-996.