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Understanding processes of path renewal and creation in thick specialized regional innovation systems. Evidence from two textile districts in Italy and Sweden

Cristina Chaminade ^{a,b}, Marco Bellandi ^c, Monica Plechero ^c and Erica Santini ^d

^aDepartment of Economic History, Lund University, Sweden; ^bDepartment of Business and Management, Aalborg University, Denmark; ^cDepartment of Economics and Management, University of Florence, Florence, Italy; ^dFondazione per la Ricerca e l'Innovazione, Florence, Italy

ABSTRACT

The type of regional innovation system (RIS) strongly affects possibilities of paths of industrial transformation. This paper argues that traditional manufacturing districts, corresponding to specialized RISs and characterized by various nuclei of specialization and know-how, may foster different trajectories in combination with extra-regional networks. In particular, the paper analyses the interplay between regional and national innovation systems, providing an overview of the effect that different multilevel dynamics have on local trajectories. The cases of the textile districts in Prato (Italy) and Borås (Sweden) show SRISs can display not only path extension but also path renewal and creation strategies.

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1. Introduction

Nowadays a growing number of scholars are interested in understanding the drivers of regional path development and industrial transformation. Some contributions, mainly in the branch of evolutionary economics, focus on the transformation of industries and how their diversification may impact regional paths of transformation (Asheim, Boschma, & Cooke, 2011). Other scholars committed to explore regional innovation systems (RIS) and their dynamics aim instead to understand how the quality and type of RIS affect the development path of clusters and industries within a region (Isaksen & Trippel, 2016).

Within this last strand of literature, scholars agree on the identification of few windows of growth trajectories in thick and specialized RIS (SRIS). SRISs are usually characterized by the existence of one or few very strong industrial clusters or local production systems, specialized support infrastructure and institutions, and the presence of a multitude of clustered small firms. They enjoy classical Marshallian external economies. Some studies argue that the low relational variety that is present in SRIS and the limited diversity of actors may limit the endogenous capability of renewal or transformation of the industrial

CONTACT Cristina Chaminade  cristina.chaminade@ekh.lu.se  Department of Economic History, Lund University, Sweden and Department of Business and Management, Aalborg University, Denmark

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specialization. This type of RIS would have limited endogenous transformative capabilities, low capacity in absorbing extra-regional knowledge, being able at best to go through path extension and at worst path exhaustion (Isaksen & Trippl, 2016). Path renewal (i.e. change to different but related activities) and path creation (i.e. the path of radical change) on the other hand seem to have a better chance to occur in diversified RISs, characterizing, for example, metropolitan areas (Isaksen & Trippl, 2016).

This paper investigates under which conditions path creation and renewal is possible in industrial districts characterizing thick and specialized regional innovation systems (Bailey, Bellandi, Caloffi, & De Propris, 2010; Becattini, 2001; Dei Ottati, 1994). Particular attention will be given to *variety within specialization*, *extra-regional networks* and to the *role of alignment of policy visions between the actors of regional and national systems* in supporting path renewal and path creation. The relevance of the theoretical framework will be examined by use of two cases of historical textile districts: Prato (Italy) and Borås (Sweden). The main research question of this paper is how can thick and specialized regional innovation systems engage in path renewal and creation. This general question can be divided into the following specific questions:

- What type of path development characterize the textile industry in Prato and Borås?
- What are the historical conditions underlying regional specific path trajectories?

Next section will discuss the main literature linking industrial transformation with the typology of RIS, and bringing concepts from the industrial district literature. It will focus on the intra-regional variety, extra-regional networks, and multilevel policy coordination. Section 3 will present the cases of the two textile districts, after a short overview of the current conditions of the European textile industry. Section 4 will provide a brief conclusion and will discuss some remaining questions related to growth trajectories in SRISs.

2. Regional innovation systems, transformation paths and regional specialization

2.1. Regional innovation systems and transformation paths

An innovation system refers to the set of organizations and institutions engaged in processes of interactive learning and knowledge creation and diffusion (Lundvall, Vang, Joseph, & Chaminade, 2009). Geographical proximity enables interactive learning and innovation through the exchange of both tacit and explicit knowledge among individuals and organizations (Boschma, 2005). This exchange is facilitated by a set of institutions embedded in the territory. Together, the set of organizations and their relations embedded in specific institutional frameworks, are the cornerstone of the regional innovation system (RIS).

RIS is thus defined as ‘the wider setting of organisations and institutions affecting and supporting learning and innovation in a region with an explicit focus on competence building and organisational innovations’ (Asheim, 2009, p. 28). Higher education and research institutions, funding organizations, bridging institutions, and companies among others interact in production and innovation related activities within highly contextualized institutional frameworks (e.g. culture, values, habit, norms, and regulations).

