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**Monica Plechero**

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through Participation in  
Globalization of Innovation  
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Mechatronics District in the  
Veneto Region**

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# **Facing Global Competition through Participation in Globalization of Innovation processes: The Case of Mechatronics District in the Veneto Region**

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**Abstract.** The paper investigates the mechatronics industrial district of the Veneto region, key for Industry 4.0 and for pursuing development opportunities related to smart specialization strategies. It shows how firms of a local system can gain competitiveness from different modalities of participation to processes of globalization of innovation. Firms' size matters when exploiting own innovation in the international markets, but it is not essential for linking to specific external knowledge sources which can sustain the injection of new knowledge into the system and help firms increase their innovation performances.

**Keywords:** Industrial district, innovation, internationalization, global innovation network, mechatronics, Veneto region

**JEL Classification Numbers:** R11, F23

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## 1. Introduction

The crisis faced by Italian industrial districts (ID) since the new millennium (Dei Ottati, 2009) and the worsening of economic conditions for the Italian traditional industry during last financial crisis 2008-2014 question how firms belonging to Italian manufacturing sector and industrial local systems could renovate their traditional competitive advantages to cope with global competition and with recent digitalization processes. Both phenomena are challenging without any doubt the way firms do business and operate in the market. By the recent introduction of a series of incentives under the umbrella of Industry 4.0, the Italian Government has started to take seriously into consideration the needs of small and medium companies (SME) of manufacturing sectors to adequate to specific digitalization standards geared towards the global trends.

Mechatronics industry, which combines traditional knowledge domain with new knowledge domains (e.g. mechanics, electronics and informatics), is one of the strategic sector involved in industry 4.0 processes. The sector is also one of the most strategic for Italy to be able to follow EU recommendation related to smart specialization strategies. The idea of smart specialization is to prioritize at regional level those industries and their ecosystems in which it is possible to pursue the best development trajectories and high tech potential performances in the long run. This supports the view of those scholars who think that some IDs with roots in traditional sectors, if adequately supported, may still have some chances to maintain good competitive advantages in the new global context, for example, through upgrading of specialized competences or through a shift in other domains (Mudambi et al. 2016) within a certain industrial and technological relatedness (Neffke et al., 2011).

Digitalization is anyway only one side of the story. The other side is the effect of globalization on ID competitiveness, which is well known (Dei Ottati, 2009). The last recent financial crisis determined the erosion of competitive advantages of Italian firms belonging to traditional industries. More and more global players, particularly from emerging economies, are aggressively entering into the market with competitive advantages that are not only related to price, but to new quality standards of their production (Lv et al, 2013; Rabellotti et al., 2009;).

Although firms belonging to IDs have always shown great export performances in relation to products and services of a certified quality (Rabellotti et al. 2009), being able to propose also *new products and new services* in the international market might help in a more substantial way to increase local firms competitive capacity and capture new added value in the global value chain (GVC). The endogenous

capacity of the IDs and regions to innovate and adapt to new technological trends has been well recognized in the past (Becattini, 1978; Porter, 1998, 2000; Asheim, 1996). However since the new century relying only on local self-sustained innovation capacity to compete in international markets is not a sufficient condition for long term sustainability.

With the awareness of a certain limit of the endogenous capacity of a local system to renovate out of the box (Uzzi, 1997), many scholars in economic geography (EG) suggest that firms belonging to a local system/region need to cross the borders of their local and national geographical agglomerations to be able to find new way to innovate and spillover new knowledge into the system (Bathelt et al., 2004; Boshma and ter Wal, 2007; Chiarvesio et al., 2010; Giuliani and Bell, 2005; Moodysson, 2008; Rabellotti et al. 2009). Contributions related to the relation between internationalization and innovation have been quite substantial in recent years, particularly in the international business literature (IB). However, contributions in relation to Italian IDs have been mainly limited to analyzing firms' generic international strategies within GVC, the role of multinational enterprises (MNC) or to discussing some limited alternatives to access global flows of knowledge. Those contributions, although significant, have missed to really disentangle and simultaneously consider different modes firms can use to participate in global innovation networks, and to analyze more concretely different typologies of globalization of innovation processes.

*By investigating the mechatronics district of the Veneto region the paper wants to shed new light on how firms belonging to a local system participate in different modes of globalization of innovation to sustain not only firms' competitive position in the global market, but also to gain in terms of innovation performances.*

Section 2 presents some literature which discusses how internationalization of innovation has been treated by IB, EG and specifically by scholars investigating industrial districts (ID). Different modes to participate in global innovation processes which underline a certain direction of knowledge flow are here presented and discussed. Section 3 presents the empirical setting and the method used. Section 4 discusses the empirical finding highlighting the different degree of firms participation in globalization of innovation processes, the relation with firms' size as well as the relation between some established international linkages and innovative firms' performances. Section 5 shortly concludes and highlight some policy recommendations.

