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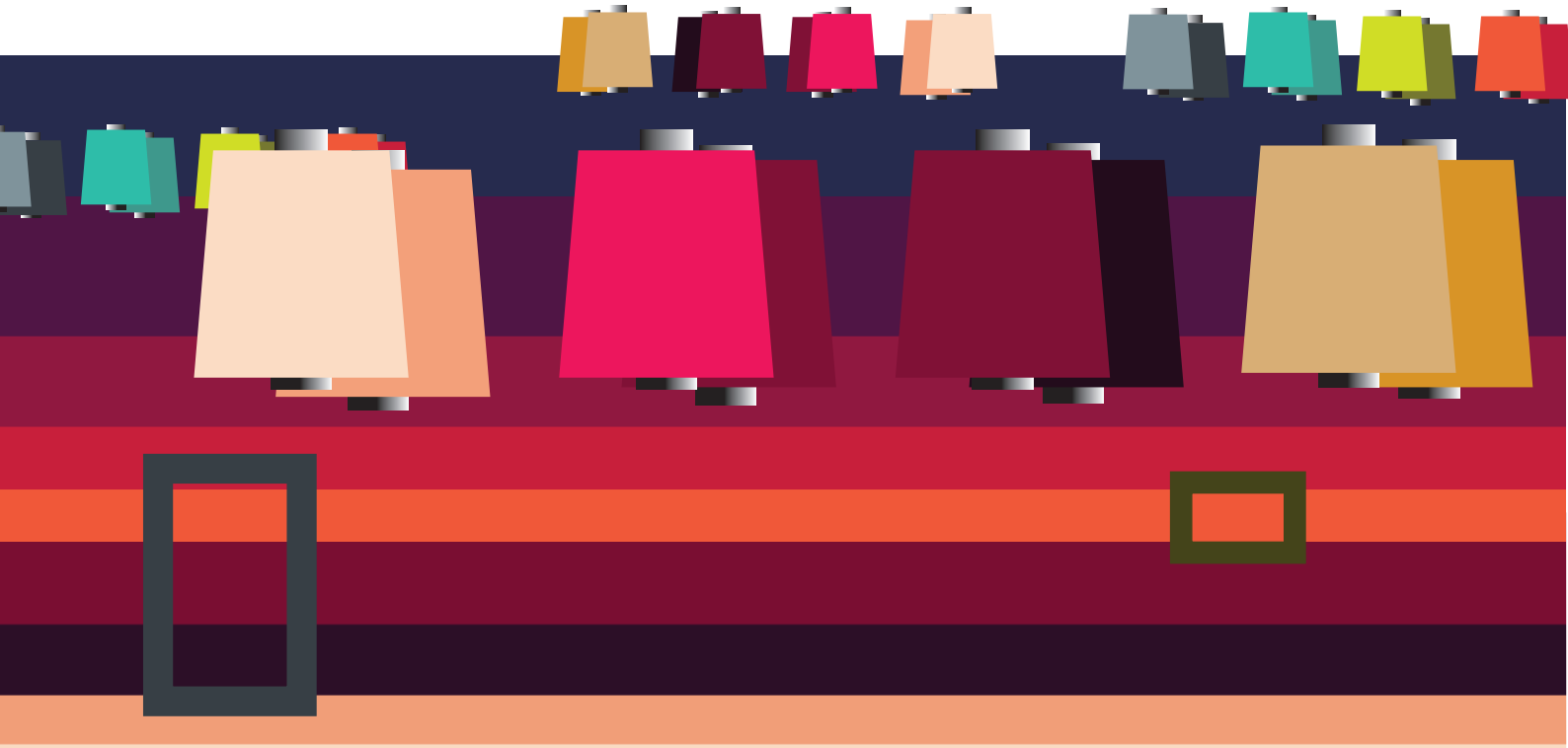