Considering both the organizational endowment and the degree of specialization Isaksen and Trippel (2016) propose to distinguish between three different types of RIS: (a) Organizationally thick and diversified RIS (DRIS); (b) Organizationally thick and specialized RIS (SRIS); (c) Organizationally thin RIS (TRIS).

DRIS are usually found in metropolitan regions, with a dense and diverse scientific, technological, and productive infrastructure featuring a high density of innovative firms operating in different industrial sectors. On the other side of the spectrum there are TRIS that are typical of peripheral regions with weak innovation and productive infrastructure.

SRIS are usually characterized by the existence of one or few very strong industrial clusters or local production systems, specialized support infrastructure, and institutions that are highly targeted to the specific regional industries. Industrial districts are typically mentioned in the literature in relation to organizationally thick and specialized RISs.¹ Industrial districts are small regions (usually referred in statistical terms to local labour systems) characterized by a main localized industry and the presence of a multitude of specialized firms, usually small-to-medium sized, and independent (Becattini, 2001). Thus, the RIS related to IDs tends to be thick and specialized.²

Past and current industrial specialization and institutional frameworks influence the possibilities for future regional development. Isaksen and Trippel (2016) distinguish four different types of regional transformation paths. *Path extension* refers to transformation processes in which regional industries introduce incremental innovations in existing predominant technological paths. In the long term, path extension runs the risk of transforming into path exhaustion as the innovation potential of the local firms decline. *Path renewal* refers to transformations in which local firms switch to different, but often related activities and sectors. *Path creation* refers to the most radical transformation of a regional industry, implying the emergence of new sectors and new types of firms in the region or the introduction of technologies and forms of organization that are radically different from the technical standards in the region.

According to Isaksen and Trippel (2016), path renewal and path creation would occur more often in diversified RIS. Instead, in specialized RIS there would be a high propensity to continue along existing development paths. The strong social capital and the limited variety of knowledge bases that would characterize these types of RIS tend to reinforce existing patterns of behaviour and lock-ins (positive and negative). Path extension would be thus the typical development path followed by a SRIS, unless complemented by external regional sources of knowledge (Trippel, Grillitsch, & Isaksen, 2018).

2.2. Transformation paths and extra-regional networks – exogenous sources of renewal

The role of extra-regional sources of knowledge in processes of regional path creation and renewal has recently been addressed in the literature, particularly in thick and specialized regional innovation systems (Martin, Wiig Aslesen, Grillitsch, & Herstade, 2018; Trippel et al., 2018). The probability to link to external region sources is considered to be a function of the knowledge base prevailing in the regional industries, the specific institutional framework, the organizational infrastructure operating in the system, the embeddedness structure of relations, and the degree of urbanization (Asheim et al., 2011; Sotarauta, Ramstedt-Sen, Seppänen, & Kosonen, 2011). In particular, differences may depend on

the types of RIS. Tödtling, Lengauer, and Höglinger (2011), investigating on RIS in Austria, show that while firms in institutionally thin RIS (e.g. Salzburg) tend to establish international linkages more extensively, firms in institutionally thick RIS (e.g. Vienna) tend to limit the establishment of linkages at a domestic level. Plechero and Chaminade (2016) analyzing and comparing RIS in emerging and developed economies find similar results. Firms located in SRIS, featured by strong specialization advantages, would rely more on linkages in close proximity (e.g. local or domestic), than on extra-regional linkages. This is particularly evident when a system reaches a mature stage of development where networks stabilized throughout time and ‘inertia’ can limit exploration strategies (Trippel et al., 2018). The exception could be agglomerations with highly specialized and localized knowledge hard to find anywhere else in the world. Additionally, thick and specialized regions might not have the capacity to tap into, absorb and integrate the knowledge acquired outside the region with the knowledge already available in the region.

However, what such stream of interpretations tends to ignore is the possible heterogeneity within a localized industry and not only in local complementary industries. This is an area well studied within the industrial district literature.

2.3. Transformation paths and intra-regional variety – endogenous sources of renewal

Industrial districts may host a complex array of productive activities, which develop products and services in the area, within the main localized industry, and in the complementary industries. As discussed by Bellandi and Santini (2017), the main industry of an ID and the local complementary industries can be represented, on the cognitive dimension, as a multiplicity of know-how nuclei, each nucleus being a niche of relatively homogenous knowledge, practices, and firms; mainly local SMEs.

