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Globalization and Institutional Change in Italian Industrial Districts

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Issue 2016-02| Volume 13
www.spaces-online.com

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Please quote as Bathelt, Harald and Conserva, Nicolas (2016): Globalization and Institutional Change in Italian Industrial Districts. SPACES online, Vol.13, Issue 2016-02. Toronto and Heidelberg: www.spaces-online.com.

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Keywords Arduino, Canavese, FIAT, globalization, industrial districts, institutional change, localized learning, Olivetti, restructuring

JEL codes R11 (Regional Economic Activity), L25 (Firm Performance), O33 (Technological Change)

Abstract

This chapter investigates the adaptability of regional production systems characterized by localized learning dynamics to globalization processes. In applying an institutional perspective to the analysis of regional economic change in Italian industrial districts, the argument is developed that successful adaptation is most likely in situations of hybrid institutional adjustment in which fundamental institutional change aimed at triggering new economic developments in certain fields is combined with institutional persistence in others in order to actively integrate established industries into the restructuring process. This is illustrated empirically by analyzing regional restructuring in the Canavese district, Italy over the past 35 years – a district traditionally dominated by the automotive/metallurgical industries around FIAT and the electronics/mechatronics industry around Olivetti.

ISSN: 1612-8974

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1 Introduction

Italian industrial districts and their internal economic structures became a major field of academic inquiry in the social sciences during the 1980s and 1990s. These districts received a lot of attention as a new alternative regional industry configuration that successfully resisted the trend toward mass production and large-firm dominance during the Fordist development period. Especially the so-called Third Italy was celebrated for its ability to achieve growth on the basis of an agglomeration of small- and medium-sized firms that were closely linked through regional production networks (Becattini 1990; Becattini et al. 2009; Belussi and Pilotti 2002; Brusco 1982). The success of Italian industrial districts was attributed to the development of localized learning processes and specialized institutional settings (Amin and Thrift 1995; for an overview of developments and debates see Bathelt 1998 and Bathelt and Glückler 2012).

With intense globalization processes and the pressure on firms and regions to become better integrated into the global economy, new challenges to growth have arisen in these industrial districts since the 1980s. The fundamental question raised by these developments is whether localized learning systems can still survive in an era of increased global competition (Belussi and Sedita 2012; Camuffo and Grandinetti 2011; Dei Ottati 2009a, 2009b; Rabellotti 2004; Whitford 2001; Whitford and Potter 2005) and how the institutional settings of industrial districts can be modernized to enable economic growth in a globalizing world?

To provide an answer to this question, this chapter employs a case study of the Canavese district in northern Italy, north of Torino. The region has an interesting economic structure in that it is characterized by two interlinked organizational fields (DiMaggio and Powell, 1983) in the automotive/metallurgical and the electronics/mechatronics industry. Canavese is home to the automotive producer FIAT and the electronics/minicomputer firm Olivetti. While somewhat different from other industrial districts that do not specialize in capital-intensive and technology-based industries, Canavese similarly established localized production and learning systems in the automotive/metallurgical industry and electronics/mechatronics industry with a division of labor that was centered on the two lead firms (e.g. Albino et al. 1998; Giblin 2011). With increasing competitive pressure on FIAT and Olivetti, the entire region had to undergo extensive restructuring processes since the 1980s. Interestingly, both organizational fields underwent a similar institutional change from a context characterized by localized learning and a distinct regional 'culture' toward a more global, open learning and interaction system, without completely giving up established regional linkages and reference points.

This chapter uses this example to show that it is advantageous in such a situation to employ a mix of elements combining institutional change with continuity to sustain regional growth in the context of globalization. It is argued that successful regional restructuring of a localized production system cannot be built on radical technological and institutional shifts alone. It requires, on the one hand, that some more fundamental institutional adjustments take place that support the formation of global linkages and new

technological trajectories and, on the other hand, that elements of continuity support long-established industries and prior competitive advantages.

In the next section, we develop our conceptual argument and present a model which relates regional restructuring to different types of adjustments in the localized institutional context and industry structure. This is followed by brief comments about the methodology applied and a description of the socio-economic context of the Canavese region with FIAT and Olivetti. The analytical part of our study presents a systematic discussion of how the regional production system developed from a setting of localized learning toward an open economic system, providing support for the conceptual model of regional and institutional change. We conclude by considering policy implications.