## **2. Literature review**

### *2.1 Industrial districts, globalization and strategies to link to the global circuit of knowledge*

Before the downturn started at the beginning of the new millennium and the turbulent effect of globalization processes, IDs have represented a very successful alternative model to Fordism (Porter, 1998). Thanks to the presence in the districts of co-located small and medium firms (SME) and cultural and institutional conditions favoring economic interactions (Becattini, 1990), IDs have become perfect models for niches productions and flexible specialization. In the past they have captured the attention of scholars among all over the world. Only in the last years, and particularly with the beginning of the last financial crisis, many scholars seem to have lost interest for studying IDs, due to a prevailing view that after all they represent a successful passed model.

However, with the very recent Industry 4.0 government focus on manufacturing industry, and EU smart specialization strategies recommendation related to find development trajectories also for traditional manufacturing sectors, interest of scholars for IDs seems to be back. This is particularly true, for those districts with a focus on strategic sector like mechatronics that rely on different knowledge domains linking the old traditions with the recent software and technical engineering technological advancement and the new wave of digitalization processes.

When a combination of different knowledge domains happen, there is a large variety of knowledge and input that are put in place. One the one hand, there is a general need for firms to acquire strategic knowledge outside the boundaries of the companies - since it may be distributed across different actors and different technologies (Asheim et al. 2011) -. On the other hand, it is clear that the injection of new knowledge globally distributed into the local system for the renewal of local capabilities and for avoiding lock in at firm and district level become necessary (Asheim et al. 2011; Bathelt et al., 2004; Mudambi et al. 2014).

Contributions which examine the effect of globalization on IDs and how firms of local system can gain from international knowledge linkages do not lack in literature (Amighini and Rabellotti; Becattini, and Rullani, 1996; Belussi et. al, 2010; Chiarvesio et al., 2010; Rabellotti et al.2009).

Many of these scholars have investigated the potential access for firms belonging to ID to global knowledge using a GVC approach, i.e. considering functions and activities taken within the value chain. They have particularly investigated the role that some local leading firms (mainly multinationals of medium and large size) and technological leaders can have acting as interface between local

production system in which they become relevant node and GVC (Becattini & Rullani, 1996; Chiarvesio et al. 2010; Coro' and Grandinetti, 1999; Morrison, 2008; Morrison and Rabellotti, 2009). To the leading firms it has been recognized the role of gatekeepers, key for the diffusion of external knowledge to the system or at least to part of the system in which the leading firm is willing to invest and to share the relevant knowledge (Morrison, 2008).

Those different contributions have put some light on the one hand to the positive relation that may exist between the acquisition of information and knowledge at international level, and, on the other hand, the increased innovative and competitive performances of firms. However, most of the contribution do not allow to disentangle well if those activities internationally taken such as foreign direct investments (FDI) (Corò et al. 2013), or other sources of knowledge considered (Rabellotti et al. 2009) are only related to production functions or are serving more specifically innovation strategies (i.e. the aim to acquire or exchange knowledge particularly dedicated to increase firms innovation capabilities and performances). Many contributions remain also very vague in defining which typology of knowledge and innovation can flow at international level (Rabellotti and Morrison, 2009). Moreover, only few contributions have tried to look at the relation between international linkages and innovative performances in the Italian ID with a systemic approach, inclusive of several modes of internationalization of innovation.

In the work of Boshma and ter Wal (2007), related to the Barletta shoes district, the authors have applied a social network analysis technique to distinguish at least between network of knowledge of technical and market nature. Belussi et al. (2010), applying an open system approach in relation to the ID of Modena Life science industry, have investigated sources of information and knowledge for the system market and not market based. In particular, they have analyzed the extension of the geographical network of research relationships both with other firms and also other public research organizations. Belussi and Sedita (2012) have also contribute to analyse different formal and informal knowledge structures for distant learning.

Beside few tentative to open up the box of knowledge linkages that firms of an ID can exploit for gaining in relation to innovation activities, there is in general a lack of analysis of different modes (not only in terms of channels but also in terms of content and direction of knowledge flows) in which firms can be involved in globalization of innovation processes, the degree of participation of firms in the district to those modes and the possible effect on firms' performances. This is probably due also to the fact that previous studies were relying on data that did not allowed to have such detailed information for capturing international linkages related more directly to innovation activities and the possible effect

on some firms competitive and innovative performances.

## *2.2. Globalization of innovation and different modes to participate*

In the global economy, innovation happens more and more with the division of cognitive and technological activities in which different typologies of knowledge (beside knowledge related strictly to production and productive processes) are necessary (Chaminade et al., 2016; Rullani, 2009). Many scholars in the field of international business (IB) and economic geography (EG) have for this reason focus their research not only on understanding better the complex relation between innovation and internationalization, but to understand the impact of specific modes of innovation on firms, industries and regions (Cantwell and Piscitello, 2007; Castellani and Zanfei, 2006; D'Agostino et al., 2013; Dunning and Lundan, 2009; Le Bas and Sierra, 2002; Perri et al., 2017; Zanfei, 2000). Very recent are also contributions investigating innovation networks of truly global nature which involve countries both from the South and North of the world (see Chaminade et al., 2016 for a literature review).