Learning and creativity develop within and between the different productive experience of diverse ID nuclei. It is a clear example of what has been called decentralized industrial creativity (see Bailey et al., 2010) or doing-using-interacting mode of innovation (Jensen, Johnson, Lorenz, & Lundvall, 2007), in which innovation takes place thanks to the interactions between users and producers and on-the-job learning.³ When processes of exploitation of a given pool of knowledge dominate inside the industrial district, the SRIS has limited endogenous dynamic capabilities. Alternatively, given favourable enabling conditions, the proximity⁴ between the nuclei might allow exploration processes that bring about the spawning of new complementary or substitutive nuclei. This second type of processes would contribute to the inner differentiation of the traditional main industry through time, outlining two scenarios. When the new nuclei are complementary in productive terms to the traditional nuclei and support their technological and market strength, path extension would be the most likely outcome. Instead, when a decline hits the traditional nuclei, a substitutive function may emerge. Accordingly, some among the new nuclei, having also developed products and market channels independent on the demand of the traditional nuclei, would be able to absorb the local resources made redundant by their decline and start to grow rapidly. This would transform the main specialization of the district, and open up renewed trajectories, possibly categorized as path renewal (see Bailey et al., 2010).

In an evolutionary perspective, the set of nuclei might mutually play a complementary and/or a substitutive role, triggering exploration processes in face of market and technological challenges, also involving non-local sources of knowledge and ideas. A critical issue is understanding how these processes can be nurtured.

2.4. Regional development paths, regional and national policies, and multilevel dynamics

Regional transformations, particularly those involving path renewal and creation, can hardly take place without the support from regional and national policies.

Regional actors and their activities as place leaders are crucial driving forces for sustaining regional transformations (Bailey et al., 2010; Njøs & Fosse, 2018; Sotarauta & Beer, 2017). Therefore, even in regions that are similar in terms of structural preconditions, the type of regional governance makes a difference in regional development path. Specifically, public authorities at the regional level can act as ‘proactive facilitators’ to face path transformation only when they are positively interrelated with local market-oriented actors and supported by industrial partners (Holmen & Fosse, 2017). This implies an alignment of interests and visions at least between actors at the regional level (Isaksen & Jakobsen, 2017). Alternatively, this alignment would in turn be negative for path renewal and path creation in SRIS, if most of the actors were stuck along an existing development path (Ibid.). On the other side, regional policies are also partly path dependent being more or less embedded in the territory. If not affected by strong path dependency, regional policies could be directed to ‘broadening’ the scope of the main local industries, supporting crossovers with other related activities in the region, and enable path renewal through the development of related industries (Neffke, Henning, & Boschma, 2011; Njøs & Jakobsen, 2016). However, SRIS might not dispose of the supporting infrastructures needed for regional diversification or some crucial pool of knowledge needed for path renewal and creation. In that case, it has been suggested that effective national policies could provide those infrastructures and support access to such pool of knowledge (Njøs & Fosse, 2018).

National policies might play a fundamental role in shaping the transformation strategies and the regulatory framework of different industries. They support the accumulation of technological competences and the specialization in particular technological fields through the actions of national actors and organizations. They provide as well general ‘direction of innovation and competence-building emanating from processes of science-based and experience-based learning’ (Lundvall et al., 2009, p. 7). In this perspective, it is important to consider how the different levels of governance could align or could instead generate contradictory effects.⁵

In countries like Finland or Norway, where both State and regional governments share responsibilities for regional development (Njøs & Fosse, 2018), regional actors coordinate constantly with state actors engaging quite efficiently in regional developing strategies. However, the same Norway shows the possible evolution of policies by regional authorities pursuing trajectories that divert from national programmes (Njøs & Jakobsen, 2018). In particular, when policy actions for sustaining industrial regional upgrading are taken at national level, they might be less effective in certain regions with respect to others due to the specific cumulative path of regional choices and the typology of social capital

(Ibid.). Indeed, in the case of IDs, which do not coincide with the administrative boundaries of the region, the dynamics of political interventions at national level directed to new development path may be even more difficult to integrate or align. In Italy, for example, the historical evolution of national policies shows how, in the past, some policy failures of State interventions were due to the difficulty of matching with the specific ‘Marshallian capital’ of the IDs in which local knowledge, organizational capabilities sediment, and peculiar social governance mechanisms sediment (Bellandi & Caloffi, 2016; Goglio, 2001).

In sum, in the case of high intra-regional variety, such as in industrial districts featuring multiplicity of knowledge nuclei, path renewal processes might be possible, if the most innovative actors receive policy support to develop new activities; but even then, extra-regional networks with external sources of knowledge might be needed. In those cases, as well as in path creation strategies, the coordination between policies by the regional government, by the State and the networks between regional and extra-regional actors might prove crucial. This will be illustrated by looking at different transformation strategies of two regions specialized in traditional manufacturing: the textile districts of Prato (Italy) and Borås (Sweden). We will see how different government mechanisms and multilevel dynamics of policies in the two SRIS, bring about different opportunities.