ENTREPRENEURIAL PROCESS IN TEXTILE AND CLOTHING INDUSTRY

Technical Report

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MAPPING AND CLUSTERING. ENTREPRENEURIAL SKILLS IN TCI

SPECIALIZED CLUSTER AND INSTITUTE OF APPAREL AND TEXTILE - DANUBE

March, 2021

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Content

ENTREPRENEURIAL PROCESS IN TEXTILE AND CLOTHING INDUSTRY

AN OVERVIEW OF EUROPEAN PRACTICES

Introduction

The best example of entrepreneurs can be seen in fashion and apparel industry where some are reforming manufacturing practices to make them eco-friendly, some are satisfying the fashion needs of the younger generation, while others are providing these products to the clientele on time and in a cost-effective manner. Thus, the entrepreneurial process in the **T**extile and **C**lothing **I**ndustry (TCI) is focused on **SUPPORTING INNOVATION IDEA DEVELOPMENT**, and respectively – on **COMMERCIAL APPLICATION OF INNOVATIVE IDEAS** in the TCI.

The fashion entrepreneurial business is widely acknowledged as an accessible market. Its low entry barriers, both in terms of needed capital and skills, allow for a very diverse range of motivations and backgrounds among fashion entrepreneurs, and is one of the causes behind the large number of start-ups entering fashion (Negarandeh, 2008; Malem, 2008; Mills 2011, 2012 and others).

Thus, two major theses on innovations in TCI were developed:

- TCI entrepreneurship is related to fashion design;
- TCI development is focused on the ecological dimensions of sustainability and/or the technological fibre industry dimension.

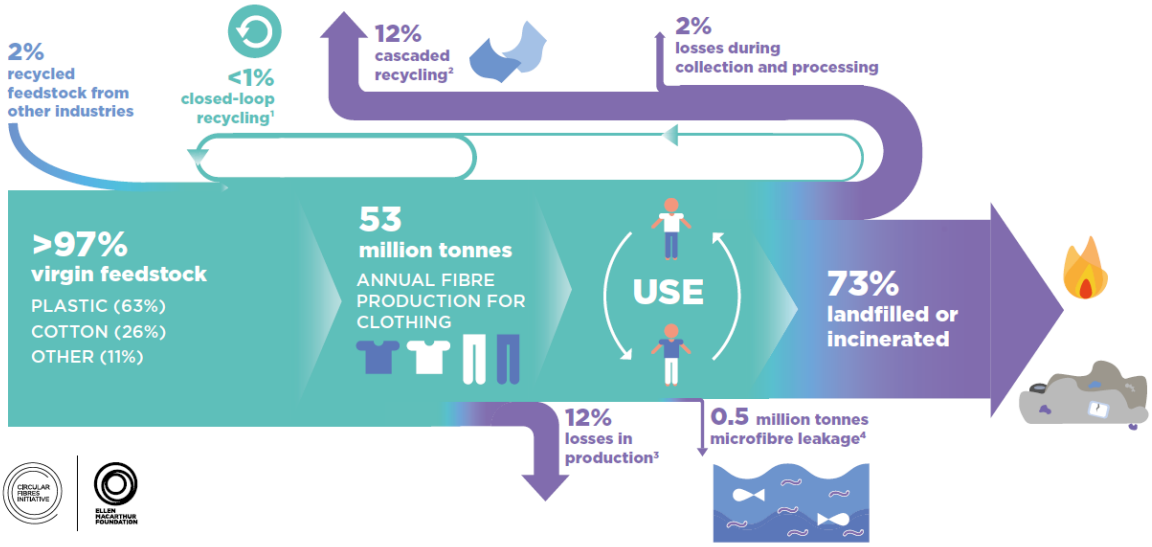
Both theses explore the intellectual ownership and new knowledge progress in textile and apparel production. The main reason that is given is that the apparel and textile industries are labour-intensive industries and traditionally they are driven by cost minimisation.