IB studies have mainly focused attention on multinational enterprises (MNC), FDI activities and on traditional indicators of innovation such as patents, role of inventors and publications (those last ones exploited also by geographers scholars such as Balland et al., 2013 and Cassi et al., 2012). Less attention has been devoted both to firms which were not belonging to certain dimensional scale, or to the analysis of other indicators less conventional, but important to disclose other possible modalities in which firms can participate in globalization of innovation processes (Chaminade et al., 2016). The EG literature on the other hand have provided a more systemic and inclusive approach for investigating international linkages. Micro conditions have been investigated in parallel with meso conditions (regional innovation system and sectors in which those firms are embedded), but the empirical settings have been mainly regions and local systems in emerging economies and in North Europe with a preference for high tech industries and clusters in which there are better chances for knowledge to flow at international level (Aslesen and Harirchi, 2015; Fitjar and Rodríguez-Pose, 2013; Plechero and Chaminade, 2016a, 2016b). Those studies have helped to provide an overview of different modalities to get access to global knowledge and to take part of globalization of innovation processes (Martin and Rypestøl 2017; Plechero and Chaminade, 2013).

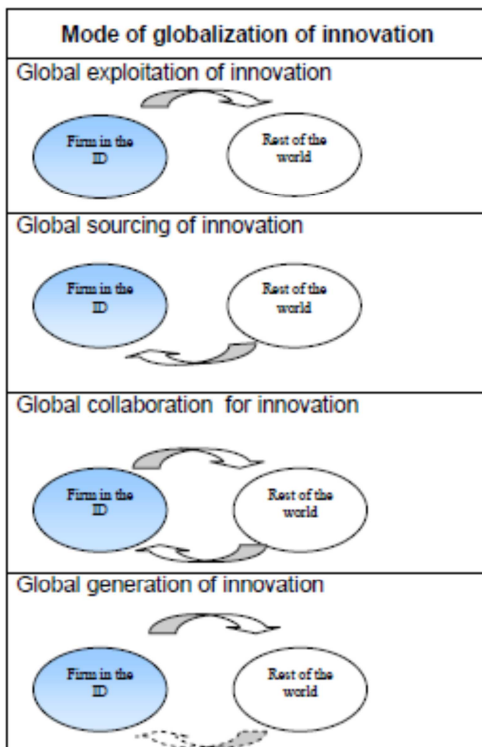
It is clear that globalization of innovation cannot be considered as a simple phenomenon (Archibugi and Michie, 1995). It embraces a series of modalities in which firms can have different roles and that point to different direction of innovation flows like, for example, the global exploitation of technology,



the global generation of technologies and global technological collaboration (Ibidem, 1995). Broadening this taxonomy and relying on other recent studies (Plechero and Chaminade, 2013; Plechero and Chaminade, 2016a), it is possible to point to other different strategies and modes for firms belonging to ID to be involved in globalization of innovation. Those modes (fig. 1), far to be exhaustive, want principally to stress different direction of knowledge flows and highlight different degree of firms involvement in global networks, but also indicate possible different relation between global innovation processes and firms performances.

Firms, for example, can show that are already able to assume some leading and active role globally when they use as main strategy to access global market the provision of products and services with a certain degree of novelty (*global exploitation of innovation*). Firms can also direct their attention to international activities for acquiring knowledge not available in the local system and that they may find strategic for improving their innovation activities (*global sourcing of innovation*). Sometimes their mode of accessing international knowledge can be quite passive when it refers to the only international acquisition of know how (without, for example, a particular involvement in activities of co-development with other firms or organizations). They can try to access scientific knowledge, patents, licenses, specific aspect of product development of technical or aesthetic nature, high technological machinery and equipment, human resources to dedicate to innovation activity or specific training related to innovation. Sometimes firms' involvement can instead be more active and show a more propulsive participation of firms in GIN. This can happen, for example, through activities of joint development of research and innovation with other firms and organizations in other countries (*Global collaboration of innovation*). Firms can also activate international innovation processes through FDI related specifically to research and development activities. In this case we discuss a form of *generation of innovation* with the purposes of serving the home country or global markets in a location abroad. Different studies have recently underlined the returned positive effect of offshoring R&D activities for the home regional knowledge production allowing, for example, some reverse technological transfer (Castellani and Pieri, 2013; D'Agostino et al. 2013).

