Top-down and bottom-up legitimization of emerging industries. Evidence from two Italian Mechatronics clusters

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Top-down and bottom-up legitimization of emerging industries.

Evidence from two Italian Mechatronics clusters

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Abstract

The paper investigates legitimization trajectories of emerging industries in traditional manufacturing areas by focussing on two inner structures: the cognitive and institutional structure. These structures and their interplay inform about the heterogeneity of routes and capabilities to enter these trajectories. We compare two mechatronics clusters, both located in the North-East Italian area, namely in the provinces of Vicenza and Trento. The cases reveal how the evolution and legitimation of emerging industries might surface from bottom-up dynamics related to the technological upgrading of local historical industrial specializations, and from top-down institutional strategies, when the business community remains fragmented.

Keywords: Mechatronics; Emerging industry; cognitive structure; legitimization trajectories; clusters; institutions.

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1. Introduction

Several research fields theoretically and empirically contribute to the scholarly debate on the phenomenon of emerging industries in regions and markets (e.g. Feldman & Lendel, 2010; Isaksen & Trippl, 2017; Binz & Diaz Anadon, 2018; Lubik et al., 2013). In this heterogeneous literature, “emerging industry” has not a univocal meaning. ¹ As suggested by Brachert et al. (2013), an emerging industry might refer not only to an industry that is new to the world, but also to an industry that is just new for a specific place.

In the recent debate on regional studies, many scholars have observed that pre-existing regional structures matter for the emergence of new business and that the reinforcement and the recombination of local manufacturing specialization might be important drivers underlying industrial branching processes (Neffke et al., 2011; Klitkou & Coenen, 2013). Contest-specific knowledge bases, techniques and competences, on one hand, and policy measures on the other, provide a fertile breeding ground for the emergence of technological improvements that could, in turn, enable the spawning of new economic activities (Asheim & Coenen, 2005; Kemeny & Storper, 2015; Martin et al., 2016; Isaksen & Trippl, 2017; Hassink, 2017).

¹ Lubik et al. (2013) claim that “emerging industries are those where no clear or established value chain currently exists. These can either be those where a new technology exists and there is no clear market and therefore no route to market, or those where a market exists but the introduction of a new technology could rearrange or destroy the existing value chain or industry.” (ibidem, 11). The authors do not focus on manufacturing areas or regions, but they explore new industries for the market.
In this debate, the focus has revolved around the recombinant effects of related and unrelated knowledge bases in reshaping local industrial configurations (Grillitsch et al., 2018; Manniche, 2012). Here, path dependency and rerouting result from different types and levels of proximity between the different local players (Boschma, 2005). Consistently with the evolutionary economic geography (EEG) literature, the emergence of new industries, seen as a special case of structural reconfiguration of traditional manufacturing areas, is more likely when the existing industrial specializations combine with new, but related, knowledge bases (Xiao et al., 2018). The colocation of diversified knowledge bases, lively cross-sectoral collaborations for the exploration of new technological opportunities, and an institutional structure ready for selecting valuable emerging solutions seem to be at the core of the emergence of new business activities in traditional manufacturing areas (Isaksen & Tripl, 2016; Moodysson & Sack, 2016; Bellandi et al., 2018; Asheim, 2019).

Despite the richness of the existing literature on emerging industries and rerouting of traditional manufacturing areas, it is not clear how new industries embeds into the existing industrial milieu\(^2\) of a place (e.g., a region, a province, a local productive system) and develops peculiar local features. Indeed, how new, emerging industries gain legitimacy within consolidated specialized clusters or regions, where the local structures shape their original configuration, remains a poorly investigated issue.

The paper contributes to this underexplored topic by assessing legitimization trajectories of emerging industries in traditional manufacturing areas by applying a place-based approach. Specifically, the aim of the paper is to describe the equifinality in

\(^2\) The “milieu” of these systems is defined by the degree of interdependence and cohesion between the various entities embedded into the manufacturing area, which incorporate know how, codified rules, values and standards (see Maillat, 1998).
the legitimacy of emerging industries, which is the heterogeneity of their legitimization trajectories, by focussing on the pre-existing features of two main inner structures: namely, the cognitive and the institutional structures.

The section 2 presents the conceptual framework, describing how the aforementioned structures contribute to the emergence and legitimization of new industries in traditional manufacturing areas. In such local settings, firms, organizations and other economic and non-economic agents are viewed as repositories of knowledge whose interaction is enabled according to two separated, albeit intertwined, structures. The cognitive structure consists in the set of the various knowledge bases localised into a traditional manufacturing area, while the institutional structure relates to the rules of the game shaping interactions, such as, i.e., norms, regulations and cultural habits (North, 1990). We claim that the interplay between the various configurations of these two structures defines a heterogenous set of legitimization trajectories which new industries might undertake to gain the status of emerging industry.