Some *examples* from previous research (Ünay and Zehir 2012; Plieth, Bullinger-Hoffmann, Hansen 2012; Kellogg et al. 2002; Gilsoo Cho et al. 2010 and others):

- *The corporate strategy of **PIERRE CARDIN** who has been related to innovation and creativity* both *in fashion design and business approach is a highly talented "fashion designer, a businessman, and an innovator" who adopted several aspects of the current fashion management*;
- ***RAYON** brought* a new type *of competition to textiles and continuous advances in fibre and fabric technologies would impact the future of apparel design such as development of seamless garments;*

- *The company culture, which is like an enormous database including its experience, skills, individuals' contributions formed by the genetic code of entrepreneurs as the case of* ***SALVATORE FERRAGAMO'S*** *the family tradition of innovation could be given.*

- Smart or intelligent textile innovation was one of the most revolutionary developments in the textile innovation history. A new era due to the emergence of new materials as the building blocks of intelligent or smart textiles is based on the use of nanotechnology and using textile innovations in the fashion industry will provide fashion businesses competitive advantage in the 21st Century.
- Less than 1% of material used to produce clothing is recycled into new clothing. This will be the next generation opportunity for developing entrepreneurial businesses in TCI (Figure 1.).



Source: *Strategic Agenda on Textile Waste Management and Recycling, ENTeR - Expert Network on Textile Recycling, p.16* [Stategic-Agenda.pdf (interreg-central.eu)]

Figure 1. Recycling map of textile and apparel industry

The success of TCI entrepreneurs is based on the fact that small and medium-sized enterprises (**SMEs**) in fashion are considered depositories of the traditional skills and creativity needed to penetrate and/or/ expand markets and can generate stable employment and income for the diverse communities and to those of different levels of education (see: UNIDO 2019).

In addition, the success of entrepreneurship in fashion and apparel design involves combining design, business and manufacturing knowledge.

The next steps of analysis explore the main opportunities for developing entrepreneurial business in fashion industry and summarise the knowledge on TCI's entrepreneurs for establishing a successful innovative idea and finding appropriate financing for sustaining the entrepreneurial business in textile and apparel industry.

1. Entrepreneurial Map

A. Definition

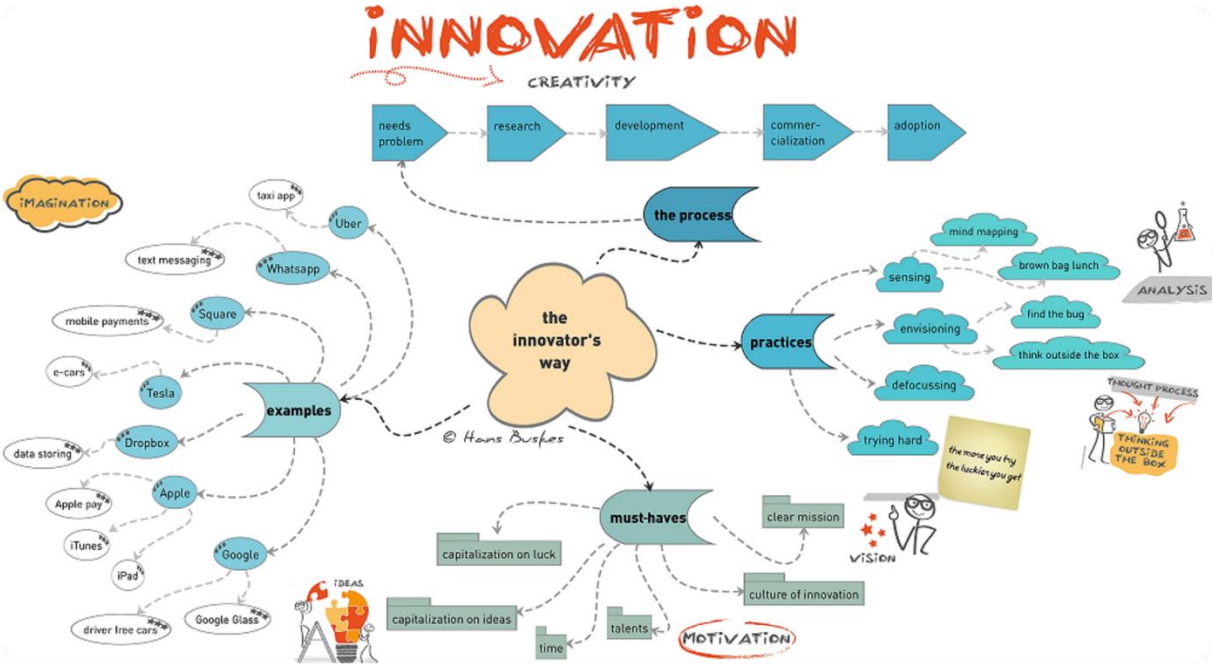
Entrepreneurial mapping is the process of proposing a **MAP** of different entrepreneurial decisions on the existing textile and clothing business based on the main reasons for those businesses' establishment, for example:

