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Sustainability Strategies in Clusters and The Role of Communication

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ABSTRACT:

Environmental sustainability impacts on industrial districts and their lifecycle evolutionary processes. Nevertheless, research in this direction is scant, suggesting on the one hand, the role of lead firms of global value chains and, on the other hand, potential contributions of suppliers. The paper explores how district firms have invested in sustainability by analyzing sustainable-oriented communication strategies (certification, web, exhibitions) of Italian leather and jewelry clusters. Results show that districts are evolving by including sustainability in their strategies. A variety of sustainability strategies emerge among district firms, with differences also between firms in B2B and B2C markets.

KEYWORDS: Communication; sustainability; jewelry; leather; cluster; certifications.

JEL CLASSIFICATION: Q56; O30; M14.

Estrategias de sostenibilidad en los clusters y papel de la comunicación

RESUMEN:

La sostenibilidad medioambiental repercute en los distritos industriales y en los procesos evolutivos. La investigación en este sentido es escasa, lo que sugiere, por un lado, el papel de las empresas líderes de las cadenas de valor mundiales y, por otro, las posibles contribuciones de los proveedores. El artículo explora cómo las empresas de distrito han invertido en sostenibilidad analizando las estrategias de comunicación (certificación, web, exposiciones). Los resultados muestran que los distritos están evolucionando mediante la inclusión de la sostenibilidad en sus estrategias. Surgen diversas estrategias, con diferencias también entre las empresas de los mercados B2B y B2C.

PALABRAS CLAVE: Comunicación; sostenibilidad; joyería; cuero; cluster; certificaciones.

CLASIFICACIÓN JEL: Q56; O30; M14.

1. INTRODUCTION

In recent years, sustainability is becoming more and more important in corporate strategies given the increasingly attention on environmental problems, also intertwined with social sustainability. This trend may have an impact also on industrial districts and their lifecycle evolutionary processes (Belussi, 2015) since it pushes product and process innovation and calls for new forms of collaboration. Nevertheless, research on environmental sustainability focused on industrial districts is scant and does not help disentangling the role of lead firms of global value chains (De Marchi, Di Maria, & Ponte, 2013) from

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the potential contributions of firms within the district that act as specialized suppliers in global value chains (De Marchi & Di Maria, 2019) with strategy specific strategies (Sako & Zylberger, 2019) that may be developed also independently from the global lead firms (Ponte et al., 2023).

Environmental sustainability push firms to develop new product and process innovation in order to cope with market requests and the challenges related to sustainability (Kolk & Pinkse, 2005). This innovation dynamic requires collaboration to share key knowledge and to leverage on different contributions of actors in the value chain (De Marchi, 2012; Pace & Miles, 2019). From this perspective, industrial districts may become important contexts where to develop sustainability-oriented strategies and to innovate at the product and process level due to their strong orientation towards open, collaborative innovation and specialized manufacturing knowledge (Becattini et al., 2009). Nevertheless, the evolution towards sustainable districts requires to consider the interdependency of districts with external actors – i.e. multinational companies (Belussi, 2018) – and the cluster's inclusion in extended, global value chains (Giuliani & Rabellotti, 2017).

Moreover, firms oriented to sustainability need to show towards stakeholders their level of commitment and to legitimize their effort towards the market (Bansal & Roth, 2000; Porter & Kramer, 2006). Relevant factors in the sustainable strategy of firms refer to the communication activities and the actions implemented oriented towards sustainability. In this regard, different communication strategies can be adopted depending on the set objectives. In particular, online communication is one of the most adopted by firms given the current high use of digital platforms (Vogler & Eisenegger, 2021). Such communication effort can change to consider the difference in terms of the market – between business-to-business (B2B) and business-to-consumer (B2C) (Blenkhorn & MacKenzie, 2017).

In this scenario, further knowledge is required to understand whether district firms have invested in environmental sustainability in terms of product or process innovation and how such firm strategies are diffused at the district level to obtain a better view of its broad impact in terms of district evolution. Research in this domain is in fact scant and not well developed (Barakat et al., 2023; Da Ronch et al., 2013; De Marchi & di Maria, 2019). Limited research has explored the communication investments at the industrial district level related to firm' sustainability strategies within the broad transition of industrial district towards sustainability. We aim at exploring whether district firms have invested in environmental sustainability by analyzing their communication effort and how such firm strategies are diffused or not at the district level to capture a broad impact in terms of district evolution.

The paper explores sustainable-oriented communication strategies of district firms and its role in the relationship with the market. Based on empirical analyses of sustainability strategies (captured through certification, web communication and communication during exhibitions at international trade fairs) of district firms in the leather and jewelry industrial districts in Italy, the paper provides a better understanding on the direction of sustainability strategies in terms of product and process innovation at the firm and at the district levels.

Results show that districts are evolving by including sustainability in their strategies. Nevertheless, even if the broad district scenario emphasizes a moving towards sustainability, a variety of sustainability strategies emerge among district firms, suggesting that there is still a difference among firms within the same district (district internal heterogeneity) (De Marchi, Di Maria & Gereffi, 2017; Hervas-Oliver et al., 2023), and in relation to B2B and B2C markets.

