

Digitalization and Resilience Strategies in Italian Furniture Manufacturing Districts. Quarrata (Tuscany) Case Study

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Abstract:

Furniture manufacturing in Italy is based on interconnected SMEs based on craftsmanship know-how. During the past decade, these companies presented significant transformations within the production chain integrating enabling technologies into high-quality craftsmanship. This change has been based on supports from European Commission and local institutions enhancing digitalization. The research focuses on furniture production clusters in Tuscany (Italy) and, in particular, on Quarrata district. Even if several international analysts report on a scarce diffusion of technological skills in Italian SMEs, Tuscany area includes significant case studies that present digital integrations to the supply chain, structuring resilience strategies. The paper presents a joint project Industry-Academia on Quarrata cluster, including researchers and students. The team analysed significant supply chains about the grade of digitalization among the companies of the same production network. Then, the study proposed specific reorganization guidelines through the introduction of digital systems both on production reorganization and new design directions.

Keywords: Furniture; Supply-chain; Clusters; Digitalization

1. Introduction

The organization of furniture manufacturing districts in Italy is based on networks of many independent small and medium-sized enterprises, each one specialized on specific works. The "subcontracting" agreement is the most widespread kind of relation in between the companies. The coordination of production is carried out by a leading SME that supervises design, product engineering and logistical aspects. Since the end of nineties, we notice the introduction of "cluster" definition (Porter, 1994), as general expression that just describes economic and territorial organizations.

Since the launch of Lisbon Strategy program in 2000, European Commission established the transition from an industrial economy to a post-industrial or knowledge-based economy, supporting the competitiveness of European companies. Varaldo identifies significant factors that qualify the knowledge-based economy (Varaldo, 2006): the increasing role assumed by knowledge and intangible factors in the Global Value Chain (GVC) and exchange of information, expertise and services.

Considering the recent global financial crisis, the research aims at outlining on organizational and operative systems for a “renewed” *Made in Italy*, by the combination of intrinsic high craftsmanship values and technological innovation. Summarizing, if the concept of craftsmanship implies the arts and skills of making and related intangible values (Fucks, et al, 2015), on the other hand when these know-how meets the demands of contemporary innovation we talk about “advanced craftsmanship” (Author, 2016).

2. Digitalization in Furniture Clusters of Italian Craft-Based SMEs

2.1 Ongoing Digitalization Processes

SME Instrument of EU Horizon 2020 program targets innovative SMEs, aiming at offering a strategic support in developing and internationalising. The strategy allowed significant transformations within manufacturing districts by developing a new technological paradigm in production and clusters organization.

This ongoing digital transformation of Italian furniture manufacturing networks merge inner peculiar factors of Italian districts:

1. Development of technological innovation in the production processes given by technology transfers from other manufacturing contexts (i.e. automotive or fashion);
2. Saving craftsmanship values within the technological innovation of the supply chain;
3. Logistics innovation attitude, including improvements of production planning and time-to-market, materials procurement and traceability (Fry et al, 2017).

Anyway, according to the “Digital Infrastructure Index” report published in 2020 by Ernst & Young, the Italian situation is rather uneven. The Italian “miniaturization” of production system is one of the reason-why of this status quo. The index describes the degree of introduction and efficiency of digital infrastructures in 107 Italian provinces. In addition, OECD's “Skills Outlook 2019” reports a scarce diffusion of technological skills, which places Italy in the last positions of ranking among European countries in terms of skills for digitization, exposure on the digital market and policies to foster skills. On the other hand, the report of Qonto Observatory highlights how in 2020 majority of SMEs realized on the importance of equipping their companies with digital tools to face market challenges and unexpected events as Covid pandemic: over 40% of companies allocated more than 10% of their budget for digitization and 50% of them allocated a share of more than 30%. SMEs have therefore accelerated some aspects of digital transformation, aiming at making resources more efficient, reducing manufacturing costs and improving work flexibility (EU, SME Annual Report 2021).