In the third section, we systematize the conceptual framework by presenting two types of legitimization trajectories: the first one resulting from bottom-up dynamics of the agents; the second one influenced by top-down actions of institutional players. The framework is illustrated through the use of two case studies on two Italian mechatronics clusters located, respectively, within the province of Vicenza and the Autonomous Province of Trento (Trentino), two neighbouring provinces in the North-East area of Italy (section 4). The final section concludes by offering policy implications and some remarks for future research.
2. A place-based approach to emerging industries

A common assumption is that emerging industries do not result from patterns of deviation in the evolution trajectory of a single industry, as they rather take place at the intersection of various technological improvements coming from the evolution of different industries (Kodama, 1992).

In traditional manufacturing areas, these dynamics are defined both at an industry level and at a place level (Menzel & Fornahl, 2010; Manniche, 2012). Place-specific legacies play a critical role in supporting the emergence of new economic activities. Opportunities for emerging industries have been mainly explored by looking at preexisting conditions of inner structures of manufacturing areas (Isaksen & Trippl, 2016; Boschma, 2017; Asheim et al., 2017; MacKinnon et al., 2019).

Many authors investigated the nature of these inner structures to understand learning processes and structural transformations in such areas by starting from the definition of the systemic components driving the evolution of the area, for example, social structures, industrial organizations and institutional settings (Menzel & Fornahl, 2010; Bellandi et al., 2019). A traditional manufacturing area, such as those characterized by well-rooted clusters or industrial districts (Becattini et al., 2009; Porter, 1996), is defined by a large population of local specialised firms, micro-to-medium sized, contributing directly or indirectly to the main manufacturing industry where the local area has a high and long-lasting specialization. Here, technological improvements are spatially embedded, and result from the recurring interactions between the different agents taking advantage of the relational infrastructure of the manufacturing area (Strambach & Klement, 2012; Boschma et al., 2017; Hassink et al., 2019). Following Bellandi et al. (2019), technological improvements and the adjustment of the existing industrial milieu are driven by both the set of knowledge bases defining the cognitive
structure of the area, and the institutional configuration of the system that refers to the rules of the game enabling interaction and cooperation between the different local actors.

2.1. Cognitive structures

Following the suggestions of Menzel and Fornahl (2010), the industrial economic structure can be characterized by a single cluster or by several distinct subclusters, defined by a different degree of horizontal and vertical complementarity in terms of resources, skills, productive processes, sectorial specializations, and markets.

The cluster and the subclusters of a traditional manufacturing area are made up of a variety of local actors, such as final firms, suppliers, subcontractors, intermediaries, research institutes, training institutions and so on. These local actors are identified as repositories of specialized knowledge and competences and can be mapped by a multiplicity of know-how nuclei (Bellandi et at., 2019). Here, depending on the levels of interaction between these nuclei of specialized knowledge and competences, the cognitive structure of a manufacturing area contributes variously to the renewal of the industrial configuration of the area (Chaminade et al., 2019). Specifically, when cognitive structures feature a high degree of specialization in one or few subclusters and a poor multiplicity of know-how nuclei, such renewal processes rarely result in an emerging industry, as the traditional manufacturing area is more likely to enter transformation processes characterised by patterns of incremental innovations which, eventually, result in the self-reinforcement of existing industries (Isaksen & Trippl, 2017). On the contrary, when the cognitive structure of traditional manufacturing area is characterised by a diversified set of nuclei of specialized knowledge and competences, the evolution trajectory of the different nuclei within the subclusters defining the area
might lead to various technological improvements which might result, eventually in an emerging industry (Bellandi et al., 2018).

Hence, the intersection of various technological improvements, coming from the evolution of know-how nuclei that contribute directly or indirectly to the different subclusters of the area, is the triggering factor of a legitimization trajectory (Kodama, 1986).

However, in traditional manufacturing areas, which are characterised by deeply-rooted subclusters, the systemic support is industry-specific, and legitimization trajectories of an emerging industry need both the development of peculiar local features, supporting the new industry, and the fit of new industry structures into the existing industrial landscape (Brachert et al., 2013). Therefore, the configuration of the cognitive structure is not enough to explain the legitimization trajectories of an emerging industry in traditional manufacturing area (MacKinnon et al., 2019). As indeed stressed by Binz et al. (2016), the legitimization of industries that strongly differ from the preexisting industrial landscape of the place might meet challenges in several institutional dimensions of the legitimization process.