i. New textile and/or clothing design
ii. New textile fibres or materials
iii. New textile and/or clothing production equipment/machinery, techniques or technologies.

The map will allow to recognize the entrepreneurial premises. Our assumption is that in different TCI sectors there are quite different preconditions for entrepreneurship. Thus, the entrepreneurial know-how, especially for internal entrepreneurial needs, will be applied differently.

Additionally, the map will develop the source of the entrepreneurial ideas: students, business staff: workers and managers, special innovation / research teams, competitors or customers.

As the entrepreneurial business is close to the new idea rise-up in practice, some examples of mapping could be very useful (Figure 2).



Source: *Buskes H. (December 7, 2014) Best practices for successful innovation, Best practices for successful innovation | mastermind maps (wordpress.com)*

Figure 2. Entrepreneurial map

In summary, **Entrepreneurial mapping** is based on understanding the entrepreneurial process and its key elements.

B. Entrepreneurial process in TCI

The **entrepreneurial process** is a set of **STAGES**: the idea or conception of the business, the event that triggers off the operations, implementation and growth.

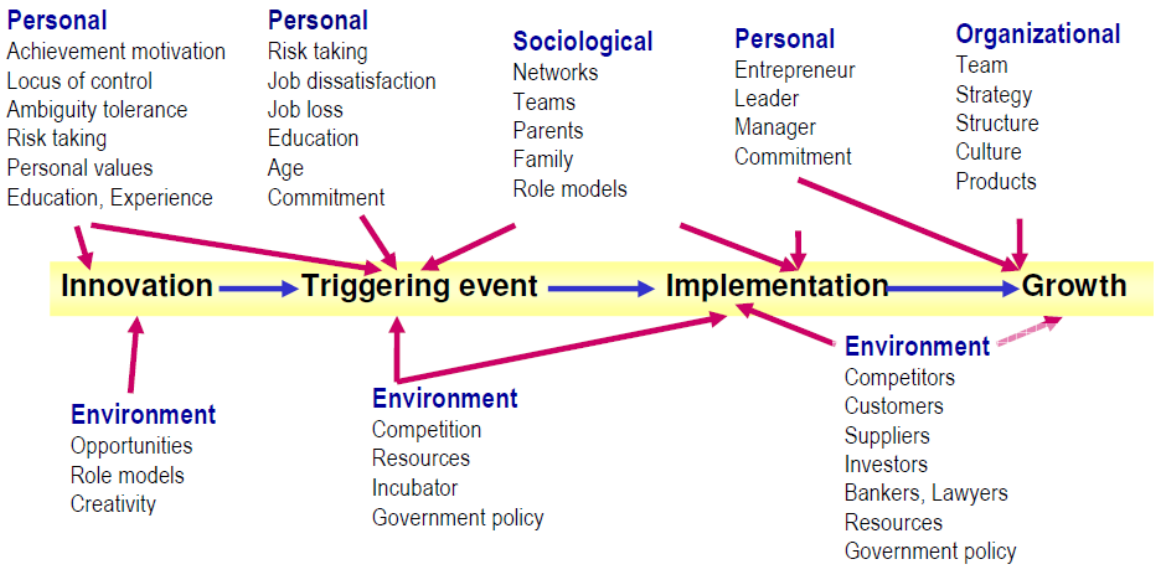
A critical factor that drives the development of the entrepreneurial business at each stage is shaped by **PERSONAL ATTRIBUTES** and **ENVIRONMENT**. The attitude of people shapes their own surroundings. When an entrepreneur looks for the characteristics of successful people, then their chances of success increase, especially if they belong to an entrepreneurial ecosystem. Entrepreneurial environment is based on the networks and institutions (Stam & Spigel, 2016).