Furthermore, the study highlights on associations between resilience by incorporating new digital equipment and social capital. In fact, locational choices generate a proximity premium, and develops a growth-survival-maturity perspective on SME resilience, highlighting on the value of the cluster. Data reveals an interplay between an ensemble of entrepreneurial activities and decisions about planning, networks, learning, including new technologies and location (Herbane, 2019).

2.2 Digitalization In Tuscany Clusters: a resilience booster integrated to advanced craftsmanship processes

In Tuscany area, we highlight on SMEs case studies that successfully developed a digital transition through Industry 4.0 management software and hardware and “smart” production management without affecting the value of high-quality craftsmanship. As example, Savio Firmino¹ company (Florence area) since 2015 implemented a reorganization program of production aiming at:

- improving time-to-market and reacting appropriately to market demand;
- coordinating company departments and suppliers;
- developing a digital archive to set a craftsmanship works’ taxonomy integrated into industrialized processes;
- implementation of 3D scanning technologies aiming at developing reverse engineering processes on classic company craftworks and new design artefacts. (Cianfanelli et al, 2015)

In the company Baldi (Florence), specialized in high-end artistic furniture and home details, since 2012 design and production framework have been reorganized through digital scanning systems combined to parametric modelling software. In addition, Baldi introduced a management digital platform aiming at controlling the Product Lifecycle Management (PLM) and the production steps (Cianfanelli et al, 2015).

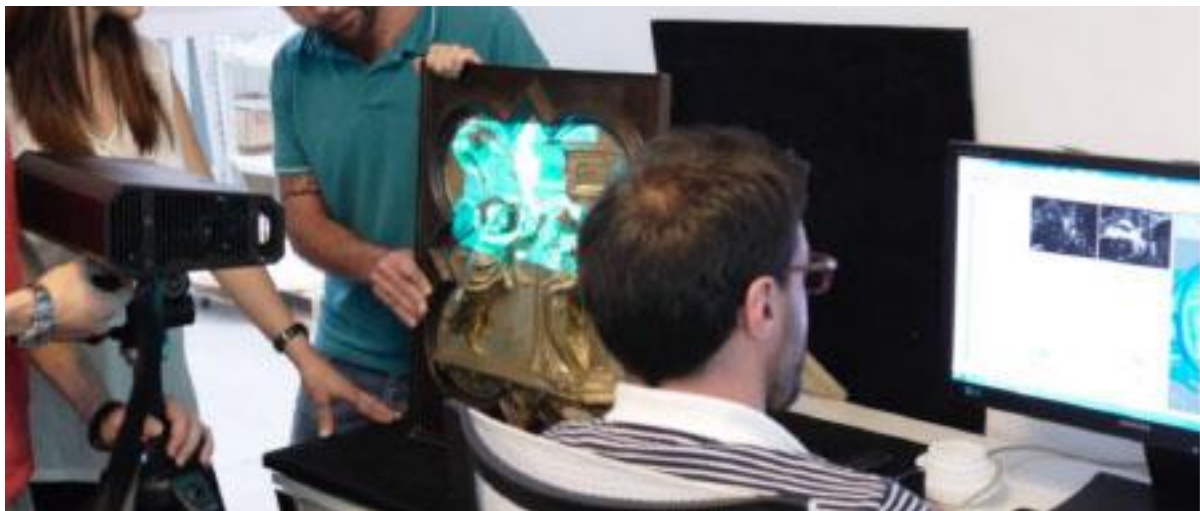


Figure 1. 3d scanning for craftsmanship (Florence, Italy)