2 Regional Growth and Institutional Change

In conceptualizing the question of how localized learning systems can adjust to globalization pressures and successfully restructure, we develop a perspective that pays particular attention to the role of regional institutional settings and their adjustments. This perspective links to other work in economic geography that has dealt with the dangers of regional lock-in processes and challenges to regional resilience. There is a now broad literature on regional lock-in that emphasizes the threats to innovation and economic growth, which result if institutional settings become too rigid and are over-embedded in hierarchical power structures with few dominant actors (e.g. Grabher 1993; Hassink and Shin 2005; Saxenian 1994). This literature focuses on ways to explain and avoid institutional rigidity. Other, more recent work has focused on the economic resilience of regions that are subject to external shocks. Studies on resilience have investigated how regions are able to withstand or overcome external shocks and get back to their former growth paths (e.g. Hassink 2010; Martin and Sunley 2015; Pike et al. 2015). While the studies on lock-in and resilience emphasize the importance of institutions in economic development, their analytical focus is on preventing interruptions to economic growth patterns, rather than on investigating the interdependencies between corporate adjustments and regional institutional change in the regional development path. Especially in the context of fundamental ruptures, when localized learning systems are threatened by globalization processes, the institutional perspective applied in this chapter may be important to explore the potential for successful regional restructuring and identify alternative scenarios of development (Bathelt and Glückler 2012; Glückler and Bathelt 2017).

2.1 Institutions and Institutional Context

An institutional perspective is crucial to analyze regional economic development as a collective process, since institutions enable economic actors to develop expectations of the behavior of other actors and reduce uncertainties in economic life (e.g. Hodgson 1988; North 1990). Especially when certain types of behavior can be enforced and deviations sanctioned, firms will find it less risky to engage in collaborative practices. Accepted institutional settings are a crucial prerequisite for the development of any sort of social division of labor. Thus, when analyzing coherent regional economic structures, such as localized learning systems, special attention must be paid to the role of regional institutions that enable localized interaction patterns and generate the conditions for the reproduction of such patterns (e.g. Rodríguez-Pose and Storper 2006). If these specific institutional settings are replaced by different types of institutions, learning processes that rely on a regional division of labor may change substantially and localized interaction patterns may disappear.

While most researchers in economic geography would agree with the above logic (e.g. Boschma and Frenken 2009), their understanding of institutions is often vague and the term ‘institution’ is sometimes used in a

rather unspecific way to relate to all sorts of government influences on economic development. This is confusing and causes misunderstandings as to how institutions operate (Bathelt and Glückler 2012, 2014). An example may help illustrate this: let us assume the government in a region that has been in power for some time introduces a fundamentally new policy to stimulate economic growth. The question here is whether this is a case that is characterized by institutional persistence (associated with an established government) or by institutional change (because of a new policy approach)? Our answer would clearly depend on the understanding of institutions applied. In what follows, we will suggest a careful and explicit definition of institutions.

We suggest to look at institutions in terms of how they shape economic interaction. In some studies, governments, banks or pension funds are viewed as institutions (e.g. Clark and Monk 2013). However, in our perspective these are organizations, not institutions. A ministry for economic development, for instance, does not have an immediate impact on economic interaction. However, it may decide upon and create new rules, regulations or policies that are relevant for the firms in a region and are targeted to guide their behavior. In economics, institutions are widely understood as rules and regulations (Gertler 2010; North 1991). In our view, however, such rules and regulations are not yet institutions. They establish a framework for actions but do not determine a specific form of action and interaction. A new regional start-up policy that provides financial incentives may lead to innovative firm start-ups from local universities or it may trigger vertical disintegration tendencies in existing industries. In the first case, this may generate a regional context of individualistic technology start-ups; in the second, a trust-based division of labor in established industries may develop. This example suggests that rules and regulations can be interpreted differently by firms and may have a completely different outcome in terms of the unfolding regional practices and patterns of interaction. It is these latter patterns of correlated behavior (Setterfield 1993) or planned and unplanned stabilizations of economic interaction (Bathelt and Glückler 2014) that we refer to as institutions in a narrow sense.

For an institutional analysis of regional economic change, it is clearly not enough to focus on only one element of this development. When investigating the dynamics of organizational fields within a framework of regional change, it is necessary to consider all levels of what we refer to as the 'institutional context', as well as their interplay (Glückler and Bathelt, 2017): the role of and linkages between institutional actors (individuals and organizations that generate rules), the rules and regulations that are created by them (that act as a framework for interaction) and the patterns of interaction that develop in practice (institutions in a narrow sense). While these interconnections between organizations, rules and practices have hardly been systematically studied in broader conceptual and empirical investigations, some extreme scenarios seem intuitively clear when we think about the consequences of globalization processes. It is likely, for instance, that existing organizations that operate based on long-term rule systems with established practices will find it hard adjusting to abrupt changes caused by globalization. Vice versa, young firms that engage in emerging technology fields driven by new rules and regulations may develop flexible interaction patterns that can adjust more easily to new global technological structures. Since the challenges of globalization in the localized learning context of an industrial district will have to be met by many existing firms that operate in established technology fields according to well-established practices of production and bringing products to market, institutional adjustments cannot just focus on new technologies and new firms with new practices but will have to develop bridging and connecting capabilities to be able to trigger inclusive regional change.