3. The restructuring of the European textile industry: the path transformation of Prato and Borås districts

This section analyses the emergence of possible traverses to new paths of development in two European industrial districts: Borås in Sweden and Prato in Italy. Both districts have historically specialized in the textile industry, with a somewhat stronger focus on the fashion and clothing subsectors in Prato, and industrial and technical textiles in Borås. The historical development of both districts has been characterized by crises and a consequent industrial re-structuring. The two case studies have been chosen because they illustrate two different trajectories in thick and specialized regional innovation systems. The research reported in next section is based on a combination of previous research by the authors and new secondary and primary data.⁶

3.1. Current trends and path transformation strategies of the textile industry in Europe

The textile industry in Europe has undergone profound changes in the last half-century since it is a sector not only sensitive to the development and stability of the world economy, but it is also highly dependent on technology and demand changes as well as on competition of emerging economies (Wysokinska, 2003). Despite different downturns, recently, the European textile industry and the related clothing industry seem to have found new growth trajectories based on a variety of strategies (European Apparel and Textile Confederation, 2015). The prevalence of strategies aiming at lowering costs, either through the introduction of technologies or through the reconfiguration of value chains and relocation of production facilities, exemplify cases of *path extension*. Digitalization and automatization pervade design and prototyping for reduced time-to-market and fast fashion within existing typologies of products. The introduction of advanced

digital manufacturing and the increase in digital trade, as well as of innovative solutions to reduce the environmental impact, may instead express cases of *path renewal*.

As recalled for example by Scheffer (2012), the European industry has its main disadvantages in the low and medium segments of the market. The introduction of digitalized industrial technologies, or the increase of the engineering, and the intangible aspects of products, may guarantee high quality of production and consumption for new personalized customers' needs and new attractive niche markets. The 'artisan' touch, as well as intangible aspects such as reputation, labels, and creative designs, remain crucial both for leading firms and the linked system of suppliers and subcontractors.

New investments in R&D processes and scientific knowledge may support *path creation* that, in the textile industry, appear to be strongly linked to sophisticated technological innovation. They concern for example solutions that improve people quality of life, increase comfort and safety (e.g. fibre material to store energy), or contribute to mitigate health problems (e.g. allergies, pollutions etc.). The dominance of knowledge of more scientific nature is also required to take advantage of cross-fertilization between the textile sector and other sectors and disciplines (medicine, architecture, environmental), involving new chemicals, sensoristics, testing, and measurements methods (Allgemeiner Vliesstoff-Report [AVR], 2013). The technical textiles sector, which today represent the EU part of the industry with stronger linkages to research activities (Scheffer, 2012), appears to provide favourable, though not exclusive, fields for path creation.⁷

Although the heterogeneity in firms' strategies has increased in recent years within IDs, we will see, in the next subsections, that Prato (Italy) seems to be following predominately path extension with a potential for renewal strategies, while Borås to be heading to path creation.

3.2. Path extension and renewal in Prato (Italy)

The textile district of Prato (in the Tuscany region) has been one of the most celebrated Italian industrial districts and one of the main textile districts of Europe (Becattini, 2001). Its area extends to the municipality of Prato (close to Florence) and to other 10 contiguous smaller municipalities.

The local textile industry has a long history that dates back to the Middle Ages. At the beginning of the 1960s, a decentralized industrial organization emerged around the flexible production of a changing variety of carded woollen fabrics and yarns. This drove a fast growth in the number of textile firms, usually SMEs, specialized in single or a few stages of the production processes and employing an increasing number of skilled and semi-skilled workers (Dei Ottati, 1994). Local markets for the exchange of intermediate textile products and operations were integrated by social trust and collective action on contractual norms, territorial and technical infrastructures (e.g. collective industrial purifiers), and by the action of 'open teams of specialised businesses' (Becattini, 2001). Between the 1970s and the 1980s, firms started to work with many different fibres, expanding production across an ever more differentiated range of yarns and fabrics. Various complementary and related production and service activities emerged locally, such as machinery, tools and dyes for the textile industry, clothing, and, later, ICT-enabled solutions for the industry.

In the second half of the 1980s, the local textile industry registered some difficulties of over-production, and the number of textile workers and firms started to decrease. However, the capability of the district to specialize in a rich variety of textile products and services related to the world fashion industry became stronger and confirmed the buoyancy of the district in the 1990s. Technical textiles also expanded without replacing the historical specialization of the district. In the first half of the 2000s, the competition in the yarns and fabrics markets from Asian low-cost producers and international value chains increased, especially because of the reduction of trade barriers and the technological progress in transportation and management systems. This directly impacted the local textile production and the related system of local firms and job markets, even if services and complementary industries kept on growing.