### 2.2. Institutional structure

Since the technological improvements at the core of new industries in manufacturing areas result from continuous interactions and exchange of specialised knowledge within and across the subclusters of the area, scholars agree that the knowledge recombination allowing the emergence of new industries derives from process of social embeddedness (Freeman, 1987; Malerba, 1992; Lundvall et al., 2002; Bathelt et al., 2004).

In a traditional manufacturing area, the so-called “rules of the game” (North, 1990) frame the institutional structure of the place and orchestrate the coordination and
cooperative attitude of the local actors. The institutional structure is made of a set of locally established habits, convention and routines, but also laws and regulations, which provide incentives and coordination for knowledge exchange, co-learning and innovation activities (De Propris, 2002; Scott, 2008; Bailey et al., 2010). Here, the legitimization of a new industry, which differs from the pre-existing industrial structure, might ask for the adjustments not only of local institutional structures but also for complementary or reinforcing institutional conditions at different multi-scalar levels (Isaksen & Trippl, 2017; Zukauskaite et al. 2017).

Indeed, the legitimization of a new industry in traditional manufacturing areas relies on various types of local and extra-local institutions (e.g., regional, national, or industry-specific institutions). These institutions when provide consensus and support to the evolution of the set of local specialized nuclei, favour path creation and rerouting (Gertler, 2010; MacKinnon et al., 2019). Evenhuis (2017), looking at the institutions supporting the transformation of a place, points to two different types of local and extra-local meso-structures at the core of the institutional structure of a place. These meso-structures are market institutions, and governance institutions. Both have an impact on shaping the socio-economic interactions taking place within the local area, but they act at two different levels. Market institutions operate mainly at the industry level, whereas governance institutions act at a regional and supra-regional level.

These meso-structures shape both the interactions between actors involved in production and transaction activities (market institutions), and the engagement of multi-local agents and organizations pursuing public or common goods (governance institutions). The role of these meso-structures in the transformative process of a place makes both market and governance institutions able to influence the legitimization process of emerging industries (Plechero et al., 2020).
3. Two types of legitimization trajectories of traditional manufacturing areas

The literature on regional studies agrees that the industrial transformation of a traditional manufacturing area is strongly characterized by path dependency (Cooke et al., 1998; Martin & Sunley, 2006; Asheim & Coenen, 2005; Neffke et al., 2011). As indeed suggested in the previous section, the transformation of a manufacturing area is strongly influenced by the cognitive structure configuration and the dominance of some institutional arrangements. These pre-existing systemic conditions might enable the emergence of new industries in traditional manufacturing areas and foster legitimization trajectories, or prevent any mutations in the industrial landscape of the area.

Table 1 represents the nature of legitimization trajectories in traditional manufacturing areas by mapping the pre-existing systemic conditions of cognitive and institutional structures. We assume that opportunities for the emergence of new industries depend on the status of the multiplicity of nuclei of specialized knowledge and competences in a traditional manufacturing area.

A cognitive structure featuring a poor multiplicity of nuclei of specialized knowledge and competences and few subclusters is characterized by scanty endogenous resources for innovation and scarce opportunities for the intersection of various technological improvements coming from different know-how nuclei, hence it is not a breeding ground for the intersection of various technological improvements, which is at the core of rerouting (Table 1, part A). As a consequence, this configuration of the cognitive structure has a limited endogenous capability to go through the transformation of the main manufacturing filière, if not by path extension (Isaksen and Trippl, 2016).

This holds both in the case of favourable market institutions and of active and strategic governance. Indeed, in such traditional manufacturing areas, institutions are usually characterised by strong sector-specificity and there is limited power and
awareness in supporting emerging industries and legitimization trajectories (Hassink et al., 2019). Specifically, when thick institutions, at the industry level, support collective learning, innovation and entrepreneurial activities, the area might embed self-reinforcing mechanisms that support path dependency (Table 1, scenario A1). If, instead, a manufacturing area is driven by top-down strategies (i.e., governance institutions), the place might benefit from policies supporting for diversification and innovations (Table 1, scenario A2). However, the limited latent mechanisms and endogenous resources, such as a multiplicity of know-how nuclei contributing directly to the different subclusters, are not likely to foster emerging industries (Chaminade et al., 2019).