¹ <https://saviofirmino.com/?lang=en>

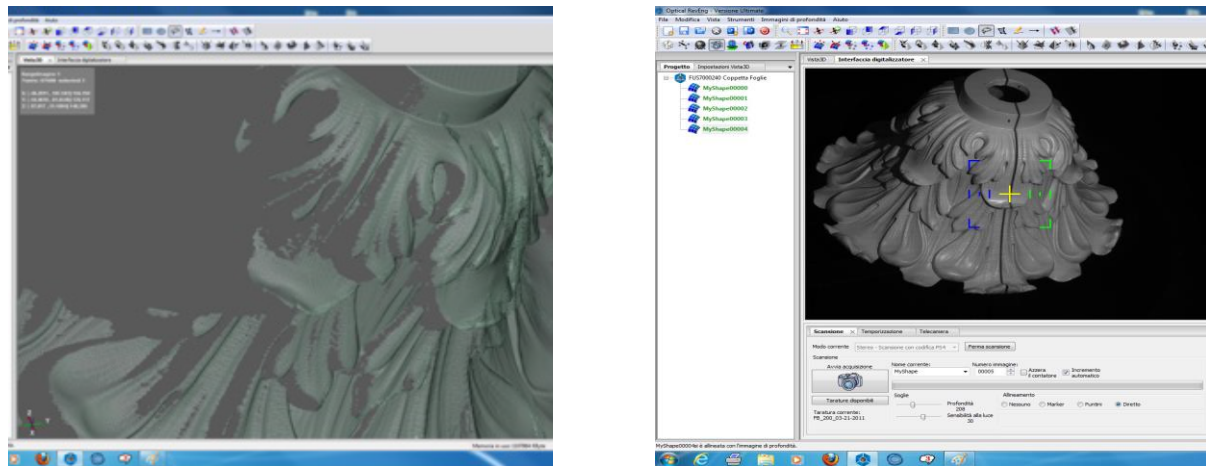


Figure 2. Parametric modelling for craftsmanship, assembly management

According to the presented case studies, we can define some aspects of SMEs resilience as:

- 1) companies competing in today's business environment that combines adaptability, responsiveness, sustainability, and competitiveness;
- 2) the capability to self-renew over time, to maintain status-quo or move to a new desirable state after (or before) being disturbed, if impacted by external and internal events;
- 3) this digital implementation allows to adopt IT technology, to overcome market issues and crisis or by reorganizing their manufacturing supply chain -including all the subcontractors companies- enhancing their resilience to changes in external conditions (Bak, et al, 2020).

The peculiarity of digital transition of Italian SMEs -even if presenting non-homogeneous features- is based on the “endemic” companies’ attitude to technology transfer and cross-fertilization attitude among the clusters.

Moreover, the concept of advanced craftsmanship could work as “digitalization booster”, supporting the organization in including new technological equipment and to integrate them. On the other hand, this technology-driven transformation could not work without a proper inclusion of inner manufacturing values of *Made in Italy* into the digital transition. According to this perspective we can highlight on a significant difference in between Italian SMEs digitalization and several international SMEs’ case studies that mainly refer to the organizational asset of the company (Moef, et al, 2018). In fact, the introduction of enabling technologies in the Italian clusters is always strongly referring to the production know-how and the related intangible values.

3. Quarrata district (Tuscany, Italy) and resilience strategies -“Lights and shadows”

Quarrata area (Tuscany, Italy) is characterized by an historically rooted craftsmanship-based furniture cluster, in particular about padded and upholstered products. Quarrata includes hundreds of companies specialized in the production of furniture in wood or carpentry construction, semi-finished products, furniture components, padding, upholstery and wood finishing. Recognized as industrial district since the 40s, during the 50s Quarrata became well known about the creation of transformable furniture, positioning the district as a pole of upholstered artifacts. In the 1970s, the entrepreneurs of Quarrata started working on product qualification and diversification, to overcome a first crisis in the sector. In this phase, emerging companies started collaborating with designers as Ettore Sottsass, Gae Aulenti, Michelucci and Portoghesi. During the 1990s, thanks to the integration in between artisanal know-how and design awareness the district survived even if facing sharp increase in competition.