2. THEORETICAL FRAMEWORK

2.1. ENVIRONMENTAL SUSTAINABILITY AND CLUSTER EVOLUTION

Investing in environmental sustainability is relevant for firms to sustain their competitive advantage and being consistent with requests coming from the market and the society (Bansal, 2005; Porter & Kramer, 2006). Firms are pushed to redefine their business strategies and the sources of value creation at different levels (Orsato, 2006), and it is tightly connected with innovation (De Marchi, 2012).

Environmental sustainability may refer to path of innovation at the process and product levels, managed internally to the firm, but also involving the whole supply chain (Kolk & Pinkse, 2005).

It can also involve the redefinition of the firm's business models towards sustainability (Evans et al., 2017; Ritala et al., 2018) suggesting a deep transformation of firms where firms may compete not only relying on efficiency, but through innovation in creating new products or services rooted on a sustainable view. Some research is also highlighting the systemic approach towards sustainability and innovation, further emphasizing the collaborative dimension for value creation (Adams et al., 2016).

This scenario requires an evolution for firms embedded into industrial districts. Research on the life cycles of industrial districts suggest that there are multiple factors driving the transformation at the district level, related to internal and external causes (Belussi, 2015; Belussi & Sedita, 2009; Bianchini Galuk et al., 2023). Among the different drivers, scholars have considered technological innovation as well as (international) demand, together with strategic and product diversification. Technological innovation can affect industrial districts in its development stage while the role of the demand – both in terms of final customers and global buyers – and the transformation in the district product range can shape district evolution in its maturity stage. Industrial districts have been able to benefit from a virtuous cycle of knowledge exchange and exploitation of local and global knowledge (Bathelt et al., 2004) - as open learning systems (Belussi & Sedita, 2012) – through the interaction with external actors operating abroad or embedded into the districts (multinational firms).

In this view, environmental sustainability influences cluster evolution. On the one hand, environmental sustainability pushes industrial district to innovate (De Marchi, 2012) in radical terms (Kennedy et al., 2017), where the role of technical innovation and knowledge (R&D) is relevant and calls for open innovation approaches. From this point of view, the emerging technological trajectories connected with sustainability (Horbach et al., 2012) can ask district firms to change, with potential impacts on the whole industrial district evolutionary trends. On the other hand, emerging market requests related to environmental sustainability urges industrial districts to adjust.

While studies on environmental sustainability related to proximity among firms within the framework of industrial symbiosis is extensive (Baldassarre et al., 2019; Deutz & Gibbs, 2008), limited attention has received environmental sustainability in relation to the framework of industrial districts (Becattini et al., 2009). In this view, scholars have explored the drivers of sustainability at the district level (Da Ronch et al., 2013), identifying that district firms may have their own sustainability strategies – specifically leading firms –exploiting knowledge already available within the district to achieve new product and process innovation. District firms may also develop sustainability-related knowledge exchange with actors external to the district. In other cases, the district can evolve towards an eco-cluster where, through cooptation (Afuah, 2000; Dagnino, 2007), firms benefit from internal manufacturing ties and pooling of resources, also in relation to changes in regulation. By exploiting spatial proximity, firms can benefit from dynamics related to industrial symbiosis and define innovation paths that sustain firms' competitiveness in terms of “eco-collective efficiency”, also relying on the support of location institutions for environmental upgrading (Yoon & Nadvi, 2018).

Research on Global Value Chains (GVC) offers additional insights related to the relationships between environmental sustainability and clusters specifically in terms of environmental upgrading. According to this framework firms may develop sustainability strategies enabling the reduction of environmental impacts of their business activities – through innovation in product, processes, or at the organizational level (De Marchi, Di Maria, & Micelli, 2013; De Marchi, Di Maria, & Ponte, 2013). Scholars have identified different drivers of such upgrading (De Marchi et al., 2019; Krishnan et al., 2022; Ponte et al., 2023): a) external-to-the-firms, that is considering the role of customers and society at large (i.e. NGOs) and regulations; b) lead firms, which push suppliers to modify their production processes or outputs to be aligned with their environmental strategies and goals; c) internal-to-the firm, where the firm decides to implement environmental strategies to reduce its business impacts, by developing innovation processes and actions irrespectively from external pressures; d) the pressure of the local community who has to carry on the burden of the negative externalities of the districts in terms of pollution.

The role of lead firms has been specifically emphasized as fundamental driver for environmental upgrading in GVC, but empirical evidence suggests also that different forms of governance – not only captive, but also relational – may be crucial in achieving such goals (De Marchi, Di Maria, & Ponte, 2013; Golini et al., 2018). In this respect, research also emphasizes the role of suppliers as active actors within the GVC. Suppliers are not necessarily passive receivers of knowledge inputs from lead firms, as specified in much research on upgrading (Schmitz & Knorringa, 2000). Rather, with their manufacturing competences and innovation expertise they can contribute to innovate at the process and product level towards more environmental-friendly outputs. Through such viewpoint, firms operating in industrial districts may play a specific role in developing innovation oriented to sustainability specifically because of their expertise and gain competitiveness beyond a top-down approach (De Marchi & Di Maria, 2019).