Fig. 1 Globalization of innovation modes



Source: Further elaborated from Plechero and Chaminade (2013)

### 3. Method

To investigate how firms from an ID can participate in different modes of globalization of innovation and gain from that participation, a survey to the Mechatronics district of Veneto region has been lunched on February 2017. Mechatronics companies are diffused in all Veneto region, but Vicenza province, where the higher numbers of those companies are located, can be considered the core of the mechatronics ID. Due to the complex nature of mechatronics sector which combines competences in mechanics, electronics and informatics, it is very difficult to capture the specific population. Previous studies lead by Universitas Mercatorum (2013) have pointed to different NACE codes (2007) which are strongly related to mechatronics<sup>1</sup> in the Vicenza area. Those codes captures rather well the traditional and well established metal mechanic local specialization and particularly the application of mechatronics activities in the 3 following sub-areas: 1) automations, 2) industrial machinery and 3) electrical and electronic appliances and machinery.

Using updated data retrieved from AIDA (list of limited companies in Italy) and CCIAA (list of

<sup>1</sup> NACE codes (2007): 262, 2711, 28, 332001, 332002, 332003, 332006

register companies to the Chamber of Commerce) databases, a population of 644 firms has been detected. Following the same methodological approach of similar studies on globalization of innovation (Chaminade and Plechero, 2016a; 2016b) firms with less than 5 employees have been excluded. For all firms there has been a check of related information on the web. After cleaning the database from companies without the necessary contact information (e.g. email, website), evident not related mechatronics activities or without operative activities in loco (e.g. only commercial activity, only legal address) or with active failure procedures, the list has been reduced to 460 companies.

A survey on line has been sent to the detected population of firms during the months of February and March 2017. When needed firms have been called to check that the survey reached the targeted persons within the company (the entrepreneur, CEO or alternatively when not possible a manager/family component with deep knowledge about the company).

After soliciting both on line and in some cases by phone companies to reply to the questionnaire a total number of 86 firms responded to the survey (18.7% of the detected population).

The data collected at the firm level were related to firms' structural characteristics (i.e. size, age, group composition), competitive capacity, innovation activities, internationalization strategies, nature of linkages with other companies and organizations at different geographical level and role of local system in sustaining competitive advantage and internationalization.

The survey has been complemented with some qualitative interviews to get more insights in relation to innovation, internationalization linkages and the perception of quality of the local system. Five companies (selected from the respondent list according to their good performances in terms of competition, innovation and internationalization) accepted to be interviewed. Others companies belonging also to different activities codes, but that play a relevant role in the local economic system, have been suggested by two interviewed representatives of the Vicenza entrepreneurial association (Confindustria Vicenza). One company accepted to be interviewed.

Table I shows the percentage of firms that responded to the survey which belong respectively to small, medium and large size in terms of employees and their representativeness of firms selected population. The test of proportion  $\chi^2$  (Pearson's chi-squared test), as well as the percentages themselves, show that not significant differences in terms of size compositions exist among the two groups. As expected the higher percentage of firms are small while less than a handful of firms have more than 250 employees. This mirrors well the size composition of a typical Italian ID.

Table 1. Firms size expressed in employees terms

Size	Firms responding to the survey n=86	Firms population n= 460
Small <50	77.91%	80.21%
Medium 50-249	18.61%	18.47%
Large ≥250	3.48%	1.3%

P value of  $\chi^2$  test = 0.155 (non significant)

## 4. Empirical results

### 4.1 The participation of Mechatronics firms in globalization of innovation modes

Different questions in the survey were related to detect the participation of firms in different globalization of innovation modes discussed in the theoretical framework. Questions provided for the responded the possibility to choose among different activities which are commonly linked to innovation, many of them generally detected within the Community Innovation Survey and to check their internationalization. All activities refer to the last 3 years. Table 2 shows in details the activities and the percentage of firms in the ID that have been involved in the different modes of globalization of innovation.

Table 2. Participation of firms to different modes of globalization of innovation (% of respondents)

Mode of globalization of innovation detected in the survey	% of firms
<b>Global exploitation of innovation (GEI)</b>	25.58
Providing new products or services into international markets	(n=86)
<b>Global sourcing of innovation (GSI)</b>	27.06
Source of technology or knowledge <i>from an international organization</i> (e.g. clients, suppliers, consultancy, university, research center...)	(n=85)
It includes:	
• Acquisition of basic or scientific research activity (2.35%)	
• Acquisition of foreign licenses or patents (3.52%)	
• <b>Acquisition of technological advancement machinery and equipment (18.82%)</b>	
• Technical and experimental development of new product and services (7.06%)	
• Acquisition of aesthetic and creative activities related to new products and services (2.35%)	
• Activities such as marketing related to the launch of innovative products and services (1.18%)	
• Human resources to dedicate to innovation activities (1.18%)	
• Training for innovation activities (1.18%)	
<b>Global collaboration of innovation (GCI) (R&amp;D international collaboration)</b>	8.24%
It includes:	(n:85)
• Collaboration with other firms/organizations in relation to basic or scientific research activities	