In the last 20 years we highlight on rising weaknesses of the local productive cluster, both from economic and financial point of view. In addition, Quarrata's economy heavily suffered due to economic crisis of 2008. Manufacturing industry presented huge losses in terms of production and turnover for all quarters of 2009 and the first quarter of 2010, presenting a significant decreasing of -1.8% in production and of -0.8% in turnover. The diffused "contractors" or "sub-contractors" mindset represents a limitation to the development of proper skills in business management. After years of variable market trends, the recent pandemic time has further weakened the district, leading to an additional contraction of production of -16.2% in 2020 (Intesa San Paolo features).



Figure 3. Traditional woodworks at Quarrata's production district; padding and upholstering works

4. "From Design to Product", Resilience Program for Quarrata's District

In 2016, Tuscany Region launched a strategic project for product design and the reorganization of company clusters of Quarrata manufacturing system. The project aimed at boosting innovation processes in design, production and internationalization. In particular, the project focused on seven furniture production chains relating to following steps:

- Design management innovation: through specialized researchers in design innovation management, product design and marketing. Development of a visiting and workshop program to enhance an innovation-driven entrepreneurial shift.
- Training new human resources through academic education and workshop experiences within industry-academia joint labs, through the partnership with *Master Program in Design Innovation for High-End Craftsmanship* of IED Istituto Europeo di Design/Florence (Italy).
- Development of "pilot" capsule collections for each of the seven production chains.

The research project consisted in two phases:

- Phase 1- April/September 2017:
 - 1a. The first phase involved an in-depth market analysis, defining current trends in high-end furniture global market.
 - 1b. Then, the team of professionals developed a visits plan to the SMEs and made a detailed analysis of the seven supply chains taking into consideration: the production framework, grade of introduction of innovative equipment, experiences of technology transfer and cross fertilizations already implemented.
- Phase 2- July/December 2017:

Development of a work plan of workshops including researchers, students and companies, focusing on design process in relation to the supply chain. Design of one capsule collection for each of the seven supply chains.

The final project presentation has been held in Zhenzhen Furniture Fair (China) on March 13th 2018.

4.1 Overview on Quarrata's SMEs Cluster

The analysis of the supply chains followed a visits and interviews plan with entrepreneurs that provided a clear picture of the status quo of production. The research addressed the issues related the introduction of new technologies to support production processes and management through digital platforms. While some players in the supply chain show a clear scepticism towards new technologies as a support to craftsmanship, others are up-to-date and already implement innovative design and production systems

4.2 Different Grades of Digital Technologies Integration Within the SMEs District

Within different visiting experiences and data collected, some supply chains stand as significant case histories.

The Supply Chain leaded by Artigiangomma² is for sure a reference case study. The company produces upholstery and assembly of components for the sofa system. Artigiangomma directly manufactures polyurethane foam and padding systems. The company presents an artisanal identity and over the years it has built a complex supply chain. Among this production cluster, the company Superevo develops processes on polystyrene blocks in line with contemporary design trends, spray-coated with polyurethane foam. The process is developed through numerical control machines and robots. This highly innovative process allows to obtain light products and complex shapes that could not be developed through traditional processes. In fact, through a 3D model Superevo³ set the shape and then works through CAD-CAM software for post-processing, which translates the processing files into the robot language. Then, the company artisans can create the final outcomes supported by the robots works. The supply chain includes other company that presents just traditional artisanal processes as custom upholstery solutions and artisan carpentry.