Vice versa, when the area’s initial conditions are described by a diversified set of nuclei of specialised knowledge and competences contributing directly or indirectly to a diversified set of subclusters, the traditional manufacturing area might benefit from decentralised industrial creativity and contamination experiences, leading to a spawning of new nuclei at the core of an emerging industry (Menzel and Fornahl, 2010; Bellandi et al., 2019). In such a case, the institutional structure might open legitimization trajectories where peculiar local features, specific to the new industry, are developed by top-down or bottom-up dynamics (see part B of Table 1).

Referring to the two institutional meso-structures, one trajectory might be entered thanks to the dominance of market institutions pressing for adjustments of the industrial landscape in order to answer to external or internal market needs; whereas the other trajectory might have at the core some strategic top-down actions orchestrated by a thick and favorable governance.

In the former trajectory (scenario B1 of Table 1), a business cohesion supporting bottom-up collective actions may foster legitimization trajectories of emerging
industries. Here, various industrial-related formal and informal institutions (e.g., routines, work practices, technical standards, skills training schemes, and so on) are crucial for the development of peculiar local features at the core of the new industry. The support of various local intermediates such as chambers of commerce, business associations, labor unions might help the coordination of collective resources following internal or external market trends. Depending on the driver of this trajectory and the extent of the structural reconfiguration of the area, the legitimization of a new industry might assume a thick or a weak place-based nature.

A thick based nature of the trajectory can derive, for example, when local governance institutions strongly shape and dominates paths for the adjustments of the local milieu to support the legitimization of a new industry in the area. The legitimization of the outcome of the intersection of various technological improvements in different know-how nuclei derive from top-down institutional strategies and relations (Table 1 scenario B2). The strategic functions of the governance institutions may foster the collaboration of actors within public, private sectors, and civil society, managing the coordination of both conflicts and new resources (Evenhuis, 2017). In this regard, many authors have advocated for the important role of local governance institutions in building up a shared vision lowering transaction costs (Bailey et al., 2010). A place-based “strategic intelligence” (Evenhuis, 2017) is indeed crucial for the interpretation of changes and the adjustment of the local industrial landscape.

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3 When, for example, the legitimization trajectory is driven by global markets, and the legitimization of the new industry is not followed by key reinforcing adjustments by the public organizations and the local educational systems the place-based nature of the trajectory remains less dominant.
Table 1 Legitimization trajectories of traditional manufacturing areas.

<table>
<thead>
<tr>
<th>Multiplicity of know-how nuclei</th>
<th>Market institutions</th>
<th>Governance institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>A1) Self-reinforcing mechanisms in existing industries driven by bottom-up actions</td>
<td>A2) Incremental innovations supported by top-down strategies</td>
</tr>
<tr>
<td>High</td>
<td>B1) Emergence of new industries thanks to the bottom-up interaction at an industry level</td>
<td>B2) Emerging industries resulting from top-down strategies at a regional and national level</td>
</tr>
</tbody>
</table>

4. The case of two Italian mechatronics clusters

In order to characterize the two legitimation trajectories described above, we employ two case studies: the mechatronics cluster of Vicenza and the mechatronics cluster of Trentino, both located in the North-East Italian area. These cases have been selected for their similar cognitive structure (i.e., a diversified set of know-how nuclei) but their different institutional configuration. Moreover, both cases represent well-known examples of performing clusters in the North-East area of Italy, showing great potential due to the focus in the adoption of the latest digital technologies related to the fourth industrial revolution.

Over the last three decades, many Italian manufacturing areas entered deep transformations of their industrial landscape. In some cases, these transformations have resulted in the embeddedness of emerging industries, as in the case of mechatronics.

Despite the increasing attention from policymakers in the mechatronics industry, we are not aware of any previous case study developed in the literature which looks at the heterogeneity of legitimization trajectories in traditional manufacturing areas. In the few existing cases, mechatronics is typically recognised as the ‘natural’ technological upgrading of the machinery industry (Gretzinger & Royer, 2014; Ingstrup, 2014).
Given the long-lasting tradition of mechanics in Italy, the mechatronics industry might be the result of path-dependent dynamics. However, several studies concerning Italian mechanical clusters show that only a few of them are nowadays identified as mechatronics clusters (Freddi, 2009; Florio et al., 2014; Plechero, 2017).

In what follows, we will explore legitimization trajectories by comparing the main features of an emerging industry in two different places and how the two resulting industries have been shaped by heterogeneous trajectories.