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(4.71%)

- Collaboration related to technical aspects and development activities (applied research) with other firms/organizations (5.88%)

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<b>Global generation of innovation (GGI)</b>	16.28%
FDI related to activities of research and/or development for the purposes of serving home country or global markets in a foreign location	(n:86)

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<b>Combination of modes</b>	
GEI; GSI	5.88%
GEI; GCI	2.36%
GEI; CGI	3.48%
GEI; GSI; GGI	1.18%
GEI GCI; GGI	1.18%
GEI; GSI; GCI; GGI	1.18%
GSI; GCI	1.18%
GSI; GGI	2.36%
GSI; GCL; GSI	1.18%

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All listed activities refers to the 3 years: 2014-2016

To capture global exploitation of innovation, one question in the survey was specifically directed to ask firms which strategy they used in the last 3 years to get access to international market with the best return on firms performances (in terms, for example, of revenues, market extension or new placed orders). Respondents could choose among 4 options: 1) none, 2) price, 3) quality and 4) introduction of new products or services.

Around 1 out of 4 of firms (22 in total) have pointed to the introduction of new products and services in the international market. This underlines that a certain number of firms in the ID after the crisis (2008-2014), may have upgraded their traditional international strategies (based for example on quality or price), to differentiate even more their production with respect to their competitors.

Around 27% of firms have declared to have accessed some international knowledge relevant for their innovation activities (*global sourcing of innovation*). This has been mainly related to the acquisition of foreign technological advancement machinery and equipment which have been international sourced by a large number of companies (18.82%). According to what has emerged from the interviews, for many firms those machinery and equipment are chosen because they are technologically among the best in the market (particularly the ones coming from Germany which can guaranty to the local firms to maintain certain high level of quality standard of their production processes). According to some interviewees technological specialization in loco is mainly based on technical skills which suit customization, so such level of technological sophistication based more on the use of advanced sophisticated engineering knowledge may be still difficult to find in loco. Some firms (around 7%) show to have acquired from other firms and organizations abroad some technical activities related specifically to improve development phases (two of those companies have also acquired aesthetic and

creative activities in relation to new products and services). All these activities seems very much related to reach some degree of production differentiation to meet the best quality standards at global level or to adapt the production to new international market needs in which the local system may not have the full resources for accomplishing specific requests from international clients. Other typologies of knowledge and technologies have been international explored by firms to a much lesser extent. Only 2 companies have accessed international scientific or basic research activities; 3 some foreign licenses or patents, 1 marketing related activities for the launch of innovative products and services; 1 human resources to dedicate to innovation and 1 some training for innovation. The fragmented use of some typologies of knowledge sourcing among firms in the ID shows how different companies in the system follow their own specific international strategy which is not yet emulated by other local firms. In relation to the development of some more active forms of involvement in GIN (*collaboration of innovation*) - for conducting common research or participating jointly to some development activities - only 8.23% of respondents have declared to have such collaborations. This confirms that international collaboration for innovation is a prerogative of really few companies in the system. Indeed many of the activities related to global sourcing of innovation and collaboration for innovation listed in the survey and reported in table 2 are (when done externally to the firm or group the firm belongs to) maintained mainly locally and to a lesser extent domestically.

A quite important number of firms (16.28%) have instead FDI related to research or development activities (42% in conjunction with FDI specifically for production purpose). This mirrors the new global trend to use FDI not only to get access to cheaper resources, as a strategy well exploited by firms in the ID in the past. As emerged particularly from the interviews, those activities are often connected to strategies of exploitation of specific foreign markets or as a result of some new opportunities taken when those companies have started to exploit new geographical areas to get closer to some of their international clients. Needless to say that those activities are more related to improve development phases than to conduct basic research or more scientific activities.

Regarding combination of different modes of globalization of innovation, it exists a certain variety in the local system, but more than half of companies with global exploitation of innovation shows also to have accessed (mainly through sourcing) some foreign knowledge and technologies. This confirms once again that the local system has limited endogenous capacity in providing skills and technologies for generating novel products and services aimed at targeting international market, therefore often the development of novel products and services come in parallel with the exploitation of global knowledge pipelines.

#### 4.2 To what extent do size and ‘openness’ matter?

In line with the leading role that often medium and to a much lesser extent large firms play in the ID, relevant differences in terms of innovation, market international expansion and performances emerge when comparing the survey responses across size categories. Table 3 highlights how the proportion of firms with good resources and actions to put in place in terms of innovation and exploitation of global market is significantly higher for the group of firms with equal or more than 50 employees.  $\chi^2$  TEST - which can function as a test of proportion has been run to confirm the robustness of differences.