² <http://www.artigiangomma.it>

³ <http://www.superevo.it/en/home.php>

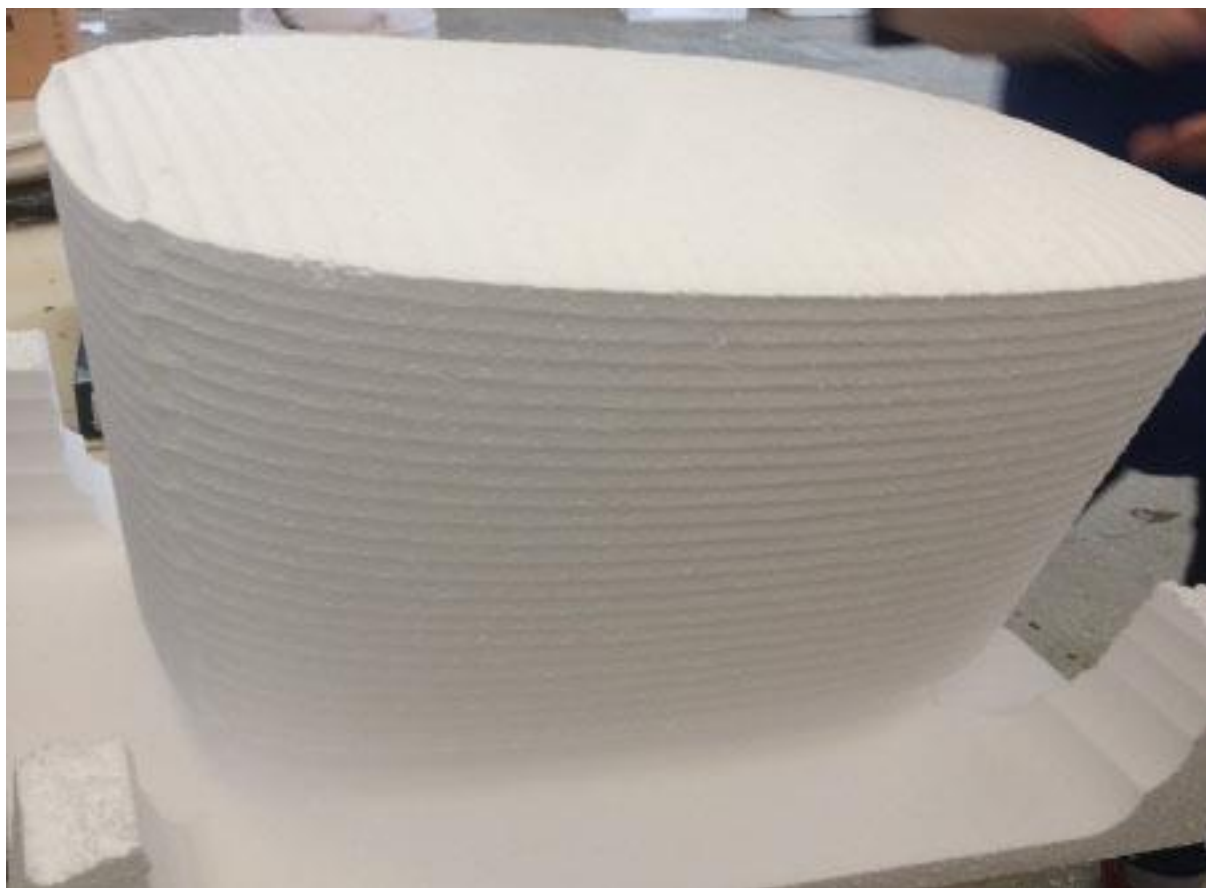


Figure 4. Polimex works through robots at Superevo

Among the seven analysed supply chains, also the SMEs' cluster headed by the company Formitalia presents interesting characteristics.