2.2. SUSTAINABILITY STRATEGIES AND COMMUNICATION

Environmental sustainability is rooted in collaboration among firms within the value chain. District firms may benefit from their embeddedness in the cluster, where competition and cooperation coexist (De Ottati, 1994, 2017). Firms investing in sustainability strategies are interested in communicating with their potential partners and customers about their commitment to sustainability. This communication serves the dual purpose of setting up open innovation processes and making the market aware of their strategic efforts (Verk et al., 2021). Cluster-wise, this can be valid not only within the district, but also beyond the district boundaries towards international suppliers and global buyers (lead firms in global value chains). On the one hand, district firms can follow the requests of lead firms oriented to sustainability such as in the case of globally led cluster models (Giuliani & Rabellotti, 2017), following standard-driven forms of governance (i.e., adopting specific certifications (Ponte & Ewert, 2009)) or mentor-driven ones. On the other hand, as mentioned above, district firms can play an active role in environmental upgrading trajectories as specialized suppliers where more relational forms of governance may be adopted and hence communication within the value chain is a key process.

Firms can derive benefits by developing specific communication strategies that convey their commitment to sustainability, aiming to communicate their societal engagement to the markets (Porter & Kramer, 2006a). Such strategies also serve to legitimize their behavior in comparison to competitors and in the eyes of stakeholders (Maignan & Ferrell, 2004). Scholars confirmed the positive outcomes of communication on Corporate Social Responsibility (CSR) in terms of firm's reputation (Nickerson et al., 2021). However, there are also threats connected to greenwashing (Delmas & Burbano, 2011) and research pointed out that firms should carefully evaluate the tools adopted and the appropriate message to convey to their audience (Illia et al., 2022).

In this scenario, digital technologies – from web to social media – have been recently considered relevant tools to enhance stakeholder engagement, by emphasizing their interactive role (Amabile et al., 2022). Nevertheless, the use of digital technologies does not always lead to positive impacts in terms of reputation and possibility to legitimize the effort done by the firm towards its customers (and stakeholder in general) (Vogler & Eisenegger, 2021). According to CSR communication studies, it becomes relevant to consider both the use of digital technologies and personal interaction within communication strategies related to sustainability, paying attention on the different markets and audience – between B2B and B2C – (Garner & Mady, 2023; Huang et al., 2022). On the one hand, scholars pointed out that digital-based communication may support firms in structuring deliberate CSR communication strategies (Verk et al., 2021) in addition to interactive, social-media based, approach. On the other hand, specifically in B2B contexts, communication for CSR may particularly be influenced by tightly connection with the strategic dimension of sustainability where the buyer-supplier relationship is important (Blenkhorn & MacKenzie, 2017; Huang et al., 2022).

In the context of Small and Medium-sized Enterprises (SMEs), specifically operating in (global) supply chains, research has pointed out the opportunities, but also the challenges, connected with CSR communication (Baden et al., 2009; Matten & Moon, 2017; Morsing & Spence, 2019). On the one hand, SMEs suppliers may invest in explicit communication strategies to cope with market (lead firms) requests, but this may not necessarily relate to a coherent sustainability strategy of the firm or real internal transformation of the strategic intent of the firms. On the other hand, communication can also become

an important driver for competitiveness in the realm of SMEs, when they can signal their commitment towards sustainability and hence being considered attractive for global buyers (Krishnan et al., 2022).

This may be particularly interesting considering firms operating in industrial districts, characterized by high level of physical interaction rooted on proximity (Becattini et al., 2014) and at the same time being involved in extended value chains (De Marchi et al., 2017). Communicating the district firms' effort towards sustainability may allow them to be coherent with lead firm' sustainability and sourcing strategy, pursuing the attractiveness of the district local manufacturing system for multinational firms (Belussi, 2015). At the same time, district firms may adopt different communication strategies. On the one hand, district firms can invest in more formalized communication such as through digital technologies or certification as mentioned above. On the other hand, consistently with the often B2B nature of their business, district firms may also use personal communication to transfer knowledge about sustainability of their products and processes towards their customers. This dynamic has traditionally led to knowledge diffusion and product and process innovation (Camuffo & Grandinetti, 2011; J. L. Hervás-Oliver et al., 2022; J.-L. Hervás-Oliver & Belussi, 2018) and it is important to explore these dynamics also when environmental sustainability is considered.

3. EMPIRICAL ANALYSIS

3.1. METHODOLOGY

In this work, we evaluate the sustainability strategies of firms of two industries – jewelry and leather – characterized by the presence of significative industrial districts and we specifically consider Italy as empirical setting for the research. We studied these industries due to their relevance to the Italian economy rooted on industrial districts (Belussi & Sedita, 2009b; De Marchi et al., 2014). Specifically in the case of jewelry, industrial districts are in Vicenza (Veneto region), Arezzo (Tuscany region), and Valenza Po (Piedmont region), while leather districts are in Vicenza, Santa Croce sull'Arno (Tuscany region), and Solofra (Campania region). We formed two samples each composed of 50 firms with the highest turnover, divided by industry operating in those industries and which participated in the international industry business fairs (VicenzaOro, September 2022 and 2023 editions for the jewelry sector; LineaPelle, September 2022 and 2023 editions for the leather sector) to have a homogeneous and comparable set of data in terms of communication (see below). Firms data were extrapolated through the ORBIS database.

Firstly, sectorial filtering following the NACE Rev. 2 code classification was performed to find the firms operating in those sectors. In particular, we selected the 32.12 code (i.e., Manufacture of jewelry and related articles) for the jewelry firms and the code 15.11 (i.e., Tanning and dressing of leather; dressing and dyeing of fur) for the leather ones. Subsequently, we identified the belonging of each firm to an industrial district by finding the location of headquarters and production sites for each firm, and then we matched them with the location of the districts. Moreover, we marked a firm as belonging to international groups if more the 50% of its shareholders were not from Italy. Finally, firms have been classified based on size into four categories: Micro (from 0 to 9 employees), Small (from 10 to 49 employees), Medium (from 50 to 249 employees) and Large (over 250 employees) following the European Union classification.