*Table 3. Difference related to relevant aspects of Innovation, market international expansion and performances across size categories*

Description:	Small firms	Medium/Large firms	$\chi^2$ Test
<b>Presence of Internal R&amp;D Department</b>	<b>31.34%</b>	<b>73.68%</b>	<b>***</b>
<b>Presence of HR with technical/engineering background involved in some innovation activities</b>	<b>73.13%</b>	<b>94.74%</b>	<b>**</b>
<b>Patents applications</b>	<b>19.40%</b>	<b>47.37%</b>	<b>**</b>
<b>Export activities outside UE and North America</b>	<b>64.62%</b>	<b>89.47%</b>	<b>**</b>
<b>Feeling stronger than international competitors (after financial crisis)</b>	<b>10.45%</b>	<b>31.58%</b>	<b>**</b>
<b><i>Exploitation of Innovation</i></b>	<b>19.40%</b>	<b>47.37%</b>	<b>**</b>
<i>Sourcing of Innovation</i>	27.27%	26.32%	
<i>Collaboration of Innovation</i>	9.09%	5.26%	
<i>Generation of Innovation</i>	14.93%	21.05%	

Comparison of distribution across size categories

\*\*\*P-value significant at the 1% level; \*\*P-value significant at the 5% level.

Firms with equal or more than 50 employees have better resources to dedicate to innovation activities (R&D formal department, quality of human capital) as well as they dispose of a better capacity to generate defendable outcomes (patents). More firms in this category show also to have reached in the last 3 years *a truly global market* that goes beyond the simple presence in Europe and North America (i.e. US and Canada).

Recently many medium firms started not only to exploit emerging countries in Asia, but also direct their sales towards new emerging markets in Arabian countries. Those are areas where cultures distance may represent an obstacle to more spontaneous approaches to the market typical of small firms with limited absorptive capacity. Quite a good number of firms with equal or more than 50 employees

accessed international markets with the introduction of new products and services, showing a better provision to get involved in global exploitation of innovation (47.37%), although not significantly in other modes of globalization of innovation. Higher is also the proportion of firms that in this category overcame quite well the last financial crisis feeling after it even stronger than international competitors (31.58%).

Some of the qualitative interviews conducted in the system highlight how this better performances in the international market may have pushed some suppliers in the district to follow new trajectories. The manager director of one of the large company with a global leading position states that some (although not all) of local suppliers have been able to follow the company in its market growth. Thanks to some dedicated training activities also of informal nature, some suppliers have been able, to adapt to all new and international regulations and rules that the company is forced to cope, facing at the end organizational innovation. Nevertheless, the manager director pointed also that the company for maintaining a global leading position, has found as a matter of course the necessity to look for some competences outside the district:

*“In the last years some subcontractors have been substituted with other national subcontractors more at the forefront, and more open minded than the local ones. They dispose of a structure more able to respond to our requests and to match our business in the global market”.* (Interview to a manager director of a large mechatronics firm - English translation)

The company still recognizes the value of the quality of local traditional manufacturing activities and the specialized pool in the district which provides some excellent technical competences, but also underlined that firms in the district are embedded in a culture that is not open to globalization processes. Sometime this can be a limit to be able to appreciate and valorize what is outside the border of the local system. The local culture (as representatives of the main industrial association have stressed and as the CEO of another company specialized in the automation sector has underlined as well) may create some rigidity for challenges:

*“In the local system we have a very important pool of technical schools and technical culture, there is also some capital to invest, but what we need to change is our mentality... I save everything (in the local system), but not the local mentality”* (Interview to a CEO of a medium mechatronics firm - English translation)



The limit of the local mentality discussed during some of the interviews was referring mainly to some cognitive distance that firms in the district have in understanding the most recent technological advances and opportunities coming from a better monitoring and participation in the global market. Medium firms can act as gatekeepers for small firms for exploiting innovation in the international market if those firms are indeed ready to open to change, to share and to bring new strategic knowledge from external sources.

According to other empirical results, the opportunity to link to external knowledge which can be considered core for innovation are still something that firms in the district need to learn. To make an example, a pair of questions in the survey were directed to ask which were the type of knowledge considered strategically for the innovation activity of the company and to point to the main source (i.e. if within the company/or the group or if external ) when the knowledge was valued important 4 or 5 in a scale from 0 to 5<sup>2</sup>. Only 30 firms out of 86 pointed to the more important relevance of external sources for strategic knowledge. What is interesting is that when comparing those 30 firms with the ones without any external strategic knowledge linkages there is an important difference regarding their economic performances that emerges: the proportion of firms that in the last 3 years have increased the economic performance is larger for the former. In particular, companies that have been able to improve productivity (measured as proportion between added value and employees) have been 56.7% among respondents of the former group and only 26.67% among respondents of the latter one. Moreover, a higher percentage of companies with strategic external knowledge linkages have improved simultaneously to productivity, also revenues and margins (36.67% against 13.04%). The results have been confirmed by  $\chi^2$  TEST, significant at 5% level. For sure, independently of the size been able to stay 'open' and rely on external strategic knowledge allows to reach a certain flexibility to face market fluctuation and obtain some economic advantages. Nevertheless, as literature have stressed and as next subsection will try to demonstrate neither size, nor openness disregarding the geographical location of linkages are alone sufficient conditions to reach high degree of innovative performances. What it seems more important is instead the capacity of the company to link somehow to international knowledge.