At the same time, since the 1990s and at an increasing pace in the 2000s, the district experienced waves of Chinese immigration, which led to the emergence of a parallel clothing and knitwear business cluster in Prato, led by the Chinese community. Unfortunately, the interplay between the historical textile industry by Italian firms and the new specialization by Chinese companies did not lead to important economic synergies.⁸ When the great international crisis exploded in 2007, Prato's industry was under a phase of instability and uncertain transition. This triggered a reshaping of the textile industry⁹:

The value of textile exports from the Province of Prato between 2001 and 2009 halved (decreasing from 2,412 to 1,026 million euros). As a consequence, the Prato textile system downsized considerably: the number of textile establishments in the Province of Prato fell from 4,976 in 2001 to 2,926 in 2009, while at the same time the number of workers dropped from 32,218 to 18,431 (Dei Ottati, 2014, p. 1258).

Though its local dominance has reduced, the textile core (fabrics, yarns, and other textiles) could still drive the local economy, its competences and knowledge granting a bedrock for a renewal path. As underlined by recent research (Bellandi & Santini, 2019), path renewal would ask active strategies of investments by the more dynamic entrepreneurs, followed by the larger population of artisans, and supported by appropriate knowledge-intensive and institutional services. Specifically, Bellandi and Santini (2019), exploring the transformation of the set of competencies into the district area, suggest that the population of specialized SMEs within the manufacturing core is characterized by a growing heterogeneity in term of firms' capabilities and knowledge nuclei; such heterogeneity could help catch renewed opportunities and the implementation of related strategies. With respect to the challenges coming from digital based processes and organization, the authors identified three main profiles in the population of firms within the core activities of the textile industry:

- (a) The Traditional leaders, where the employees are not identified as a crucial source of strategic knowledge, knowledge inputs come from traditional intermediaries working for the manufacturing core, and physical components and outsourcing of material inputs remain central in the organization of production;
- (b) The Neo-Makers, quite marginal at the moment, combining artisan approaches to textile products with digital-supported solutions. Employees are identified as a crucial source of strategic knowledge, and knowledge inputs to development projects come predominately from local knowledge intensive service providers (KIBS). Smart/

connectivity components and outsourcing of immaterial inputs are searched at regional but more often at extra-regional level.

- (c) A small set of more Vertically integrated firms, led by innovative entrepreneurs with industrial strategies where employees are encouraged to increase their skills, explicitly in technical or scientific fields; knowledge inputs are partially internalized and integrated with manufacturing activities, while high-level knowledge inputs are also searched from relation with universities and international technological networks. For these firms, smart/connectivity components become central, while outsourcing related to material inputs have a lower importance.

The institutional support to the local manufacture appears to have not yet adapted (year 2017) to the exploration of new opportunities opened up by the recent challenges and the possibility of a wave of investments related to the new types of firms and strategies within the core. Therefore, the Neo-Makers and the innovative (relatively) vertically integrated players, which include the germ of path renewal, complain a lack of appropriate local policies and government support. Local support would be at the moment still too much devoted to traditional initiatives of lobbying, mediation, and sectoral training at the local level linked to the main traditional knowledge nuclei.

Inter-sectoral matching platforms, also at cross-scale territorial and sectoral levels, would be needed to strengthen the opportunities of sharing and learning new and diverse knowledge and competencies, and adjust technical standards and contractual expectations in order to reduce transaction costs and conflicts (Bellandi & Caloffi, 2016). But the local support organizations, including policy-makers are still too focused on supporting the traditional knowledge nuclei, rather than on supporting the needs for tapping into new sources of knowledge of the Neo-makers and vertically integrated firms. While the traditional leading players enjoy this kind of traditional institutional support, being strongly reliant on intra-sector relations and initiatives (Bellandi & Santini, 2019), Neo-Makers and Vertically integrated players still remain aside to the system. Path renewal strategies will be unlikely nurtured, and path creation even less so.

The remarks above raise some doubts on the possibility that path renewal or creation in the district could be supported by positive evolutions within the textile core, in particular within fashion specializations characterized by artisan and engineering knowledge or nurtured only by regional policies. National policies aiming at linking the Neo-Makers and the Vertically integrated firms domestically or internationally might be needed.

There is great potential in this strategy. Particularly considering the specificities of the Italian national innovation system characterized by a multitude of industrial districts specialized in different parts of the value chain and with multitude excellence centres often located in large cities.¹⁰ Both Neo-Makers and Vertically integrated firms can potentially take advantage of some external knowledge and service providers, outside the local and often outside the regional borders. In the case of Prato, some of them may be found in the nearby city of Florence, and rarer ones still within national borders, e.g. in Milan, also including a creative advanced service cluster specialized in the fashion industry (Scheffer, 2012). The cognitive and cultural proximity that local actors from Prato have with the upper-regional government (Tuscany region) and with national providers is still at a level in which cooperative activities among the agents are possible, not only because of

geographical proximity, but also because actors under the same national identity share the same language and some cultural and social proximity.