2.2 Institutional and Regional Change

To discuss the institutional context of regional economic change further, we introduce a simple model which can be applied to our situation of an industrial district with a localized learning system that is challenged

through globalization. The model, which is summarized in Table 1, presents different scenarios of regional restructuring in relation to two factors: (i) adjustments in the industry/corporate structure and (ii) adjustments in the regional institutional context. Inspired by studies of Douglas and Hargadon (2017), Scott (1998) and Streeck and Thelen (2005) who point at the importance of hybrid or mixed scenarios, the following analysis investigates how different combinations of corporate and institutional adjustments in a region will influence the outcome of regional restructuring processes in response to globalization.

The table refers to a specific regional context, such as an industrial district, that has developed a coherent industry structure characterized by localized learning dynamics and self-sustained innovation. As this regional context is challenged by a wave of globalization processes, the industry structure in the region and the institutional context are both put under pressure. The table pictures six possible scenarios. In a first set of scenarios, we assume that corporate structures in the region do not adjust to the globalization forces but instead continue to collaborate with the same set of regional/national partners and rely on the same technologies as before. In this case, we cannot expect a positive regional outcome, no matter what changes are implemented and occur in the institutional context (assuming that both can, at least initially, change independently). If changes to the institutional context are minimal, we will likely be faced with a loss of corporate competitiveness and while regional learning processes are still in effect these would be unable to fundamentally solve globalization-related problems because actors would lack access to wider knowledge ecologies. This is a situation that may be due to institutional hysteresis (Setterfield 1993) or regional lock-in (Grabher 1993). The result could be regional decline. If such a situation would be coupled with efforts to radically change the institutional context, for instance by generating new research organizations and establishing a fundamentally different set of support policies, the expected effects would not be much different as the new institutional conditions may not match the pre-existing corporate structures that persist in this scenario. In the end, the regional learning basis would be threatened and a regional economic crisis could be the consequence.

Table 1: *Scenarios of Regional Restructuring as a Response to Globalization Pressures*

Scenarios of regional restructuring		Adjustments in regional institutional context		
		Persistence	Hybrid change	Fundamental change
Adjustments in regional industry structure	Persistence	- Loss of corporate competitiveness - No effects of regional learning - Regional decline	- Institutional stimulus unsuccessful - Stagnation of regional learning base	- New institutions do not match - Loss of regional learning base - Regional crisis
	Change	- New learning patterns develop - Hollowing out of regional learning platform - Slow regional change	- New/old industries integrated in new/established learning cycles - Growth in global economy consistent with localized learning	- New industries supported by new institutions - Established industries left behind - Bifurcated regional structure

The outcome would be different if core segments of the regional economy recognized the opportunities and threats associated with globalization and decided to engage in corporate restructuring processes, for instance by investing into new technologies and linking with international markets and technology centers through foreign-direct investments (e.g. Cantwell 2014). The likely scenario under these circumstances would depend on the nature of institutional changes that would occur or be implemented. If, at one extreme, institutional settings in terms of practices and policies remain largely the same as before, new learning patterns may be limited to those firms that engage in restructuring but would not include other regional actors. As a consequence, the regional learning platform would likely become weaker over time and a hollowing-out process may take place (Bathelt 2009, 2013). The result would be slow regional change and limited economic growth or even stagnation. If, at the other extreme, radical changes are implemented within the institutional context by providing incentives for fundamental organizational shifts and introducing policies that target new industries and start-up processes in new technology fields, the effects may be more promising but the overall outcome could still be slow regional change and a bifurcation of the regional economic structure, as traditional industries with few changes in products and technologies may be left behind.

The scenario would be quite different, however, if we consider a hybrid structure of institutional adjustments with new policies that are directed, on the one hand, to the modernization and adjustment processes in traditional industries and, on the other hand, to discontinuous technological change and the establishment of new industries. It is through hybrid institutional adjustments that both established and new industry structures can be supported simultaneously and become integrated in overlapping learning cycles. This setting would have the potential to transform existing learning patterns by integrating external actors and technological developments while still maintaining localized linkages and feedback loops. It is such hybrid institutional change that may have the potential to preserve localized learning dynamics in the context of the global economy, combining fundamentally new institutional elements that open up regional dynamics with pre-existing institutional settings which encourage a coherent regional structure. The importance of hybrid institutional change has also been pointed out in other recent work on regional and national economic restructuring processes (e.g. Evenhuis 2015; Streeck and Thelen 2005). In their political economy analysis, Mahoney and Thelen (2015), for instance, identify multiple institutional strategies that link pre-existing with new economic structures. These hybrid institutional changes range from displacement strategies (where new institutions challenge and replace older ones) to conversion (where established institutions are redesigned to new purposes), but also include strategies of layering (linking new elements to existing structures) and drift (where active adjustments are made to existing institutional settings). Pike et al. (2015) emphasize that such processes are not one-time adjustments but involve repeated restructuring and institutional calibration over time. Which strategy is appropriate in a specific situation depends on the conditions of the challenges and the nature of the pre-existing institutional context.