For both the district specializations, the firms selected can provide a significant view of the trends occurring at the district level. Concerning jewelry, among the 50 analyzed firms, 17 belong to the district of Vicenza (Vicentino), 27 from the Arezzo district (Aretino) and only 4 from the Valenza Po one. Two firms were not related to any industrial district. Despite the sample is made by 48 district firms, representing 3.3% of all firms belonging to the analyzed districts, it describes them very well as it represents 56,3% of the overall district production (95.0% for the Veneto district, 63.1% for the Aretino district and 20.1% for the Valenza Po one). Additionally, 11 of the 48 district firms (22.9%) are controlled by a foreign group. These 11 firms represent the 34.4% of all Italian firms controlled by a foreign group.

Similarly for leather, among the 50 analyzed firms, 15 belong to the district of Arzignano (Veneto), 28 from the Santa Croce sull'Arno district (Toscano) and only 2 from the Solofra one (Campano). Five firms were not related to any industrial district. Despite the sample is made by 45 district firms,

representing 3.3% of all firms belonging to the analyzed districts, it describes them well as it represents 40,8% of the overall district production (42.0% for the Veneto district, 44.5% for the Toscano district and 18.1% for the Campano one). Additionally, 8 of the 45 district firms (17.8%) are controlled by a foreign group. These 8 firms represent the 47.1% of all Italian firms controlled by a foreign group.

We did an accurate literature review to select the most significant product, environmental and social sustainability certifications regarding both industries (Heidingsfelder, 2019; Śmiechowski & Lament, 2017) to apply such certification for the analysis of communication strategies. Research outlined four certifications (or group of certifications) for each industry, as described in Table 1.

TABLE 1.
The list of certifications concerning sustainability for the jewelry and leather industries

GOLD / JEWELRY	
Responsible Jewelry Council (RJC) Code of Practices standards (COP),	The RJC Code of Practices is the only industry standard covering the entire jewelry and watch supply chain. It defines the responsible ethical, human rights, social and environmental practices.
Responsible Jewelry Council (RJC) Chain-of-custody (CoC)	RJC Chain of Custody certification gives the assurance that the products and materials have been sourced, traced, and processed through the supply chain. This standard defines an approach for companies to handle and trade gold and platinum group metals in a way that is fully traceable and responsibly sourced.
OECD Due Diligence Guidance (OCSE)	The OECD Due Diligence Guidance provides detailed recommendations to help companies respect human rights and avoid contributing to conflict through their mineral purchasing decisions and practices. This Guidance is for use by any firms potentially sourcing minerals or metals from conflict-affected and high-risk areas. The OECD Guidance is global in scope and applies to all mineral supply chains.
London Bullion Market Association (LBMA)	LBMA Responsible Sourcing programme is mandatory for all Good Delivery refiners wishing to trade with the London Bullion market. Compliance with an audited process assures investors and consumers that all London precious metal stocks are conflict-free. The Responsible Gold Guidance (RGG) is based on the OECD Due Diligence Guidance as well as Swiss and US KYC, Anti-Money Laundering and Combatting Terrorist Financing regulations.
LEATHER	
Leather Working Group (LWG)	LWG through collaboration and standard setting, is creating a value chain for leather in the most transparent and traceable way possible. This is all to achieve the most positive impacts and aligned with the Sustainable Development Goals. There are 4 categories of standards based on the type of business processes: Leather Manufacturer Standard, Leather Trader Standard, Commissioning Manufacturer Standard, and Subcontractor Standard.
I.CE.C. Environmental sustainability	This group of certifications drawn up by the Italian certifying body (I.CE.C) includes the following standards: EMAS (environmental declaration according to EU Reg. 1221/2009), ECO-LEATHER (UNI11427 Leather with a low environmental impact and PRODUCT ENVIRONMENTAL FOOTPRINTS).
I.CE.C. Product and economic sustainability	This group of certifications drawn up by the Italian certifying body includes the following standards: MADE IN ITALY OF LEATHER PRODUCTION (EN 16484), MADE IN ITALY OF PRODUCT REALIZATION (I.E. OF LEATHER GOODS, FOOTWEAR), PRODUCT (FINISHED LEATHER) CONFORM TO UNI TECHNICAL SPECIFICATION/ CUSTOMER'S STANDARDS (i.e. UNI 10594 for footwear, UNI 10826 for leather goods), TRACEABILITY OF RAW MATERIALS (LEATHERS) (ICEC TS_SC410, ICEC TS_PC412), TRACEABILITY OF PRODUCTS (ICEC TS_PM414) and TANNING SECTOR LABORATORIES (ICEC TS_406).
I.CE.C. Ethic and social sustainability	This section includes the UNIC CODE OF CONDUCT AND SOCIAL ACCOUNTABILITY certification prepared by I.CE.C.

Source: authors' elaboration

To evaluate the number of certifications adopted, we performed accurate qualitative research on firms' sustainability annual reports by keyword research. Then, we carried out an analysis of the certifying

bodies' databases to identify the years of certification of time-based analysis of investments towards sustainability by district firms.