The entrepreneurial process is divided into five stages: idea generation, opportunity evaluation, planning, company formation/launch and growth. These stages are summarized in Table 1, and the Opportunity Evaluation and Planning steps are expanded in greater detail below

Table 1. Entrepreneurial stages

Stage	Explanation
1. Idea Generation	Every new venture begins with an *idea*. In our context, we take an *idea* to be a description of a need or problem of some constituency coupled with a concept of a possible solution.
2. Opportunity Evaluation	This is the step where you ask the question of whether there is an opportunity worth investing in. Investment is principally capital, whether from individuals in the company or from outside investors, and the time and energy of a set of people. But you should also consider other assets such as intellectual property, personal relationships, physical property.
3. Planning	Once you have decided on an opportunity, you need a plan for how to capitalize that opportunity. A plan begins as a fairly simple set of ideas, and then becomes more complex as the business takes shape. In the planning phase you will need to create two things: strategy and operating plan.
4. Company formation/launch	Once there is a sufficiently compelling opportunity and a plan, the entrepreneurial team will go through the process of choosing the right form of corporate entity and actually creating the venture as a legal entity.
5. Growth	After launch, the company works toward creating its product or service, generating revenue and moving toward sustainable performance. The emphasis shifts from planning to execution. At this point, you continue to ask questions but spend more of your time carrying out your plans.

Other researchers explore different entrepreneurial paths, as Bhave (1995:223) identifies four stages namely: opportunity identification, technology set up, organization creation and the exchange stages. This is supported by Hisrich & Peters (2002:40) who articulate four stages of the entrepreneurial process namely identifying and evaluating the opportunity; developing the business plan; determining the resources required; and managing the resulting enterprise (Figure 3).



Source: *Hisrich & Peters (2002:48)*

Figure 3. Model of Entrepreneurial process

The given model (Figure 3) defines two principle elements needed for successful entrepreneurial business, incl. inside the textile and apparel industry:

- Entrepreneurial personal characteristics such as knowledge, behaviour and experience;
- Environmental support such as research institutes, laboratories, incubators, financial institutions.

In addition, summarising the different definitions, two of the main critical points of the entrepreneurial stages arise as follows:

1) Finding The Right /resp. Successful/ **Entrepreneurial Business Idea:**

Identifying and evaluating the right opportunity is the first step to setting out as an entrepreneur. Without a business idea, you cannot start a business, and without a business, you cannot be termed an entrepreneur.

Choosing just any small business idea to start up is an entire no-no. You must do a market research to know what people really need. You must also look at your inner talents to figure out if whatever you have chosen to start up is a good fit for you. No matter how lucrative a business opportunity is, if you do not have the capacity to execute it, it would fail. This likely event is an important reason you must ensure the business is something you can do passionately.

2) Raising Seed Funding for Entrepreneurs:

This point of the entrepreneurial process is very important. By the time of identification of the problem that entrepreneurs want to solve in a market and have drawn out a business plan for it, they need to have understood the full financial implications of the project.

At this point, the focus would be to raise seed funding for financing a small business idea. Obtaining funding is one of the hardest things entrepreneurs have to do. People and institutions are not ready to easily part with their money. The entrepreneur stands a better chance of getting a loan or investment from someone, if he is introduced by a similarly successful entrepreneur that they trust. Anything else and it is a really hard case. The best way to raise working capital for any business idea is usually from family and friends. These individuals already trust you and would either invest in or lend you the money not because they believe in your idea, but because they believe in you.

C. Innovative Idea Selection

The "Front End" of innovation precedes the more formalized process of **product development** and consists of high-level processes that are broken down into the following activities: (1) opportunity identification, (2) idea generation, and (3) early concept planning and formulation (Koen, 2002; Khurana et al., 1998). Idea selection is acknowledged as important to the front-end success and contributes to the successful development and launch of a new product or service (Cooper, 1988; Dwyer and Mellor, 1991; Kim and Wilemon, 2002).