The challenge today is for such types of relations to support the exchange of relatively codified but context-dependent pools of engineering and artisan knowledge. There have been attempts in this direction over the last decade, but the results are not yet quite clear (Bellandi & Caloffi, 2016). What is needed are policies that are able to favour extra-regional linkages connecting the emerging niches led by Neo-makers and Vertically integrated firms with the variety of specializations embedded in Italian IDs and cities where complementary (high-tech) services and services devoted to sustain the excellence of made in Italy can be found.

3.3. Path creation in Borås (Sweden)

Borås is the centre of the textile industry located in Western Sweden and has been historically considered the gravitational centre of the textile and apparel industry in Sweden (Lindqvist, Malmberg, & Sölvell, 2008); it is its most important centre even today (Edström, 2018). The textile industry in Sweden is still an important source of manufacturing employment in the country, as compared with other traditional industries.

By the beginning of the twenty-first century, Borås was responsible for half of the Swedish textile exports, a proportion that is maintained today. Despite its apparent current strengths, Borås has been the epicentre of the decline of the traditional textile specialization.

Industrial textile production began in the Borås region in the mid-nineteenth century. Dyers and printers worked primarily with cotton fabrics. Growth continued until the 1950s, when the textile industry suffered its first profound crisis as a consequence of increased international competition. Data from the mid-fifties, before the first crisis hit, shows that 70% of the population was directly or indirectly employed in the textile industry (Edström, 2018). Between the mid-fifties and early seventies, more than half of the industry jobs were destroyed. The trade liberalization that occurred in the seventies and eighties as a consequence of the entry of Sweden in the EU and the Multifibre agreement only aggravated the decline of the industry which could not compete in terms of costs (Ibid.).

The aftermath of the crises brought a profound restructuration of the industry in a process of creative destruction characterized by structural adjustments, bankruptcy of iconic companies, and loss of employment (Gullstrand, 2005), as well as relocation of manufacturing first to other western EU regions, then to Eastern Europe, and finally to Asia – mainly China (Edström, 2018). The major textile, clothing, and knitting companies in the Borås region dealt with this crisis following a similar pattern:

At first, they purchased modern equipment and outsourced some production. When these measures proved ineffective, they reorganized as holding companies with various activities in other business sectors. Or they created equity portfolios of shares in diverse sectors. Then, as the crisis continued, they sold assets including their trademark brands. Some companies eventually entered bankruptcy or completely restructured. (Edström, 2018, p. 221)

As a consequence, the textile and apparel industry in the Borås region, dominated by small family business with a strongly local entrepreneurship culture, was stripped down

to mainly design activities, purchase and retailing, but almost no production. The response by the more dynamic companies, equivalent to the Neo-makers in Prato, was based on three strategies (Edström, 2018; Ljungkvist & Börje, 2016): (1) increased specialization in certain high-added value sub-industries; (2) regional mobilization for the development of skills and competencies in technical textiles, particularly in three focal areas (health and medicine, architecture and construction, and sustainable textiles); and (3) access to public investments for innovations in the area of technical textiles, requiring a coordination of different knowledge at different levels, such as in the case of a fabric that purifies water using solar energy or clothing that measures the heart rate.

Cooperative organization structures are common in Borås, partly due to the large proportion of family-owned companies and relatively few larger companies (Edström, 2018; Ljungkvist & Börje, 2016). But this cooperative spirit is not only limited to companies; in fact, one of the most important initiatives supporting path creation and renewal in the region came from a higher education institution – the Swedish School of Textiles at the University of Borås. In 2006 the University of Borås coordinated a proposal for the renewal of the local textile industry around technical textiles used in industrial applications. The ‘Smart Textiles’ initiative has as main partners the Swedish School of Textiles, the University of Borås, the SP Technical Research Institute of Sweden, and the incubator of Borås as well as local companies and the local government. The programme received 60 million Swedish crowns (around 6 million Euros) for an 8-year period from VINNOVA, the Swedish Agency for Innovation Systems. Together with local companies, they run around 450 research projects (SmartTextiles, 2017) primarily within three focus areas: Health and Medicine; Sustainable Textiles; and Architecture and Interiors (including sustainable building materials).