In sum, the argument behind the different restructuring scenarios in Table 1 suggests that chances for successful regional economic change are best if, on the one hand, open and flexible adjustments in corporate structures occur and if, on the other hand, these are coupled with hybrid adjustments in the institutional context that address both the need for new fundamental restructuring and the importance of securing regional coherence related to pre-existing competencies. Of course, the reality is more complex than expressed in this model as institutional contexts involve different layers of organizations, rules and stabilized practices. There is no guarantee that changes in these three levels will always be directed toward the same outcome (Glückler and Lenz 2016). For the sake of our overall argument, we will not investigate the potential contingencies between the three levels but focus on the entirety of the institutional context and those adjustments with the most notable impact.

3 Methodology

This paper uses the Canavese district in northern Italy as a theory-confirming typical case (Seawright and Gerring 2008; Tokatli 2015) to investigate the regional restructuring processes in a region that has been subject to globalization processes, challenging the sustainability of the localized learning system. Canavese, located north of Torino, can indeed be viewed as a typical case because the region with its two organizational fields was able to successfully adjust to these globalization pressures – a process that was enabled through hybrid institutional change as illustrated in the empirical part. In the 1990s and 2000s, its dominant industries that had historically developed around two lead firms – FIAT and Olivetti – were challenged by new international competitors both from highly-developed industrial clusters and low-labor-cost locations. At the same time, markets were opening up and massive foreign-direct investment processes took place through which firms developed a multinational structure with access to international markets and technologies. The Canavese district managed these challenges quite well compared to other Italian regions (e.g. Buciuni and Finotto 2016; Rosati 2016). Between 1991 and 2011, the number of firms in the district increased from 20,150 to 23,450, while employment experienced only a modest decline from 95,800 to 87,000 (Table 2). Remarkably, the automotive/metallurgical and electronics/mechatronics industries were able to restructure successfully and avoid a deeper regional crisis. In fact, employment in these industries remained almost constant between 1991 and 2011, at about 31,000 employees, and the number of firms increased by more than 50 percent from 2,050 to 3,250. As a result, the regional share of these industries in employment and firm population increased during this period. This was due to tremendous start-up and growth processes of small and medium-sized firms (SMEs) and declining employment in large firms.

Table 2: *Economic Demography of Canavese by Industry Groups, 1991, 2001 and 2011 (Computed from ISTAT (1991, 2001, 2011) for the local labor market areas of Cirie, Ivrea and Rivarolo Canavese)*

Economic indicator		1991	2001	2011
Industry total	Firms (no.)	20,150	24,350	23,450
	Employees (no.)	95,800	102,100	87,000
Industries related to Olivetti and FIAT[1)]	Firms (no.)	2,050	2,500	3,250
	Employees (no.)	31,400	28,350	31,000
	Firms (share)	10.1%	10.3%	13.8%
	Employees (share)	32.8%	27.8%	35.6%
	Employees in large firms (no.)	38.4%	20.1%	17.4%
	Employees in small and medium-sized firms (no.)	61.7%	79.9%	82.6%

Note: [1)] Electronics, mechanics, steel molding and components.

We applied an institutional perspective in the empirical analysis to investigate the successful restructuring process in Canavese with a mixed methods approach. On the one hand, this involved the collection of data, prior academic work, policy reports, as well as media analyses and published interviews with crucial entrepreneurs and experts in the district. On the other hand, we conducted 18 semi-structured interviews in 'close dialogue' (Clark 1998; Yin 2009) with regional firms, planning authorities, institutional actors and observers during the summer of 2015 to systematically collect information about the industrial and institutional changes that took place. The interviews started with questions about the early development of the district and the institutional context that formed in terms of decisive organizations, policies and interaction practices. The next set of questions focused on the role of globalization processes and the resulting threats to the competitiveness of local industries. Finally, interviewees were asked to compare today's industry structure and institutional settings with the earlier ones and indicate the adjustments that had occurred. Interviewees were selected first by contacting crucial firms, policy/planning authorities and university researchers and subsequently by using a snowball method. In the end, we triangulated the various sources of information with each other (Miles and Huberman 1994) in an attempt to reinterpret the regional economic restructuring process from an institutional perspective in a consistent way. The results are presented in the following sections.

4 Socio-Economic Context of Canavese

Over time, the Canavese district had developed an internal spatial division of labor shaped by the two lead firms FIAT and Olivetti. The northeastern part around the city of Ivrea, Olivetti's headquarters location, specialized in electronics, ICT and fine mechanics, the southern part near Torino in automotive, and the northwestern part in mechanics and steel molding (Confindustria Canavese 2015; Demetrio and Giaccaria 2010). The economic structure of FIAT and Olivetti and their institutional settings are investigated in separate sub-sections below.