To analyse companies intensity of the investments towards environmental sustainability, we defined a variable called $Sust_Level_k$ of a firm k ($k=1, \dots, 50$) as the normalized sum of the certifications adopted by the firm:

$$Sust_Level_k = \frac{\sum_{i=1}^N Cert_i}{N}$$

being N the number of certifications for each sector, in our case equal to 4, and

$$Cert_i = \begin{cases} 1 & \text{if } i - th \text{ certification has been adopted} \\ 0 & \text{otherwise} \end{cases}$$

a dummy variable, assuming the value 1 when a certification has been adopted during the production process and 0 otherwise.

Concerning the communication of sustainability, we have considered two communication channels: 1) online communication via website and 2) offline communication employing either posters or claims during expositions at international sectorial exhibitions. To examine sustainability communication via corporate websites, a qualitative assessment was undertaken on the website of each firm. The criterion for identifying communicative instances was established as any explicit reference or inclusion of sustainability matters or a sustainability report within the website. The manifestation of sustainability communication through these online platforms of a firm k was represented by a dichotomic variable termed Web_Comm_k , adopting 1 to denote instances of communication and 0 otherwise.

$$Web_Comm_k = \begin{cases} 1 & \text{if } k - th \text{ firm communicate through website} \\ 0 & \text{otherwise} \end{cases}$$

In the context of international exhibitions, active participation was undertaken at prominent international sector-specific events. The identification of communicative instances during these exhibitions was defined by the public display (via posters or flyers) of claims associated with social or environmental certifications by the participating firms. This form of communication was represented through a binary variable named $Exhib_Comm_k$, set to 1 to denote instances of communication and 0 otherwise.

$$Exhib_Comm_k = \begin{cases} 1 & \text{if } k - th \text{ firm communicate at exhibitions} \\ 0 & \text{otherwise} \end{cases}$$

Finally, we set the overall communication value of a firm ($Communication_k$) equal to 1 if at least one form of communication has been adopted:

$$Communication_k = Web_Comm_k \vee Exhib_Comm_k$$

being \vee the logical "or" operator.

3.2. RESULTS

We started from the analysis of the jewelry industry. The most adopted certification, among the top 50 firms for turnover participating to VicenzaOro fair, is the RJC Code of Practices (52%) followed by the OECD certification (34%), the RJC Chain of Custody (32%), and the less adopted LBMA certification (8%). The firms registered an average Sustainability Level (SL) of 0,34 and only the 44% of them communicated the sustainability (Figure 1a).

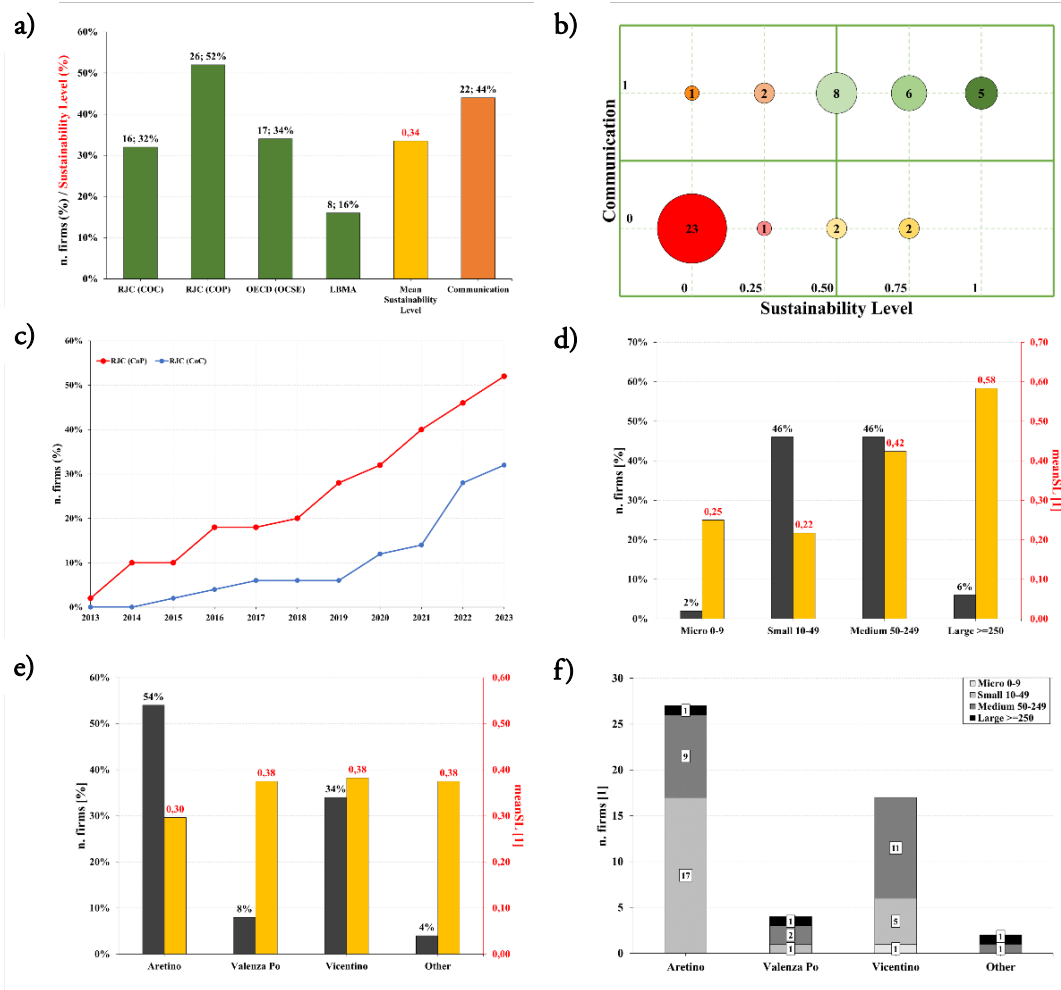
Then, we analyzed the correlation between the Sustainability Level of the firms and their Communication. As 0.5 is the median Sustainability Level, we consider a low level of sustainability if a firm adopt less than 2 certifications ($SL < 0.5$). From Figure 1b, it is easy to see that 23 firms had both a lack of sustainability and a lack of communication. On the contrary, 11 firms had both a high