The Swedish School of Textiles at the University of Borås, together with local companies and the City of Borås also initiated a project in 2011 to develop a space suitable for the development of spin-off companies from the University. The Textile Fashion Center took form in 2011 and is currently a

meeting place for businesses that are involved mainly with textiles and clothing [...]. The founding principle of the Textile Fashion Center is that it should provide a platform for the development of new knowledge, new products, and new business opportunities that can strengthen the economy of the Borås region. (Edström, 2018, p. 225)

The path creation and renewal strategies that characterize the transformation and upgrading of the Borås textile and apparel industry were initiated by local actors. However, they would not have been successful without strong support from the national and regional innovation system and policies. On the one hand, in the aftermath of the crises, the City of Borås supported the move to the higher-value parts of the supply-chain by investing in design, education, quality, innovation, marketing and logistics, including fashion e-commerce, which now represents an important source of revenue for the city (UNEP, 2016). The University of Borås, as recalled above, plays a fundamental role in supporting the development of technical and design capabilities in the industry. It employs 700 teachers and researchers and has 12,000 students enrolled in different programmes. Research is conducted in seven areas including Business and IT, and Textiles and Fashion (Design and General), in which they also have a bachelor programme (Edström, 2018).

We have seen as well that significant funding for the upgrading strategy came also through national sources with the Smart Textiles programme. It was funded by VINNOVA in 2006 through the VINNVÄXT-program, which is VINNOVA's main instrument to fund regional initiatives. The programme is a bottom-up project, in which a consortium of regional actors applies for funding to VINNOVA for the implementation of particular upgrading strategy for the region. The programme requires the engagement of companies, researchers and the government, 'which must all work proactively towards a joint strategic concept' (VINNOVA, 2016).

Additionally, the national government has funded the *SP Sveriges Tekniska Forskningsinstitut AB* (the Technical Research Institute of Sweden – TRIS), which is one of the main partners in the Smart Textiles initiative. The TRIS was relocated by the Government from Gothenburg to Borås (Edström, 2018).

The upgrading strategies related to technical textiles in Health and Medicine can be considered a success in terms of research capacity and support from stakeholders. However, the development of sustainable textiles and technical textiles for Architecture and Interiors still suffers from significant limitations. Among them, De Propriis et al. (2015) highlight the weak links with the providers of raw materials (notably the forest sector), the end-users, and large-scale retailing companies.

All in all, the Borås case illustrates how more radical strategies of path renewal and path creation strongly rely on investment in R&D and scientific activities, and depend fundamentally on the strength and alignment of the regional and national policies and multi-level government initiatives for its successful deployment. Policy makers play a very important role, not only as providers of funding but also as facilitators of networking space and access to the required knowledge.

A challenge ahead for the industry is to move from innovative specialization in existing or emerging industrial competences to interaction and collaboration between diverse and possibly unrelated actors to address societal challenges (Boschma, Coenen, Frenken, & Truffer, 2017). This is the aim of the new Strategic Innovation programmes that the Swedish government launched in 2012 as a mandate to VINNOVA (Grillitsch, Hansen, Coenen, Miöner, & Moodysson, 2019).

4. Conclusion

The driving question of this paper was to investigate to what extent path extension and renewal strategies could be pursued in thick and specialized regional innovation systems. By combining insights from the regional innovation system literature with that of industrial districts we proposed a framework that considered both endogenous and exogenous sources of renewal.

The Borås case illustrates how more radical strategies of path renewal and path creation in thick and specialized RIS are possible but depend fundamentally on the strength of regional and national policies for its successful deployment. Borås has been the object of successful strategies around shared visions of transformation and coordination between local, regional and national actors and policies. They aimed at path creation in the local industry through the combination of different knowledge across intra and extra-regional networks. State policies play a very important role, not only as providers of funding, but also as facilitators of networking space and access to the extra-regional knowledge required.

The case of Prato suggests that processes of path renewal may be triggered by a more endogenous set of forces. Prato is quite a complex system, hosting many nuclei of know-how within and around the textile specialization with a diverse degree of novelty. Lacking the shared visions and strong multi-level coordination that characterize Borås, path renewal in Prato's textile industry would demand policies supporting local innovative actors, which operate at the fringe of the main industry, and helping them to build or insert into extra-local (national and international) knowledge and trade networks.

These cases illustrate that strategies beyond path extension are possible in thick and specialized RIS but for those strategies to materialize, national and regional policy initiatives should take at least complementary functions. In the case of path creation, when new industries or new activities are to be created, reinforcing policies at national and regional level need to be strongly coordinated along common visions of the new development path, in particular if the regions lack prior industrial preconditions. More research is needed on the interplay of policies at different levels, the degree of alignment or conflict, and their impact.