4.1 FIAT and the Automotive/Metallurgical Industry

FIAT was originally established in 1899. The firm developed a network of production facilities in the Torino region and adjacent areas. Not only did it become a major automotive producer in Europe but the rise of its industry spawned a broad network of local suppliers and service providers in the wider region in western and southern Canavese. These suppliers were largely oriented toward FIAT, which received 70 to 80 percent of their products (Aimone Gigio et al. 2012). While FIAT had already established international linkages to some European markets since the 1920s, these were mainly sales-oriented and focused on market integration. Global knowledge acquisition practices and international partnerships were seemingly not important until the 1980s. However, during the 1980s and 1990s, rationalization and cost-cutting pressures in the European automobile industry were strong and led to international mergers and acquisitions (Hudson and Schamp 1995) which created strong competitive pressures on FIAT. The consequences were restructuring processes and successive downsizing exercises in order to cut costs (Whitford and Enrietti 2005). The impact of these pressures on the supplier sector in the Canavese district was severe. Between 1991 and 2007, car manufacturing and component production in the Torino region reduced their labor force by over two-thirds and one-third, respectively (Aimone Gigio et al. 2012). In Canavese, this decline was less pronounced and compensated by growth in other industries (Table 2). Despite this, the automotive industry kept a strong foothold in the region. By 2009, 355 of FIAT's tier-1 suppliers were still located in the province of Torino – indicating that there was still a substantial local production system (Aimone Gigio et al. 2012).

Overall, the automotive/metallurgical production system in the Canavese region was highly dependent on FIAT. The firm had established a hierarchical division of labor and more or less dictated the conditions of producer-user relationships and the directions of technological change. This institutional context was supported by a Fordist political economy with centralized capital-labor relations and strong unions (Bagnasco 1986; Whitford and Enrietti 2005). Disadvantages of the large firm dominance in this sector were visible in the institutional context which remained quite strong and persistent, focused on the role of FIAT, with no particularly strong initiatives to support restructuring or the development of new industries. This part of the regional economy was clearly locked into the automotive value chain of FIAT. While specifically attuned to the context of the global automobile industry with linkages to international markets, the institutional context was fundamentally characterized by linkages within the regional production system and localized learning processes that were the drivers of regional growth

4.2 Olivetti and the Electronics/Mechatronics Industry

Similar to FIAT, Olivetti was established as a family business in 1908 and developed a strong reputation as a producer of typewriters – a relatively new technology at that time. Already early on, Olivetti internationalized its activities, exported its products to other countries and established market-related branches in Barcelona (1929) and Buenos Aires (1932). In the 1940s, Adriano Olivetti took control of the firm in a period when the production of mechanic calculators had started and soon before electric typewriters were being developed (1950s). From these activities, the firm moved into segments of the electronics industry that were technologically related. Olivetti produced Italy's first electronic mainframe computer in 1959 and the first desktop computer worldwide (Programma 101) in 1965 (Brilliant 1993; Olivetti 1999-2008; Radogna 1960) and put a focus on its successful electronic calculator business. The firm eventually developed into a very large player in the field of electronics and office equipment with a total of 73,300 employees in 1970 (47 percent of which were in Italy) and a strong international presence (Barbiellini Amidei et al. 2010; Castagnoli 2014). By that time, the eastern part of Canavese had developed into a strong electronics/mechatronics district. As one interviewee, who had experienced this process, described in 2015, "*there was and still is a specific atmosphere*" in this industrial district (translated from Italian). Olivetti had a great presence in the region, especially in Ivrea, and many families had members that worked for Olivetti. The firm also introduced an extensive corporate welfare system and supported workers' education programs. All this led to the development of collaborative capital-labor relationships in the region, strong worker loyalty and high levels of social trust (Arrigo 2003).

In the 1970s and 1980s, the firm continued to internationalize its activities through takeovers and partnerships and established R&D centers in leading high-technology regions such as Cupertino, New Canaan and Cambridge (Castagnoli 2014). Canavese itself never developed into a similarly vibrant innovation center because, as our interviewees explained, it was lacking a large variety of competitors and technology leaders. While Olivetti recognized the importance of being located close to leading-edge technology centers, the establishment of R&D subsidiaries in such regions was not a substitute for the development of a strong knowledge ecology around its innovation and production base in Ivrea. One observer explained in an interview that there had been attempts at that time to sell activities to and closely collaborate with another technology leader that could have provided better access to global technology clusters, but that these attempts ultimately failed.