4.1. Methodology and Data

The emergence of new industries in manufacturing areas, and more generally at the regional and country-level, is not a trivial process and can be highly context-specific. As stressed by Feldman and Lendel (2010), generally emerging industries do not fit into existing classifications, thus making empirical analysis complex and fuzzy and accounting in our case, at least partially, for the lack of previous studies focussing on mechatronics in the literature.

In this work, in order to track the sectoral boundaries, we adopted a multi-step procedure. We started by implementing a systemic literature review to understand the sectoral codes mapping mechatronics. Specifically, in our work we focussed on firms producing mechatronics products, mechatronics components or involved in related mechatronics automation processes (Antares, 2016; Universitas Mercatorum, 2013).

After this first step, we investigated the mechatronics boundaries triangulating the evidence with some industrial experts and employing a set of semi-structured face-to-face interviews involving different types of local actors (i.e., policymakers, business
associations, and entrepreneurs). These steps allowed to clarify the set of sectoral codes related to the different know-how nuclei within and without the local subclusters of specialization involved in the creation of the new industry.

Moreover, we investigated how these places enter legitimization trajectories by administering, in both clusters, an online survey aimed at providing information on the cognitive and institutional structures of the two manufacturing areas. The survey is made by structured questions focussing on different topics: main firms’ structural characteristics (i.e., main activity, size, age, group composition, exports); post-financial crisis (referring to the period after 2014) performance; innovation activities; the nature of linkages with other companies and organizations at different geographical levels; and the role of different local players in sustaining the new industry. The percentage of respondents on the selected population is in both cases higher than 15%. Pearson’s chi-squared test confirmed that respondents represented well the entire target populations for both surveys.

In what follows, the two cases are introduced according to the following steps. First, we characterise the productive structures of the two areas as a way to understand the configurations of the cognitive structures at the time where the new industries emerged. Then, we describe the main results of the two surveys. We mainly focus on the topics of knowledge sharing and institutional support as a means to improve our

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4 We have included manufacturing sectors, such as manufacture of computer, electronic and optical products, manufacture of electrical equipment, manufacture of machinery and equipment.

5 In the Vicenza case, the survey has been conducted in 2017, while in Trentino data was collected in 2019. The percentage of respondents (on the selected population) is respectively 18.7% for Vicenza and 25.5% for Trento.
understanding of the cognitive and institutional structures, and the nature of the legitimization trajectories in the areas. Our aim is not to describe the trajectories in a single point in time, but to highlight two radically different and peculiar development paths undertaken by the two local new industries in their process of emergence (Plechero et al. 2020).

4.2. The mechatronics cluster of Vicenza

In Vicenza, the local manufacturing is strongly anchored to the traditional ‘Made in Italy’ industries. Almost 40% of the economic activities in terms of value added is related to manufacturing, around the double of the Italian average. The main subclusters characterizing the province are Electromechanical and Mechanics, counting for more than 10% of total employment. Other clusters, ordered by employment rate, are Metal products, Textile Clothing and Footwear, Tanned-leather, Chemical, Rubber and Plastic, Wood and Furniture, Agri-food and Goldsmiths and Jewellery. Even if Vicenza has a thick productive structure, the presence of several specialised subclusters organized around a multiplicity of know-how nuclei gives a picture of a province characterised by fragmented industrial institutions, where different interests of local stakeholders and communities of entrepreneurs need to coexist.

The origin and the evolution of the Vicenza mechatronics mirror the aforementioned aspects. Indeed, the evolution of different nuclei of specialized knowledge within the province and their interplay remain mainly business- and market-driven. After the Second World War, when local firms started to increase their

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6Official statistics of Chamber of Commerce related to 2015.
https://www.vi.camcom.it/downloadDoc.php?f=all%5F4756%5F1%5FRapporti%5FSTAT%5FConoscere%5FVicenza%5F2017%5FNov17%2Epdf&id=4756&r=2
specialization in Made in Italy productions, such as textile, leather, and furniture goods\(^7\), the mechanics competences increased radically. While this local dynamic has been fundamental to provide the first root to the emerging industry, an important role in the historical evolution of the mechatronics cluster has been played by some local leading firms (e.g., Pellizzari and Lanerossi). These leading firms, both directly and indirectly, have supported not only technological advancements in the direction of the mechatronics but also knowledge spillover in the local supply chain enlarging even further the specialization of competences towards the other subclusters and the further development of nuclei of specialization. In particular, Pellizzari had a key role in implementing new technics of industrial electronics for producing engines and power generators serving also other local subclusters. Lanerossi had an important role in the specific development of mechatronics products targeting initially the local textile industry\(^8\).