As there are more than 60 definitions of innovation. Baregheh et al. (2009: 1334) provided the following definition: "Innovation is the multi-stage process whereby organizations transform ideas into new/improved products, services, or processes in order to advance, compete and differentiate themselves successfully in their marketplace".

It is widely accepted that there are two general types of innovations: incremental and radical:

- **INCREMENTAL INNOVATION** defines improvement within a given frame of solution "doing better than what we already do". Incremental innovation creates less uncertainty and typically does not require a high level of technical expertise to implement (also referred to as sustaining innovation). In other words, incremental innovations are minor changes to existing products or services (Rodgers, 2010; Ritala and Hermelinna-Laukkanen, 2013);
- **RADICAL INNOVATION** consists of a larger change or doing what we did not do before. (Norman and Verganti, 2013). Academics have used many terms such as discontinuous, emerging technology, and disruptive innovation to further describe radical innovation (Robbins and O'Gorman, 2015). Radical innovation creates a high degree of uncertainty and represents a new paradigm for carrying out some tasks. Radical innovation requires a departure from existing capabilities in the firm resulting in new products and services (Rodgers, 2010; Ritala and Hermelinna-Laukkanen, 2013).

The innovation type is connected to the **INNOVATION ALIGNMENT** /CORPORATE SYNERGY/ at existing business. The main findings are that ideas that align with existing organization structure and/or operations have an increased likelihood of approval. More than 67% of people addressed the issue of alignment with the existing organization structure and existing operations. There is inherently a built-in source of friction and tension when a new innovation is not perceived as fitting what already exists. Organizational ambidexterity is a

theory related to innovation that addresses the two disparate activities of exploiting the existing operations machinery while simultaneously exploring new opportunities through innovation (Andriopoulos, C., and Lewis, 2009). This theme surfaced in responses from participants including 2 different schools of thought. One school of thought believes involving existing operations and existing organization structure early in the innovation process is beneficial.

The relevance of an idea will depend on the set of evaluation criteria applied, but the criteria do not always have the same importance. The level of importance (weight) of each criterion varies according to the field and the objective of the creative process. For example, in the case of a technically oriented problem, ideas that respond to problem specifications are qualified as good. In the case of a product design problem, it is a bit different, as an idea can be considered to be good, even if it does not respond to the specifications of the problem (Bonnardel, 2006). More precisely, the weight of the criteria applied to evaluate the ideas may evolve according to the field. For example, in the context of furniture or website creation, originality is more valuable (i.e., 70% originality, 30% adaptability) whereas in an industrial context adaptability is more appreciated (i.e., 30% originality, 70% adaptability) (Bonnardel, 2006). All this formalisation is justified by the fact that the 'evaluation system' is not directly adapted to the particularity of a situation and a context, it has to be designed and adapted (Micaëlli and Fougères, 2007).

Recent literature shows simplified categories for evaluation criteria for innovation idea check out. For example, Dean, Henders, Rogers and Santanen (2006) divide the criteria into the four categories novelty, workability respectively feasibility, relevance and specificity. Kudrowitz and Wallace (2012) also suggest using four criteria but slightly different ones. They use novel respectively **creative**, **useful**, **clear** and product-worthy which means **feasible** and marketable.