<sup>2</sup> Firms could point (with a multiple choice option) to different types of knowledge (scientific, engineering, creative, managerial and market knowledge) considered strategic for innovation activity. The scale to judge knowledge was from 0 (not at all important) to 5 (very important).

### 4.3 Global sources and linkages which help to sustain high degree of innovative performances

The positive relation between the capability of firms to reach high degree of innovation performances and the participation in some modes of globalization of innovation stressed by the literature it is captured empirically by the following simple logistic regression presented on table 4. The dependent variable is a dummy variable with value 1 when the company declared to have in the last 3 years developed an innovation at the forefront (i.e. been the only one or among the few at global level to have developed it) and 0 otherwise. The independent variables are related to the different and most important modes of globalization of innovation firms have participated in which they might have directly and indirectly sustained the acquisition of new knowledge for firms in the system. Variables related to some structural characteristics (i.e. size and organizational setting), innovation capacity and degree of openness of the companies have functioned as control variables. All variables are described in appendix A. Table 4 reports the results.

*Table 4. Logistic regression*

Dependent variable:	Dummy: 'Top Innovation'	
	OR	P> z
Group	0.1620607 (0.2046878)	
Size	1.063329 (1.078085)	
RDdep	0.7426074 (0.7134795)	
Patents	8.363431 (9.066162)	**
Openess	0.78864 (0.7495716)	
FDIResDev	9.392728 (9.122473)	**
AcqImach&equipINT	17.20129 (18.82986)	***
CollINNOINT	2.850382 (3.572248)	
N	85	

LR chi2(8)	21.71
Prob	0.0055
Log-Likelihood	-21.893276
Pseudo R2	0.3315

Standard Error in parenthesis \*\*\*P-value significant at the 1% level;

\*\*P-value significant at the 5% level

As it is possible to observe from table 4 there is a significant and positive relation between the capability of firms to develop innovation *at the forefront* and the presence of some FDI in which research and/or development activities have been pursued. Same it is for the acquisition by the companies of foreign technological advanced machineries and equipment<sup>3</sup>. Only collaboration of innovation does not seem significantly correlated, but as already discussed truly collaboration for innovation done with the aim to develop common research activities or joint development of new products or services is still something not well exploited in the local system and may take some time to generate some effects. It may have not yet lead to evident positive results also for the limited number of companies that have been possible to include in the regression analysis.

## 5. Conclusions

The paper aims to shed new light on the participation of firms of an Italian ID to globalization of innovation processes. In doing so it advances in the ID literature related to internationalization processes which so far has focused on studying firms internationalization strategies and functions mainly within the GVC. This branch of literature have been so far limited in analyzing the relation between different typologies of knowledge linkages devoted specifically to innovation activities and firms performances.

The choice has been to investigate firms from Vicenza mechatronics, a sector that merging different knowledge domains (mechanics, electronic and informatics) may result nowadays key for pursuing regional development opportunities toward high tech trajectories related to Industry 4.0 and smart specialization strategies for manufacturing based activities.

Through the use of primary data based on a survey conducted during 2017 and complemented by qualitative interviews, the paper investigates different modes in which firms of the Vicenza

<sup>3</sup> To capture better the main source of global knowledge used in the ID, instead of considering the variable related to the generic global sourcing of innovation (which contains so many different typologies) it has been considered the main and principal one. Results of the regression do not change in any substantial manner.

mechatronics can participate in globalization of innovation processes, the degree of firms involvement in those modes as well as the existence of a positive relation between firms involvement in globalization of innovation and firms' performances when controlled for size or other important factors.

The results show that in the last 3 years, overcoming the recent crisis, firms have exploited actively global market, not only to provide products of good quality, but to sell products and services with some degree of novelty. For 1 out of 4 of the companies investigated the sale of new products and services in the international market is providing positive impact on firms performances (in terms of expansion of market, new placed orders or revenues), and for sure more than strategies based on price or quality.

The possibility to do truly global exploitation of innovation activities results higher for firms that have reached a certain size (at least medium in employees terms). Large firms are few in the local mechatronics district, but as the results highlight, the presence of a number of medium firms may guaranty that there are some star firms which continue to face global competition with good performances. Supporting medium firms' global innovation strategies, and incentivizing their role as district gatekeepers, may be a way to strengthen the competitive capabilities of the local system and provide new opportunities for firms to positively face global competition. However, not all small companies seems to be able to take advantage of those relations and are open to collaborate and change their traditional way to approach the market. Local policymakers need to support changes in the culture as well as favor virtuous mechanism of relations with start firms and other external to the system strategic actors. Indeed results show also that what maintain firms competitive and innovative is not only their capability to develop active strategies on global market, but their capability to link to external strategic knowledge sources.