These two leading firms have indeed promoted the surfacing of a large number of subcontractors, suppliers, competitors, and employees aimed to become new entrepreneurs and supporting the specific productive processes of other local firms. This constellation of firms started to serve firms of other subclusters that needed to improve their flexible specialization through the application of mechanics and electronics competences, and expand their presence not only in the national but also in international markets.

\(^7\) Mechanics competences were also serving the growth of the local agricultural industry.

\(^8\) The role of Lanerossi has been key also for the implementation of one of the most important technical industrial school (A. Rossi), which today represents still one of the main sources of the mechatronics related competences.
The presence in the area of a set of subclusters characterized by a multiplicity of know-how nuclei has been the pre-condition for the expansion of the new industry since today.

Interviews initially run with key informants and the subsequent survey both confirm and underline a cluster where the mechatronics specialization is at the intersection between different nuclei of specialized knowledge and competences: industrial machinery, electrical and electronic appliances and machinery, automation, targeting strongly the other local subcluster specializations. The firms referring to the new industry mainly base their innovation processes on the clients’ needs (that today turns to be mainly international clients). This is an effect of global market pressure and the export orientation developed over the years by the different subclusters entering the global value chains.

Even if cooperation at local level exists, particularly supporting the production process and the implementation of activities related to product development, only 35% of firms has acquired from external partners the main strategic knowledge for implementing innovation. Scientific research projects in cooperation with knowledge-providers are quite limited in the area. Moreover, this cooperation attitude is mainly focused on reinforcing established local mechanisms of learning. Collaboration for innovation activities remains still an unusual practice and established within deeply-

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9 Even the Vicenza local branch of the Padua University, in which there are mechatronics specializations, seems more devoted to implement its role in the already well-established local sub areas of specialization than in new and unrelated fields of applications.
rooted supply chain networks\textsuperscript{10}. Our results show that in the mechatronics industry, innovation mainly bases on internal resources and aims at responding to the adaptation of products and services to customers specific requests. Around 40\% of the firms have an R&D department but often it results to be not so formally structured. The majority of employees involved in the development of innovation within local mechatronics firms has been trained in professional and technical institutes and has a technical and engineering profile. The type of knowledge at the core of firms’ innovation processes remains mainly based on competences developed by learning by doing and interacting processes that are typical of those local subclusters.

Our empirical investigation highlights that firms have so far strongly pursued their innovation strategies by following market opportunities and global trends.

In terms of institutional structure different local companies, investigated through the survey and the interviews, have identified a lack of vision by the local governance in supporting their growth.\textsuperscript{11} The difficulties of the governance institutions in supporting the emerging industry is underlined by the high percentage of firms (more than 60\%) considering the role of local governance not important at all in supporting competitiveness. Only less than 17\% of the firms were also aware of the regional

\textsuperscript{10} We observed through the survey that local companies support their innovation activities by using sophisticated machineries and equipment developed by national and international providers.

\textsuperscript{11} Even the strategic cluster agreement, aimed at strengthening the development of mechatronics competences in the region, promoted in 2004 by some firms of the mechatronics cluster together with the main Industry Association and the Regional Authority has not be so efficient. The agreement has not been renewed, limiting specific regional support for the mechatronics cluster.
initiatives supporting the local industry and only 5% were benefiting from them.

The above-summarized evidence (see Figure 1) goes in favour of a bottom-up legitimation of mechatronics in the local manufacturing area, and against the hypothesis of a top-down place-based legitimization, since institutions, public organizations, as well as the local educational system, did not have any dominant role in enabling the adjustment of the existing industrial milieu.

4.3. The Mechatronics cluster of the Autonomous Province of Trento

The Autonomous Province of Trento (Trentino) is part of an autonomous region, Trentino-Alto Adige, which has an independent authority of legislation. In the province of Trento, the industry sector accounts for around 20% of the gross value added\(^{12}\) and employs around the same percentage\(^{13}\) of the local labour force. Compared to Vicenza, where the service sector generates around 55% of value added, in Trentino this figure


amounts to more than 70% (in line with the national data). The relative prevalence of service activities coupled with the fragmented nature of the manufacturing sectors are considered the major drivers calling for local public intervention. Such efforts resulted in targeted local policies aimed at supporting the mechatronics industry, which contributes to the advanced manufacturing field considered strategic for the local competitive advantage.

Since the last century, as in the case of Vicenza cluster, the area has been characterized by a population of manufacturing SMEs mainly related to a traditional mechanics cluster, and several subclusters related (in this latter case) to materials for construction, mechanics, food processing, paper and wood making. In the mechanics cluster, many local manufacturers were subcontractors of large companies, such as the tire maker Michelin. However, at the end of the last century, some of these large companies left the area and the local authorities started actively planning a manufacturing transformation by mobilizing the multiplicity of nuclei of knowledge and competences located into the area.