Formitalia⁴ stands as a "design-oriented" player in the district. The company embraced a strategic policy characterized by strong internationalization and licensing of important international "griffes" in the home sector - such as automotive luxury brands. All the company technical know-how is managed by the supplier Falegnameria Cecchi⁵, devoted to product development, 3D modelling and production digital archive. Falegnameria Cecchi presents an advanced level of innovation in operating methods both at the design and management level. The synergy in between Formitalia and Cecchi is therefore a strategic factor within the supply chain. In fact, Cecchi works through advanced parametric software, in particular *3D Cad Evolution-Hevolus*⁶, aiming at controlling the cuts on wood and metal, object produced by metal smelting, entire product assembly until the final preparation of furniture products in the space. Through the software, the company can manage all wood fixtures of the furniture, door hinges, all stored in a digital archive that allows to list the entire taxonomy of the technical components. Also in this cluster, we can mention other suppliers not digitalized and strongly characterized by traditional production processes in carpentry or painting.

Another supply chain model is offered by majority of SMEs' clusters characterized by a traditional approach in production and supply-chain organization. This is the case of the production chain led by Gold Comfort company that presents high-end know-how in traditional padding and upholstery. As many case studies within Quarrata district, suppliers included in this kind of supply

⁴ <http://www.formitalia.it>

⁵ <https://www.checciarredamenti.it>

⁶ <https://www.3cad.it/en/3cad-applications/3cad-evolution/>

chain present a high-end standard in production and a precious craftsmanship. Anyway, none of the suppliers present significant digitalization processes.

4.3 Strategic Directions Aiming at Reorganizing the supply chain and Developing “Pilot” Capsule Collections

According to the analysis developed about the 7 supply chains, the research presents two kinds of organizational models and grades of digital technologies integrations. A first model is represented by a partial integration of digital technologies in design management e production management (i.e. Artigiangomma or Formitalia), involving IDETs information and communication digital technologies and ADETs advanced robotics and integration digital enabling technologies (Somohano-Rodríguez, et al, 2020). A second model doesn't present any significant digital implementation within the design and production processes.

The first kind of SMEs clusters is characterized by strong synergy in between the leading company and one or more suppliers that developed an advanced technological development - In example, the relations Superevo/Artigiangomma and Cecchi/Formitalia. These strategic innovation units could represent a pillar for the organization of a digital archive of semifinished product and assembly systems and the optimization of the production management (named in the research as “primary” management and modelling systems with the research program). These innovation units could generate a drop-down innovation within the supply chain, by setting digital platforms aiming at optimizing timing and phases of productions (named as “secondary” management systems). Moreover, reshaping the supply chain process could allow to of new categories design products and updated services for contemporary market.

The second kind of supply chain could be referred to 5 of the 7 analysed supply chains. In this context, any digitalization process has been implemented. Then, the research proposed the introduction of 3D modelling parametric systems and PLM platforms just in charge of the heading company (“primary” design and production management system referring both to IDETs and ADETs). Then, we could plan a drop-down model of reorganization and production management of the supply chain that could involve all the suppliers (“secondary” production management referring to IDETs) .