Sustainability Level and perform sustainability-related Communication. Regarding the most adopted certifications (RJC CoP and RJC CoC), in Figure 1c we can see a linear increase in terms of certifications adoption among the firms of the sample from 2013 to nowadays, witnessing the increasing orientation towards sustainability of district firms specializing in this sector.

Subsequently, we investigated if the size of the firms impacts the Sustainability level or the Communication. As depicted in Figure 1d, most of the analyzed firms were SMEs and the larger is the firm the higher is its Sustainability level.

In Figure 1e we can see that the Sustainability Level is almost the same for all the firms independently to the district they belong to, suggesting that district firms have the same behavior with respect to environmental sustainability. Finally, Figure 1f elucidates that the district industry firms are mostly of small and medium size.

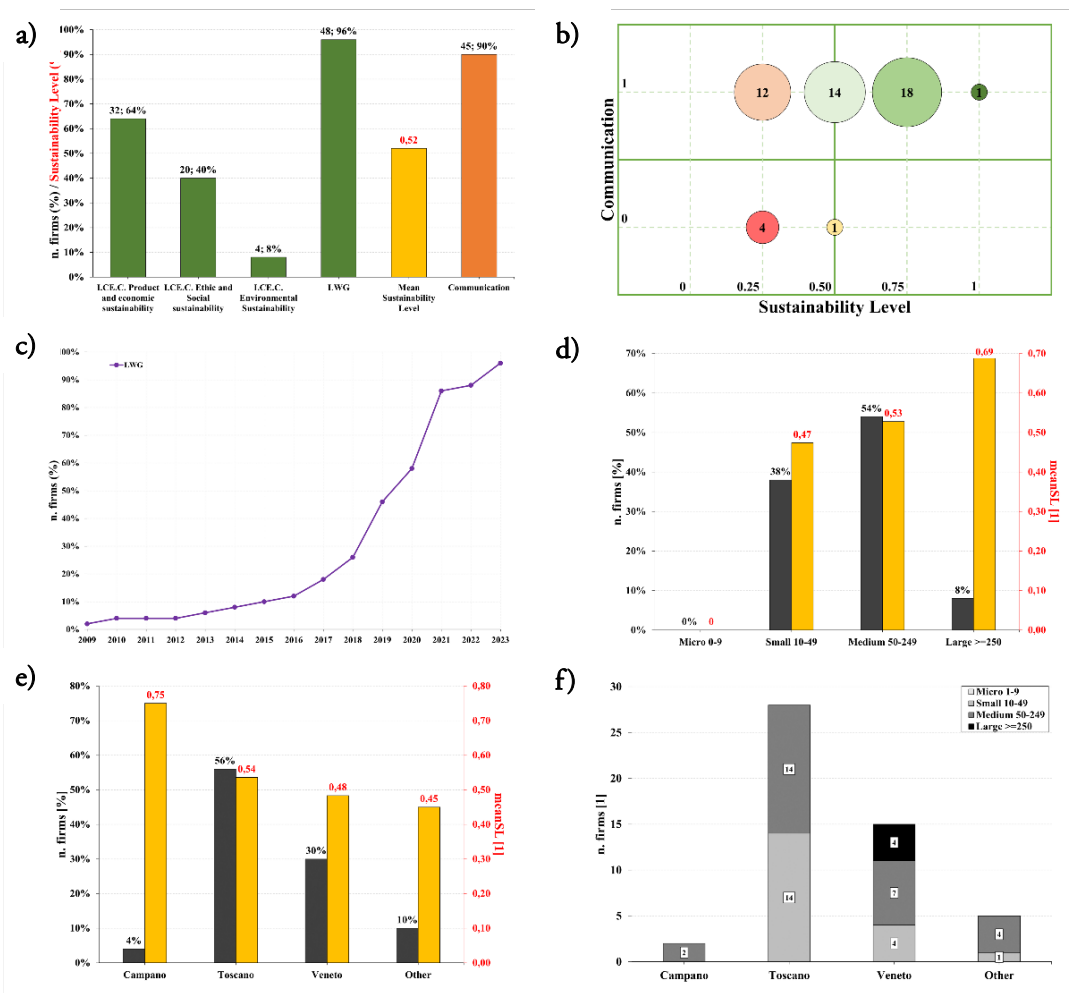
FIGURE 1.
Sustainability data of Top 50 (on Production Value) Italian Jewelry firms that participated to the exhibition VicenzaOro



Graph a) depicts the adopted certifications, the mean sustainability level, and the Communication. The scheme in b) displays the relationship between Sustainability Level and Communication. The graph in c) shows the adoption of the RJC certifications over the years. Charts d), e) and f) depict the characteristics of the sample depending on the dimensions of the firm and the belonging to a specific production district. We calculated meanSL as $\sum_{k=1}^M Sust_Level_k / M$.