From the end of the last century, the local institutions have collectively promoted the creation of new organizations to foster technological advancements and research activities at a local level. Specifically, the Province has highly invested in the higher education and research system (composed by the University of Trento and a series of research organizations such as the Fondazione Mach, MUSE Science Museum and Fondazione Bruno Kessler (FBK), which have today important research centres specialized in artificial intelligence, ICT and new materials. Besides, since the nineties, in order to support the technological upgrading of the different subclusters of specialization, the Province has focused on encouraging the adoption and spread of ICT
technologies through incentives and ad-hoc policies\textsuperscript{14}.

Finally, some local research institutes, such as departments of physics and engineering of the local university, and some national research centres jointly contributed in the advancement of electronics knowledge at a local level by investing huge resources in research fields related to sensors and microsystems.

Building upon these policy actions, a few years ago the public authorities have implemented local strategies\textsuperscript{15} to enable the legitimization trajectory of the mechatronics industry. In this regard, to support the new industry the University of Trento launched a Master degree in Mechatronic Engineering, contributing to the development of human capital with specific and integrated knowledge and competences. On the other side, professional and technical institutes started to provide courses to develop competences matching the mechatronics companies’ needs. Here, innovation is not driven only by customers’ needs, but also by the technological advancements resulting from the research activities implemented by the just recalled organizations.

Nowadays, the local area hosts an industrial park, namely, Polo Meccatronica, which gather 35 mechatronics firms employed in machinery, automotive, robotics, IT, and industrial automation sectors. It has a key role for the local embeddedness of the mechatronics industry, encouraging sharing and knowledge transfer between traditional manufacturers and mechatronics firms. This park provides start-up incubators programs and an office for technology transfer aiming at facilitating the embeddedness of the new

\textsuperscript{14}E.g., the establishment of the Provincial law 6/99 offered a general framework for stimulating the collaboration between science-based institutions and industrial sectors.

\textsuperscript{15}According to the implemented smart specialization strategy (RIS3), the Trento Province defined mechatronics among the strategic sectors at the core of the technological upgrading and innovation processes of the Province.
industry at a local level.

By the one hand, these local policy measures have allowed the upgrading of mechanical firms to mechatronics, providing specialized workforce and an ecosystem sustained by a differentiated set of know-how nuclei. Indeed, the pre-existing mechanical know-how nuclei merged with nuclei related to the subcluster of electronics and IT have been fostered by the institutional actors and targeted funding. On the other hand, the establishment of new mechatronics firms in the provincial territory has been encouraged by start-up incubators and a favourable business environment, attracting also MNCs and firms from outside the province.

From the survey, the mechatronics firms of the area show a dynamic innovation capacity. Specifically, many of the mechatronics firms have introduced innovations in their portfolio and processes, and more than half of the firms have an internal R&D department. Almost all of them claims to have introduced at least an instance of innovation in the last 3 years.

Innovation activities take place by means of a mix of sources, internal and external to the company. Sampled firms report outsourcing a large share of technical activities for product and services development. Likewise, hiring specialized employees, mainly locally trained, is the typical channel to upgrade internal knowledge and internalize innovation outputs.

Looking at the knowledge networks, while it results quite fragmented, the local university plays a central role for the competitiveness of the mechatronics firms, since it seems to be the main local stakeholder for innovation activities. Other local stakeholders, such as suppliers and clients, are not particularly important for the local firms’ innovation activities. However, even if, market institutions assume an important role for knowledge flows, they are not dominant in affecting the adjustment of the
industrial milieu.

As far as the institutional support is concerned, contrary to what we found in the Vicenza cluster, the mechatronics firms identify in the governance institutions a key player. In this regard, 25% of the respondents know the measures put in place by the different governance institutions and 15% of them has utilized such instruments. In addition, 70% of companies consider the local governmental actions relevant to their competitive advantage.

For the above-summarized evidence arising from our empirical analysis, in Trentino the legitimization trajectory of the mechatronics industry is, therefore, mainly driven by local governance institutions fostering both the emergence of the new industry at a local level and its legitimization by the involvement of multi-local agents and organizations at different territorial levels (Figure 2).