If global exploitation of innovation can be considered a propulsive strategy reserved mainly to medium and large firms, the possibility to link to global pipelines for acquiring knowledge seems to be possible also for firms of smaller size. The findings show that there is a positive relation between the capability of firms to produce innovation at the forefront and the acquisition of certain technologies from abroad (mainly embedded in technological sophisticated machinery and equipment) or through the established of some (even simple) FDI in which some research and/or development activities start to be pursued. The paper, in line with the most recent research studies in EG confirms the fundamental role of some global knowledge for increasing the innovative performances of firms embedded in a local system (Plechero and Chaminade, 2016).

Firms in the district show in particular to have started to make some use of global sources of

knowledge and technologies which are directly related to improve development phases. Other sources more science based or that may be strategic for increasing the general capacity of the companies to cope with different types of innovation activities, interface cognitively with different actors, and deal with knowledge of more analytical nature, are however still limited and left to isolated initiatives. Global collaboration for innovation remains also very much underexplored in the system if one considers that half of the firms responding to the survey see the foreign client as an important actor for pursuing innovation activities.

Policy initiatives which may leverage the use of networking activities also at informal level for increasing collaboration with international potential clients and suppliers and for increasing experiences in more advanced technological contexts should be incentivized. Recent research on ID show that strategic for sustaining knowledge flows is the role of single actors (migrant entrepreneurs able to break into the local network (Canello, 2016), CEO or independent technical specialists (Mitchell et al. 2014) that having experienced 'cognitive' connection to global knowledge and networks can be key to import diversity and strategic know how in the local system. Something that is not captured directly in the survey results used in the analysis, but that emerged in some of the interviews: the international experiences of who is covering leading position in the company has sustained international networking and allowed injection of important new knowledge into the firm.

Future research can be devoted to address better the role of specific agents and some peculiar social ties for the different modes of globalization of innovation. As many research that relies on primary data limitation comes from firms self- assessment of economic and competitive performances. The disposal of a limited number of cases and lack of panel data prevent more sophisticated econometric analysis which could help to provide stronger evidences of the relation between participation in globalization of innovation processes and firms' performances, although interviews have been a good support for confirming survey results.

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## APPENDIX A

DEFINITION OF VARIABLES AND DESCRIPTIVE STATISTICS WITH CORRELATION TABLE

Variable	Description	Obs	Mean	Stand. Dev.	Min	Max
Top Innovation (Dependent Variable)	Equal to 1 if the company has developed a top innovation at the forefront, 0 otherwise	86	0.127907	0.3359451	0	1
Group	Equal to 1 if the company belongs to a group, 0 otherwise	86	0.255814	0.4388768	0	1
Size	Equal to 1 if the company has 50 or more employees, 0 otherwise	86	0.2209302	0.4173068	0	1
RDdep	Equal to 1 if the company has an R&D department, 0 otherwise	86	0.4069767	0.4941518	0	1
Patents	Equal to 1 if the company has done patents applications, 0 otherwise	86	0.255814	0.4388768	0	1
Openess	Equal to 1 if the company has acquired relevant strategic knowledge for its innovation activities from other firms and organizations, 0 otherwise	85	0.3529412	0.4807207	0	1
FDIResDev	Equal to 1 if the company has developed FDI for research and/or development, 0 otherwise	86	0.1627907	0.3713399	0	1
AcqImach&equipINT	Equal to 1 if the company has acquired technological advanced machinery and equipment from abroad, 0 otherwise	85	0.1882353	0.3932198	0	1
CollINNOINT	Equal to 1 if the company has developed international collaboration for innovation (i.e. scientific or basic research or technical development of products), 0 otherwise	85	0.0823529	0.2765332	0	1

### Correlation table

	Top Innovation	Group	Size	RDdep	Patents	Openess	FDIResDev	AcqImach&equipINT
Top Innovation								
Group	-0.0649							
Size	0.0478	0.2017						
RDdep	0.1080	0.0568	0.3576*					
Patents	0.2542*	0.0838	0.2659*	0.4365*				
Openess	0.0086	-0.0235	-0.1599	-0.2010	-0.0430			
FDIResDev	0.3027*	0.1746	0.0689	0.0835	0.1746	-0.0625		
AcqImach&equipINT	0.2627*	0.0731	0.0306	0.0369	-0.1471	0.1482	-0.0515	
CollINNOINT	0.2670*	0.0268	-0.0580	0.1048	0.2138*	-0.1317	0.2131	0.0747

\*\*P-value significant at the 5% level