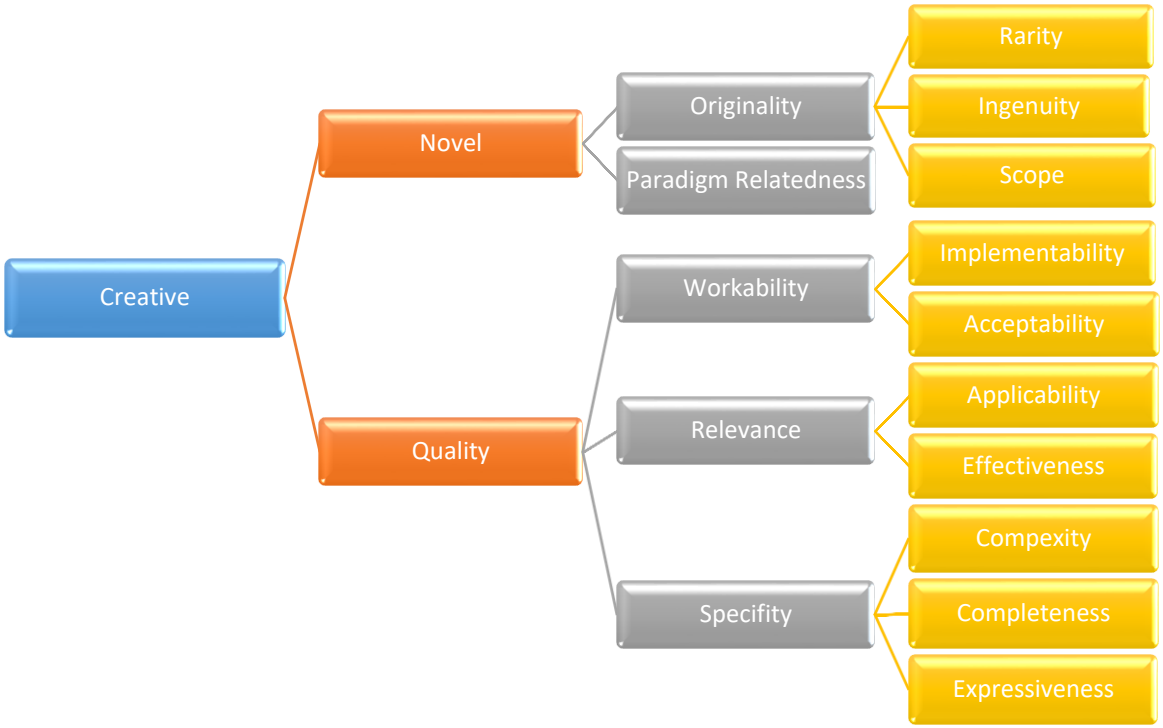
All these idea assessment methods, idea filtering and clustering techniques require criteria. Based on the definition of the creativity as something new and adapted, several criteria have been reviewed to evaluate the creative potential of a concept or an idea. These criteria can be represented through a tree (Figure 3) inspired from a classification (Dean et al. 2006) and slightly modified in the work of Paul-Armand Verhaegen and his colleagues (Verhaegen et al., 2013).

The innovative ideas foundation is based on the very first 2 stages of entrepreneurial business model for Textile and apparel industry:

- Development innovative resources and materials;
- Fashion design in apparel and textile production.

Resources are the main inputs that a company uses to develop its value proposition. They are usually based on a combination of tangible and intangible resources. These assets support the creation of the end product and deal with the operational end of the business spectrum. They highlight the type of materials needed, the equipment required and the type of knowledge held by the staff employed.

In the entrepreneurial business model, the focus is given on companies applying resource management: 1) sourcing the right material 2) acquiring new knowledge to process reclaimed material.



Source: *Verhaegen et al., 2013*

Figure 4. Entrepreneurial idea check fiche

Knowledge and skills in finding the right suppliers of materials are essential.

Design strategies are multiple and encompass various interventions throughout the life cycles of a product/service. Strategies such as design for environment, design for modularity, design for recycling (design for material recovery), design for reuse, design for reliability, design for maintainability, and design for end-of-life allow companies to increase the sustainability of the apparel products to limit their impact on the environment in the various life-cycle phases. For example, garments can be designed to be worn in more than one way –or have detachable parts so that the design can be simplified or worn on less formal occasions.

D. Innovative Idea Seed Funding

Innovation Funds are the first place entrepreneurs go for funding because their money is geared toward their needs. Most funding for technology development in the phase between invention and innovation comes from individual private equity "angel" investors, corporations, and the federal government — not venture capitalists.