5. Conclusions and Discussion

This paper aims at contributing to the growing debate between scholars and policymakers on emerging industries in traditional manufacturing areas (Brachert et al., 2013; Binz & Diaz Anadon, 2018; Hassink et al. 2019), by offering novel insights on the
nature of legitimization trajectories. Our analysis has typified the heterogeneity of legitimization trajectories by exploring different patterns of emergence of a new industry which are supported by specific systemic structures.

The proposed conceptual framework shows how the interplay between the various configurations of the cognitive and institutional structures defines a set of legitimization trajectories which new industries might undertake to gain the status of emerging industry.

Focussing on a cognitive structure where emerging industry is a more likely outcome (i.e. scenarios B of Table 1), the paper applies the framework to two different manufacturing areas. Starting from a similar cognitive structure, in terms of subclusters of specialization and know-how nuclei and a common national institutional environment, the two mechatronics clusters of the provinces of Vicenza and Trento showcase different trajectories for the legitimization of an emerging industry. By interpreting the results of the two surveys, we retrace if the emerging industry embeds into the existing industrial milieu of a place and develops peculiar local features.

In the mechatronics industry of Vicenza, the legitimation of the emerging industry relied mainly on bottom-up dynamics powered up by private actions within some know-how nuclei of the machinery subcluster. Legitimation was largely driven by market institutions, whereas governance institutions did not provide a set of public organizations supporting the new industry. On the contrary, in the Trentino case, the mechatronics industry is mainly the result of policymakers’ planned strategy, as governance bodies identified the new industry as key for the development of the local economy. In line with such vision, the governance institutions provided the area with an
experimentation platform (i.e., ProM Facility\textsuperscript{16}), start-up incubators, and offices for technology transfer supporting mechatronics.

The paper shows how legitimization trajectories might be pushed by forces at two different levels: in the Vicenza case, the market played an important role, while in the Trentino area the local governance structure was central for both the embeddedness and the orchestration of collective actions. The two trajectories are different in nature. Even if in the Vicenza case we can identify a bottom-up trajectory, the legitimization results mainly from industry-specific actions and it is driven by business interactions, global markets and value chains. If, on the one hand, this bottom-up trajectory highlights self-selection of local specificities, on the other hand, the weak place-based nature related to the governance institutions may preclude the route for alternative initiatives supporting the emergence of new niches of specialization. In the Trentino case, due to the strong action of the local policymakers, the mechatronics industry seems to have a thicker place-based nature.

These results overall highlight that when the two local meso-structures at the core of the institutional structure of a place are not aligned, a strategic intelligence with a long-term vision around the future of the new industry might be missing (Evenhuis, 2017). The cases show some weakness in the strategic intelligence which might impair in the long term the competitive positioning of the local areas and might result in lock-

\textsuperscript{16} ProM Facility is a project realized within the Operative Programme FESR 2014 - 2020 of the Autonomous Province of Trento, thanks to the financial support of the European Union - European Fund for Regional Development - of the Italian State and the Autonomous Province of Trento. This public platform enables private and public local actors to enter the current digital transformation by means of Mechanical, Electronics and IT prototyping.

https://promfacility.eu/#/
in connected to competing and unstable trajectories of transformation. In the Trentino case, despite the efforts of the local governance, local entrepreneurs still show limitations in the exploration of new knowledge resources through the creation of collaborations. In Vicenza, the local governance public organizations, as well as the local educational system, principally support self-reinforcing mechanisms in the cognitive structure that is driven by the market.

Specifically, in the bottom-up trajectory, characterised by a weak place-based nature, lock-in conditions might emerge from the area’s inability to renovate enough quickly the local knowledge bases due to new and unexpected global industrial transformations. In the case of the top-down, place-based trajectory, lock-in conditions could be more related to crystalized governance mechanisms and weak local leadership.

Future research should focus on the sustainability of legitimation trajectories of emerging industries in traditional manufacturing areas. Specifically, since the multiplicity of specialized nuclei is an initial condition to trigger the emergence of new industries, institutional mechanisms supporting the enrichment of this multiplicity (also at multi-scalar level) should be investigated more in-depth, in order to improve the sustainability of this trajectory in the long run. In the paper, we apply our framework by focussing on scenarios B1 and B2, while overlooking other scenarios opened by a poor multiplicity of know-how nuclei and subclusters (Table 1, part A). Moreover, since we do not focus on defining the different steps of a legitimization trajectory, but instead on typifying legitimatization trajectories in traditional manufacturing areas, we gave a comprehensive definition of legitimization trajectory, without exploring the relation between embeddedness and selection of a new industry in the legitimization trajectory of a traditional manufacturing area. We suggest and leave this investigation to future research.
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