The same analysis has been performed concerning the leather industry. Among the top 50 firms participating in Lineapelle fair, the Leather Working Group (LWG) certification was the most prevalent (96%), followed by Product and Economic sustainability certification (64%), Ethic and Social sustainability certification (40%), with Environmental sustainability certification being significantly less adopted (8%). The firms recorded an average Sustainability Level (SL) of 0.52, and 90% of them conveyed their commitment to sustainability, both figures markedly surpassing those observed in the jewelry sector (Figure 2).

FIGURE 2. Sustainability data of Top 50 (on Production Value) Italian Leather companies that participated to the LineaPelle fair



Graph a) depicts the adopted certifications, the mean sustainability level, and the Communication. The scheme in b) displays the relationship between Sustainability Level and Communication. The graph in c) shows the adoption of the LWG certification during the years. Charts d), e) and f) depict the characteristics of the sample depending on the dimensions of the firm and the belonging to a specific production district. We calculated meanSL as $\sum_{k=1}^M Sust_Level_k / M$.

Regarding the relationship between environmental sustainability practices (captured through certification) and communication, as indicated in Figure 2b, it is evident that only 4 firms had both a lack of sustainability and a lack of communication. On the contrary, 19 firms had both a high Sustainability Level and perform the Communication. It is interesting to notice that 12 firms had a low Sustainability Level but communicate it, this can be attributable to their exclusive possession of the LWG certification.

Concerning the LWG certification, from Figure 2c the adoption of this certification increases almost exponentially from 2009 to 2023.

Subsequent investigation focused on examining whether firm size influences the Sustainability Level or Communication. Illustrated in Figure 2d, most of the firms were of small or medium-size ones, revealing an inclination towards higher Sustainability Levels among larger firms. Moreover, no Micro firms were registered in our sample.

Lastly, an assessment was conducted to determine whether affiliation with a manufacturing district influenced the abovementioned parameters. It was found that belonging to a district slightly increase the Sustainability Level (Figure 2e). It also emerges that there are no specific differences between the districts observed, taking into account specifically Arzignano and Santa Croce sull'Arno, while the Solofra district firms in Campania show higher levels of sustainability – but there is a limited – and small-sized – sample of firms considered for the analysis. It is mentionable that all the larger firms were belonging to the Arzignano leather district (Figure 2f).

4. DISCUSSION

While considering the two industries and the districts analyzed, we observed that the attention to environmental sustainability is more diffused among tanneries and leather firms than jewelry ones. If we compare Figure 1b and Figure 2b, it is possible to spot a striking difference: 23 out of 50 jewelry firms did not have any form of certification as opposed to almost none of leather firms. In addition, if we consider the threshold below of 0,5 of the sustainability level as a low level, we can find only 16 leather firms as opposed to 27 jewelry firms are below this level. This result seems to be in line with the evolution path of the two industries. For leather firms, the request to reduce their environmental impacts is fierce. Large manufacturing companies (i.e. automotive or fashion lead firms) that are important buyers of leather products have increased, in the last decade, the requirements in terms of sustainability and certifications (Omoloso et al., 2021). This may also explain the inflection point in the adoption of environmental certification starting from 2017 as it is evident from figure 2.c and by the fact that all the top fifty firms have at least a certification. In addition, the tanning process has per se a higher toll on the environment than jewelry production. The process requires the use of chemicals and metals (i.e. chromium) that can severely pollute the environment. On the contrary, jewelry production has a more limited environmental impact while the main concerns are related with the phase of gold mining and extraction and the possible exploitation of labor (social sustainability). Moreover, the sensibility of the consumer of jewelry to environmental sustainability is relatively low (Armano and Joy, 2021).

In terms of communication, we observed a substantial coherence between the initiative undertaken by firms and their communication online and offline in both industries. In fact, we found only one jewelry firms that communicate some sustainability initiatives without having a certification. This result does not allow us to dismiss the possibility of greenwashing in firms' communication but at least it tells us that firms are engaged in the process of greening the supply chain. We noticed that there is also an opposite phenomenon: firms that do not communicate via websites their efforts in terms of environmental sustainability although they have one or more certifications. Ten firms (5 for each industry) deliberately decided not to communicate their initiatives. We could explain this behavior in at least two ways. This first one is that those firms are mainly B2B and they interact with relatively few customers that probably already know their efforts. The second is related to the tendency of the firm to self-protect itself by possible allegations of green washing moved by NGOs, media and the public sphere in general. The second way seems coherent with recent literature that highlights the tendency of firms to under communicate their environmental sustainability initiatives (Falchi et al., 2022). This behavior appears quite counterintuitive but in an era of increased public scrutiny of firms' actions and the possibility of a media storm (i.e. especially social media) could have some grounding.

The results do not show relevant differences among industrial districts in term of sustainability if we compare firms of the same industry. On average, firms located in different industrial districts do not show a high variance in terms of sustainability levels. What seems to differentiate firms is their size. The larger firms are the ones that present higher sustainability levels. The combination of these results may imply that

the leading firms within the industrial district play an important role in promoting this issue at the local level. This role has helped the industrial districts in both industries to address new demands in terms of sustainability.