Policy interventions at different levels should take into consideration the institutional and social conditions which characterize a region as well as its social capital. Furthermore, and in line with recent research (Sotarauta & Beer, 2017), the cases point out to the importance of leadership and agency at multiscale levels – from local, to regional and national. This is an aspect in which more theoretical and empirical work would be dearly needed.

The cases also hint at another important aspect that deserves further research. Strategies of path creation, such as the one pursued in Borås, engaging almost all former actors in the regional industry, if successful, may imply long-term growth for the region. However, if they fail, it might imply the annihilation of the industry in that region. Strategies of path renewal, such as those potentially available in Prato, based both on intra-regional heterogeneity, extra-regional networks and policies, provide experimentation spaces in the fringe of the existing specialization, which might be related to higher degrees of regional resilience. If successful, they eventually grow new local specializations, driving path transformation. If unsuccessful, the traditional specialization – potentially supporting path extension – will remain active, providing source of employment and possibly growth to the region, at least for some time. Therefore, long-term historical analysis of the evolution of different path development strategies in regions should also help to evaluate such different balances of strengths and weaknesses in regional resilience.

Notes

1. It is important to highlight here that IDs *are related* to SRIS but are *not equivalent* to SRIS. While the concept of industrial district refers to the region, RIS refer only to the set of organizations and institutions supporting learning and innovation *in that* region. In other words, SRIS could be understood as a part of an ID comprising those organizations and institutions related more directly to learning and innovation in an ID.
2. In this respect, recent contributions (Gabaldón-Estevan, Manjarrés-Henríquez, & Molina-Morales, 2018 and Gabaldón-Estevan & Ybarra, 2017) suggest to use the term 'District innovation systems' to refer to 'a system of relationships within an industrial district where externalities facilitate firms' innovation processes' (Gabaldón-Estevan et al., 2018, p. 898).

3. Production and innovation activities overlap thus making it difficult to draw clear boundaries between the ID and the SRIS in which it is embedded. Of course, SRIS also includes some institutional actors providing or supporting the provision of crucial specific public goods, such as shared rules on social rewards for innovators, public funding on projects of networks of innovators, or collective laboratories for testing and prototyping, etc.
4. The concept of proximity is a multi-dimensional concept (Boschma, 2005). In the industrial district literature, different forms of proximity (e.g. geographical, institutional, and so on) support also in different times the interplay between the heterogeneity of knowledge. Specifically, a high social or institutional proximity may compensate for low levels of cognitive or organizational proximity, supporting the 'productive chorality' of the system (Becattini, 2015).
5. The perspective of alignment of regional and national levels of governance (Bellandi & Caloffi, 2016; Zukauskaitė, Trippel, & Plechero, 2017), could be considered also under the light of the relations between RIS and NIS (national innovation systems). Please refer to Cooke and Morgan (1998) and Chaminade, Lundvall, and Haneef (2018) for some general remarks and examples.
6. We collected primary data through interviews to representatives of 21 institutional agents and 16 firms related to the manufacturing textile core of the district, district experts and policy makers between June 2016 and April 2017. The semi-structured company interviews enquired about the organization's innovation strategies, their innovation activities and knowledge linkages, the use of industry 4.0. technologies and the role of the RIS supporting their innovation strategies.
7. The technical textiles in Europe not only show positive trends but generate today an important part of the industry value (European Apparel and Textile Confederation, 2015).
8. Although it has supported the economic stability of the city and the overall performance of the area (Lombardi & Sforzi, 2016).
9. During the same period, the importance of the clothing and knitwear industry specialization has instead increased in relative and absolute terms, largely pushed by the local Chinese community. The role of the Chinese community in the development of the textile industry in Prato has been discussed extensively by Dei Ottati (2014, 2017), Guercini, Milanese, and Dei Ottati (2017) and Lazzarotti and Capone (2017). While their economic role in the area is increasingly important, the weakness of industrial interplay with the textile core implies that the three leading profiles in the population of firms of the core, as discussed in the text, are not affected directly.
10. The relations between industrial districts of the made in Italy and larger Italian cities have supported past successes: 'the presence of cities in regions where there is a high intensity of industrial districts' helped the districts to meet easily international buyers of haute couture, branches of multinationals operating in the fashion sectors, design centres or large universities, and take advantage of many fairs or events of the made in Italy. 'On the other hand, without the growth of sets of industrial districts specialized in various parts of the made in Italy, which cannot be explained as a simple effect of the economy of the city, the same cities would not have developed such capabilities' (Bellandi, 2014, Section 4).

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ORCID

Cristina Chaminade  <http://orcid.org/0000-0002-6739-8071>

Marco Bellandi  <http://orcid.org/0000-0002-9044-5630>

Monica Plechero  <http://orcid.org/0000-0001-8854-1343>

Erica Santini  <http://orcid.org/0000-0001-5662-0119>

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