By the 1990s, Olivetti had lost its leading edge and was not able to cope with the dynamics in technology clusters such as Silicon Valley. Like the minicomputer firms in Boston's Route 128 region (Saxenian 1994), it ran into problems. This led to a shift toward telecommunications equipment. Not only did the firm lose its

leadership, it also came under huge financial pressures as a result of problematic management decisions and its extensive corporate welfare system (Gallino 2003). The firm had always been focused on hardware rather than software development and observers argued that Olivetti eventually failed because it was unable to exploit its first-mover advantages compared to American competitors and shift from electronics to computers in the early 1970s (Gallino 2003; Perotto 1995; Soria 1979). This was no longer possible after the firm's electronics division was sold to General Electric in the 1960s in an attempt to overcome financial difficulties. Eventually, after a merger/take-over deal with the Telecom Italia group in 1999, the Olivetti brand name became marginal – and its global leadership was ultimately gone.

The regional effects of Olivetti's growth were just as significant as those of FIAT, albeit in a different way. Olivetti shaped a regional production system with more interactive trust-based collaboration compared to FIAT. Firms in this production system continued to be innovative as efforts were undertaken to maintain high skill levels. Olivetti supported university programs, professional schools and even high schools to generate new and reproduce existing talent (Arrigo 2003). As pointed out in our interviews, the firm had developed a local supplier network somewhat like FIAT's but much smaller, consisting mostly of small family businesses (80 percent; Michelsons 1990). As opposed to FIAT, the supplier network was not structured in a hierarchical way but was more open and based on interactive learning dynamics. Networks, as one expert told us, were often made up of former Olivetti employees who had got to know each other through co-working experience. These networks strengthened regional capabilities and led to the development of new technologies through firms such as Manital, CTS, ASIC or Logitech – i.e. developments that were related to former innovations by Olivetti.

The 'culture' of Olivetti produced an interactive and open learning network based on trust relations. Already early on, Adriano Olivetti had developed strong linkages between the firm and the local community and pushed for active knowledge exchanges and the idea of free knowledge access. In this spirit, the firm organized events with international designers to broaden the knowledge base beyond purely technical skills. Olivetti also established programs for its employees to regularly visit other production facilities and research centers. One of the interviewees suggested that because of these practices, "*Ivrea engaged with globalization [even] before globalization existed*" (translated from Italian). As a consequence of these kinds of practices, employees in the local production system were able to develop broad competences and contributed to the reproduction of innovation dynamics – albeit not quite at the level of leading technology clusters. When Olivetti finally faltered, extensive early-retirement programs were negotiated which were, although based on federal programs, in line with the firms' social responsibility developed in earlier times (Arrigo 2003; Censis 2001; Provost and Lai 2016). The downside of these programs was that a massive loss of local talent occurred due to retirement and that a start-up boom, such as that seen in high-technology regions like Cambridge or Silicon Valley, did not occur (Bathelt and Glückler 2012).

While the context of the electronics/mechatronics district differed in important ways from the automotive/metallurgical industry in that it was less hierarchical, more open and already since the 1960s oriented toward international linkages, there were important similarities. Both organizational fields had a strong regional technology orientation, important localized learning processes and were embedded in their respective localized 'cultures' with limited linkages to global technology dynamics.

5 From Localized Learning to Open Systems

Having characterized the structure and evolution of the production and learning system in Canavese, this section explains how the district was able to overcome the threats and challenges that went along with economic globalization in the 1990s and 2000s. It is argued that a successful transition was possible because

new economic activities were established and existing industry structures upgraded to meet the required adjustments to open markets and international competition. This went along with fundamental adjustments in the institutional context as new players introduced new economic models, new policies were established, and practices changed from localized learning toward open systems integration. At the same time, this process was also linked to and built upon existing institutional settings and former business legacies, which enabled traditionally operating firms to be included in the overall restructuring and modernization process. Interestingly, such hybrid institutional change occurred in both the automotive/metallurgical and electronics/mechatronics industry of the Canavese region. It enabled a push from localized learning and interaction towards open systems and global networks while actively embedding prior structures and competencies.

5.1 Internationalization of FIAT

Ongoing competitive pressures in the automobile industry during the 1990s led to further downsizing of FIAT but also supported the process of opening-up the sectors' structure, which became more internationalized. Local supplier linkages substantially decreased but some continuity remained and in 2007 about 30 percent of FIAT's supplies still originated from the surrounding region (Aimone Gigio et al. 2012). Suppliers reacted to the overall decline in orders from FIAT by actively strengthening other business segments and developing new customer relations beyond Torino and Canavese. In fact, significant internationalization processes gradually emerged in the supplier sector. This also included efforts to actively move into new technology fields and develop new products. The consequences were increased innovativeness and internationalization in the supplier sector, which became less dependent on FIAT and more integrated with other European car producers. Former managers from FIAT also got involved in start-up processes, while building upon and strengthening pre-existing network relations. The highly-localized FIAT district was thus transformed into a more open and internationalized automobile district (Aimone Gigio et al. 2012; Whitford and Enrietti 2005). Automobile suppliers still continued to collaborate locally with each other, albeit less so with FIAT. As one interviewee emphasized: "*Firms learned they have to collaborate to survive*" (translated from Italian).