From a district level point of view our results show that districts are evolving in the direction of environmental sustainability. There is a growing number of firms that are investing in certifications related to product and process innovations over time. The differences between the two industries capture the different trends at the market and technological levels in which district firms are operating. On the contrary, it seems that such variety is not instead so much evident when considering district specialized in the same industry. In this respect, the internal flows of knowledge related to product and process technological improvement characterizing districts favors district firms' environmental upgrading: through supplier-buyer interaction as collaborative dimension of the district (Belussi & Sedita, 2009; De Marchi & Di Maria, 2019) or imitation process in which knowledge flows also support positive imitation-innovation dynamics (Belussi, 2015; Camuffo & Grandinetti, 2011). At the same time, district firms may be interested in communicating their effort in sustainability towards the market to support their competitiveness in a competing scenario both inside the district and outside (global markets).

The embeddedness into a specialized local manufacturing system thus may facilitate firms' investments towards environmental sustainability (also small ones) at the product or process levels, which requires collaboration and specialized, technical knowledge. The traditional strong interaction between technical providers (e.g. KIBS) and manufacturing firms at the district level support effective knowledge transfer and the possibility to upgrade district firm's offering (Camuffo & Grandinetti, 2011). Such dynamics can be linked also to environmental innovation (De Marchi, 2012) where the district as opening learning system (Belussi & Sedita, 2009) can gain through the internal but also external flows of knowledge connected to environmental sustainability. In this view, autonomous strategies of district firms as well as investments from abroad towards the district impacts on district changes towards environmental sustainability.

5. CONCLUSIONS

Our research offers new insights on the evolutionary trajectories of industrial districts, specifically related to environmental sustainability trends. Industrial district firms are investing to increase their degree of environmental sustainability of their products and processes and this trend is positive over the years. Although the demand for environmental sustainability originates from the market (both B2B and B2C) in both industries – with specific roles of lead firms - district firms are actively enhancing their production processes and products, recognizing that acquiring environmental certification is a significant step in this direction. It is true that the intensity of this adaptation seems in line with the strength of the request coming from the market.

Our research confirms that industrial districts as specifically open in facing new transformations (Belussi & Sedita, 2012). Our study is based on the district firm-level, but the trends emerged from the firms analyzed show that all the districts observed are characterized by visible change towards environmental sustainability. An increasing number of certifications are widespread at the district level. Our analyses offer additional inputs on the theoretical research on industrial districts, by offering the new theoretical perspective of environmental sustainability as an innovation and market challenge that interests also local manufacturing (and learning) systems.

Large firms seem to drive the intensity of initiatives on environmental sustainability. As it appears, those firms are more exposed to international competition, and this may influence their investments in sustainability. This may represent an indirect confirmation of the literature of the role played by lead firms in GVC in sustaining the greening of the supply chain (De Marchi et al, 2019). Based on those elements, we may conclude that industrial districts are reacting and not anticipating the request coming from the market. On the one hand, this may appear critical for the future as it implies that firms need to catch up. On the other, it confirms the role of the industrial district in contributing to the diffusion of environmental practices. From this point of view, the internal B2B relationships between district firms (and with technical providers) may support the diffusion of knowledge also related to environmental sustainability transition

of products and processes, thus favoring a district upgrading. Firms belonging to clusters may benefit from this transition more than isolated suppliers in GVC. The district context represents a good social and economic ground for environmental upgrading, as other recent research is showing (Ponte et al. 2023). At the same time, especially in clusters in a maturity phase (Belussi, 2018) it is also relevant the inputs that comes from external linkages and knowledge inputs in order to push innovation.

Firms belonging to different clusters have similar sustainability levels suggesting that the industry specialization matters in shaping sustainability investments of firms – distinguishing between firms operating in the production of an intermediate good (the leather) with respect to a final product (jewelry). In this respect, our research sheds further light on the discussion concerning the variety in district evolutions (Belussi, 2018) and the potential heterogeneity across districts (De Marchi et al 2017). Our results suggest that in relation to sustainability business strategy matters, while more limited differences emerge across districts with the same manufacturing specialization. We observed a greater variety of sustainability strategies across firms than across districts specialized in the same industry. This evidence offers additional contributions on the positive innovation dynamics that can occur within a district in relation to the industry specialization that characterizes local manufacturing systems. The specific product and process-related knowledge put district firms operating in the same industry but located in different clusters in front of the same threats connected to sustainability. Reactions towards such challenges may be different across district firms based on their internal resources and peculiarities (Hervas-Oliver & Belussi, 2018; Puig & González-Loureiro, 2017), but can generate however consequences at the district level.

From a managerial perspective, our research shows the importance of the investments on environmental sustainability and the increasing diffusion of the certification among the firm both in the industry and in the industrial district. If this is true, managers should consider further initiatives in terms of sustainability to differentiate themselves in the market. Certifications are important, but as they become more widely adopted in the industry and industrial districts, their significance for competitive advantage tends to diminish. From this perspective, firms should cultivate an autonomous capacity to enhance their environmental sustainability through technological investments in the development of new products and industrial processes.

Our study has some limitations related to the scale of the analysis that includes only one country and a specific number of firms selected, with a focus on industrial districts. Future research could expand the analysis of district firms' strategies by enlarging the number of firms observed and offering also an international comparison. Additional research can also consider other industry specializations to include other cases of industrial districts and provide additional knowledge on the link between environmental sustainability and district transformations and the role of firms' strategies.

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