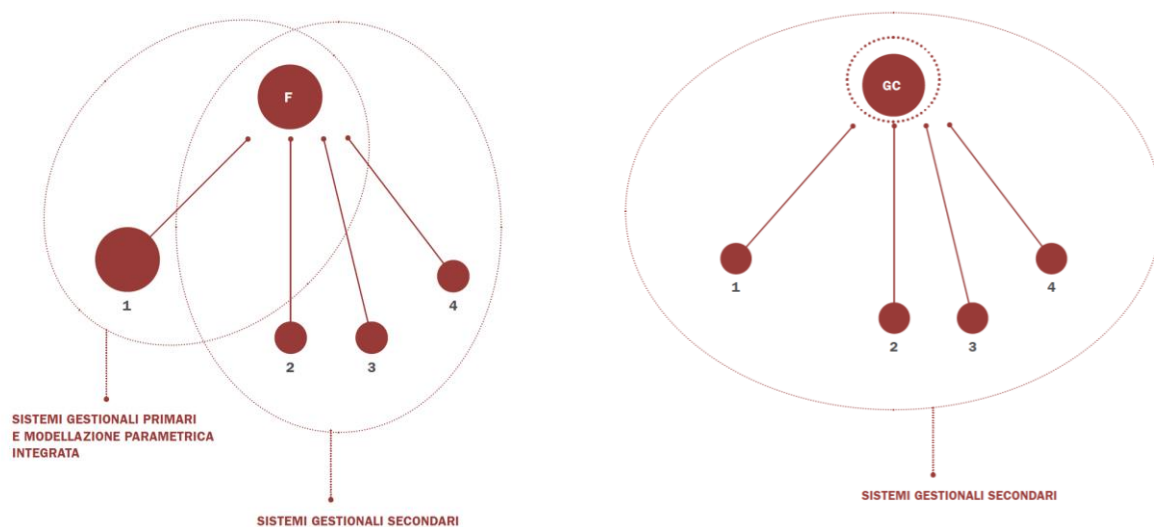


Figure 5. Reorganization strategy of the supply chain without any digital feature and drop-down strategy

According to the digital reorganization of each supply chain, the research team developed specific furniture collections to be presented within international exhibitions. The final design aimed at emphasizing on the new flexibility and time-to-market offered by the introduced innovation within the production chain. The seven capsule collections (one for each supply chain) had to highlight the tangible and intangible values of the reference production chain supported by the new digitization tools and the inclusion of enabling technologies (i.e. TCT "Time Compression Technologies", such as reverse engineering). Moreover, PLM systems could wider the variety of designs and services (such as artefact customization or storytelling) for a renewed "engagement" of the end customer.

Moreover, Digital archive could allow designers to work by distance and in connection to manufacturing chain even in special emergency situations, as the one happened during Covid pandemic time. In fact the digital archive allow the companies and designers to manage synergistically both creative processes and advanced craftsmanship manufacturing.

Summarizing, we can define the role of design within the company digitalization strategy according to following two levels:

- Macro: the design acts as a creative process connected to the production management and to envision possible creative solution that could be developed in accordance to digitalized production process.
- Micro: digital design of products and product components, including cad-cam, product assembling management and parametric design as a support for manufacturing (Cohen, et al, 2019).

CAPSULE 系列 #5
扶手椅
咖啡桌
凳子

CAPSULE COLLECTION #5
ARMCHAIR
COFFEE TABLE
STOOL



Figure 6. Capsule collection developed within Quarrata research project

5. Conclusions

Usually, Digitization processes in SMEs don't stand as strategic assets in business management, but according to Tuscany cluster overview we can highlight an uneven diffusion of digital technologies about design, production and management processes.

Although many Italian districts had already experienced a phase of severe crisis since the years 2008 and 2009, the situation is certainly aggravated with the events of 2020. In fact, the recent health crisis linked to Covid-19 has certainly changed the economy scenario. During the pandemic months, digital devices represented the only tool for SMEs able to maintain a certain business continuity. SMEs have accelerated some aspects of digital transformation, aiming at making resources more efficient and reducing costs and improving flexibility in work.

The challenge for the future will be to move from a reactive emergency approach to a long-term and strategic approach, extending digitization to the various processes and reviewing business models. Anyway, beyond the specific development and digitalization strategies of the supply chain, it is necessary a change of mentality of the entrepreneurship, looking to the future in a different perspective avoiding not to conservative mindsets (Moeuf, et al, 2020).

On the other hand, the research highlighted on the importance of a proactive relation in between the manufacturing cluster and education, to train human resources of the district of today and of the future. In fact, education of new design-oriented profiles able to operate in between the supply-chain innovation, product design and service design stand as a centric issue in the development of the future furniture manufacturing clusters driven by digital supports. The industry-academia join research model presented about Quarrata's case study could stand as a strategy aiming at aligning the shortfalls of the enterprise with existing technologies. In fact, the crucial problem in SMEs is related to a lack of perception of the links between managerial and technological vision (Dassisti, et al, 2017). The support of academic researchers and students involved in workshops and lab programs could stand as a strategic support to overcome this weakness.

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