In contrast with Olivetti's strong social and cultural impact on the electronics/mechatronics industry and its labor force, the influence of FIAT was different and focused on the needs of the production process, being less concerned with promoting socio-economic development. FIAT's presence in the region and its impact continued to decline after the 1990s (Confindustria Canavese 2015; Demetrio and Giaccaria 2010) and eventually even its headquarters moved away to the Netherlands after FIAT took over Chrysler. Despite this, the firm maintained key research centers and university linkages in the region. Existing local research capabilities, in fact, attracted new firms from other regions and countries, such as General Motors' Powertrain Europe research center. This center was established in 2005 following a partnership between FIAT and General Motors, but did not cease its activities when this agreement ended. Public policies supported the regional transformation of the automotive sector, although they were not decisive triggers of it. On the one hand, regional initiatives like the Aerospace Platform were established to strengthen the development of engine technologies in different applications. On the other hand, policies were put in place to manage areas with discontinued production, especially through the regional agency Torino Nuova Economia – a public-private consortium with FIAT (Torino Nuova Economia n.d.). All of this went along with a decline of Fordist production structures, while preserving a distinct regional production context and building upon existing competencies. The process of hybrid institutional change was also supported by new firms and organizations and through government programs that introduced new policies.

5.2 Institutional Legacy of Olivetti and Arduino

In the electronics/mechatronics industry, Olivetti's legacy was just as strong as that of FIAT in the automotive/metallurgical industry although in rather different ways. Despite the fact that many employees went into early retirement and were no longer available as employees when Olivetti downsized in the 1990s, start-up processes of new firms in the field were significant (Ronca 2015; Vanolo 2008). Former workers were heavily involved in these start-up activities, which benefited from their experience in the industry and their network linkages to other individuals and firms in the region around Ivrea. One observer confirmed that new firms were often established by "*sons of ex-Olivetti workers … [based on] 'inherited' software skills*" (translated from Italian). Supported by these processes, the regional industry structure opened up and became more diversified. The electronics sector received a broader basis (for instance in software development) and strengthened its established competencies in industrial design. Our interviewees often emphasized that the mind-set of free knowledge and open exchange that was shared by many people was due to Olivetti's prior activities.

The firm Arduino, a pioneer in open-source technology, is a good example of some of the effects of Olivetti's institutional legacy of freely accessible and freely available knowledge. Arduino is a world-renowned producer of a programmable logic controller – with the same name – (Arduino 2016; De Paoli and Storni 2011; Stückler 2016) that permits the interaction between its users and their environment. The firm's economic success is based on developing flexible, high-performance technologies and offering them at a low price. Built on an open-source ideology, the controller Arduino has become a worldwide standard for prototyping tasks and is applied in all sorts of electronics applications. The users of the technology consist of a diverse group of electronics firms, professionals, as well as hobbyists. They have the choice to buy the components as a package and assemble them themselves or to acquire the pre-assembled product, which then receives the Arduino trademark. Interestingly, the firm – as a new player in the region – is directly linked to Olivetti's former activities and benefitted from the previously developed regional research and labor market competencies. The controller technology was originally developed by the Interaction Design Institute that was linked to Olivetti and Telecom Italia's former CSELT laboratory. One former manager claimed that "*the Institute … captured the entire innovative atmosphere*" (translated from Italian) in the region.

Arduino is widely linked to its global user community that provides crucial input into product development but also promotes knowledge sharing within the local district and thus supports its cohesion. While the trademark guaranteed local production in the Canavese region, the firm's philosophy of open source technology broke with the localized division of labor in Canavese (De Paoli and Storni 2011). Despite its success, the size of the firm and its direct regional impact via supplier relationships were limited. As one of the founders emphasized during our interview, Arduino sold about one million boards and had an annual turnover of €15 million in 2014. Local supplier linkages were not extensive and consisted of about 10 firms that were directly involved in production with a total of about 80 employees. New hardware and software development largely took place in-house while bug-fixing and learning relied on the global virtual user community. Still, local identification was apparently strong and the firm received almost a 'cult' status, both locally as well as for community members worldwide**.** Despite this success, the future of Arduino is open at this point as the founders have been involved in an internal dispute since 2014 about the future development of the firm. As Arduino increasingly came under cost pressure, some of the founders suggested shifting production to China while others insisted on preserving the local trademark. This dispute resulted in a law suit that was settled in October 2016. However, it is unclear at this point whether the production of boards will remain in Canavese (Simonetta 2016).

Altogether, the shifts generated the conditions for the former electronics district to develop into a successful, more diverse information technology cluster. As argued above, the competencies of this cluster are closely related to the prior technological successes, but are also based on other information technology developments in the Torino region and have opened up spatial knowledge ecologies even further internationally than did Olivetti's earlier operations. When Olivetti was still a leader in technology development, other information technology firms were attracted to the region (De Paoli and Storni 2011). They embedded their activities locally and established corresponding supplier linkages. This contributed to the overall strength of the district and actively supported its renewal. These processes continued later on. New and existing research institutes in the region in fields such as engineering and industrial design produced new technologies and improved the localized skill base further. Related innovations of firms such as Arduino became reference points in technology development and strengthened the labor market. One interviewee emphasized that, as a consequence, "*competencies are still in the territory [today]*" (translated from Italian) and another observer added that "*there is a specific cultural milieu in the field of coding [that has developed]*" (translated from Italian). Overall, it seems that the local industry structure is still strong and develops international linkages while district-like divisions of labor based on localized learning are getting weaker (Demetrio and Giaccaria 2010).

As in the case of the automotive/metallurgical industry, the electronics/mechatronics district benefited from hybrid institutional change that supported a shift toward open learning and global knowledge circuits without giving up, but rather building upon, a distinct regional 'culture' and localized reference points. These changes affected the entire institutional context. Aside from new organizations, such as Arduino, that have pushed for institutional change and new economic practices, policies have been introduced to support and strengthen regional technological capabilities (Censis 2001; Confindustria Canavese 2015; Consorzio Aaster 2013; Vanolo 2008). For instance, the regional government established research and development facilities in technologically related fields, through an initiative to establish an information technology innovation pole, and policies were introduced to strengthen the localized learning system by providing incentives for inter-firm collaboration. Also, university departments in engineering and communication technologies were temporarily shifted from Torino to Ivrea to support the regional restructuring process. At the same time, diversification policies in the region attempted to link new initiatives to the institutional legacy of the region, for example by establishing a new biomedical technology park in buildings of the former Olivetti laboratories, thus linking the new development to the innovative spirit of Olivetti (Ronca 2015).

6 Conclusions and Policy Implications

Using an institutional perspective to analyze regional economic change, this chapter suggests that successful economic adaptation to external pressures may best be accomplished if diversification and innovation processes are coupled with hybrid institutional adjustments, which combine fundamentally new institutional settings that support new technological developments in some segments of the regional economy with institutional continuity in other segments to actively integrate established industries into the restructuring process. This theoretical claim is illustrated in a simple model depicted in Table 1 and the Canavese district in northern Italy is used as a typical case to provide empirical support for this argument. Since the 1990s, the region experienced periods of economic turmoil and strong globalization pressures that threatened the cohesion of its economic structure that is characterized by two organizational fields surrounding the automotive/metallurgical and the electronics/mechatronics industry (Dei Ottati 2009a; Whitford 2001). Globalization pressures brought into question the value of the dominant localized learning models around FIAT and Olivetti that had worked so successfully in previous periods. As a consequence of the decline of the lead firms, which triggered the district's development in earlier times, new innovative initiatives unfolded, regional

networks were cut and new global knowledge linkages established. Interestingly, adjustments in the two organizational fields went along with similar hybrid adjustments in the institutional context, involving organizations, rules/regulations and durable economic practices

The region's automotive/metallurgical and electronics/mechatronics industries established new international linkages with suppliers and technology partners and diversified their markets compared to the previous period. Arduino with its open source philosophy was a role model in generating virtual links with global user communities. All of this was supported by an institutional context that was linked to former institutional legacies to broadly integrate industrial activities into the restructuring process and maintain localized knowledge ecologies. At the same time, incentives were provided for discontinuous start-up and innovation dynamics, supported by new specialized training and education facilities.

From a relational perspective of economic action and interaction (Bathelt and Glückler 2012), the outcomes of such institutional adjustments are not pre-determined. They are contingent in nature and success eventually depends on the willingness of economic actors to engage with new opportunities and make respective business decisions. In the case of the Canavese district, there is no guarantee for successful growth in the future, since new developments, as in the case of Arduino, may be threatened through corporate power struggles. However, the opening up of the learning system, successful diversification and strong new linkages supported by hybrid institutional change have put the region into a favorable position to react to and even pro-actively prepare to changes in the global economic and technological landscape in the future.

Acknowledgements

Earlier versions of this paper were presented in 2015 at the Global Conference on Economic Geography in Oxford and the Symposium on 'Knowledge and Institutions' in Heidelberg. We would like to thank all participants of both events for stimulating debate and suggestions. Additionally, we wish to thank Johannes Glückler, Daniel Hutton Ferris and Regina Lenz for providing excellent comments on an earlier version of this paper.

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