Entrepreneurs report a dearth of sources of funding for technology projects that no longer count as basic research but are not yet far enough along to form the basis for a business plan—a

scarcity innovation gap. At the same time, venture capital companies and other investors are sitting on record volumes of resources not yet invested. In 2002, several premier venture capital firms have taken the unusual step of prematurely returning money to investors to reduce the size of particularly large funds.

Up to a decade is required for the transition from invention to innovation. Given technical and market uncertainties, venture capitalists, angels, and bankers prefer to wait to see the business case for a new technology rather than funding speculation. The technical content of the business proposal must be sufficiently well established to provide reliable estimates of product cost, performance, and reliability in the context of an identified market that can be entered in a reasonable length of time. It is the funding of this technical bridge—from invention to innovation—that is the focus of this study and is the basis for the notion of an innovation gap. Do government agencies that fund R&D provide the support required to bridge this gap? As noted above, most such agencies fund broad-based basic research aimed at increasing the stock of publicly available knowledge. Thus, the technology entrepreneur who finds it difficult to obtain early-stage funding from venture capital firms may also find it difficult to obtain funding from federal agencies to support the resolution of technical issues required to define and justify a business case:

- **Angel Investors**. We found that angel investors provide the most significant source of early-stage technology development funding for individual technology entrepreneurs and small technology start-ups. Since angel investors make the vast majority of their investments close to home, early-stage technology development activities, particularly those of smaller firms, are likely to be concentrated in regions with active communities of tech-savvy angels;
- **State Government Funds**. State governments, while providing a relatively small portion of total early-stage technology development funding, play a critical role in establishing regional environments that help bridge the gap from invention to innovation. State governments facilitate university-industry partnerships, leverage federal academic research funds by providing both general and targeted grants, build a technically educated workforce through support of public colleges and universities, and ease regulatory burdens to create a more fertile ground for technology start-ups. While Route 128 and Silicon Valley arose with little local- or state-level political support (in part because they had developed the needed networks, stimulated by defence funding, in the 1950s), several states have created many of the environmental features needed for successful innovation. Research Triangle Park in North Carolina, for example, was conceived and initiated by Governor Luther Hodges.

There are then many ways of using money to achieve these goals. In Table 2, we show some of the financial tools that can be used. These include grants, loans and equity, challenge prizes and social impact bonds, matched crowdfunding to procurement, and often they can be used in combination.

Table 2 Landscape of funding tools Entrepreneurial stages

FUNDING TOOL	DESCRIPTION	ADVANTAGES	CHALLENGES
Grants	Gift of money, usually linked to commitments on activities, outputs or outcomes.	Simple, established.	How intensively to manage, can drive dependency. No return to funder.
Grants for R&D funding	Stage-gate funding with payments released as product developed/evidence demonstrated.	Suitable for high risk/reward projects.	Requires greater management. Staging can limit project flexibility.
Grants/equity in accelerators in stage-gate	Grants plus small equity shares for new companies, often linked to non-financial help.	Higher success rate for start-ups.	Intensive input needed to achieve success.
Grants convertible to loans, or grants with royalties	Grants with conditions that make them turn into loans once milestones are met, e.g., on revenues.	Recycles money, drives good behaviours re: financial sustainability.	Requires longer-term engagement to check on revenues and repayment schedule. Modelling of repayment will often be overly optimistic. Can be gamed if repayment triggers are not set right. Tax/accounting treatment not well established.
Grants convertible to equity	Similarly, grants which turn into rights to equity once revenue or other milestones are met.	Recycles money, share of high value projects.	Managing investment, follow-on funding, getting the conversion triggers right. Only feasible if recipients established with shares. Tax/accounting treatment and legal enforceability not well established.
Match crowdfunding	Committing money on condition that matched funding is raised through crowdfunding platforms.	Encourages mobilization of public money and commitment. Engages wider audience of backers.	Skews to high income audiences; sums still quite small.
Loans	Money lent to be repaid with interest over agreed timescale.	Recycles money. Straightforward offer to recipients. Easy to value cost and likely return.	Managing loan book, risk assessment and security.

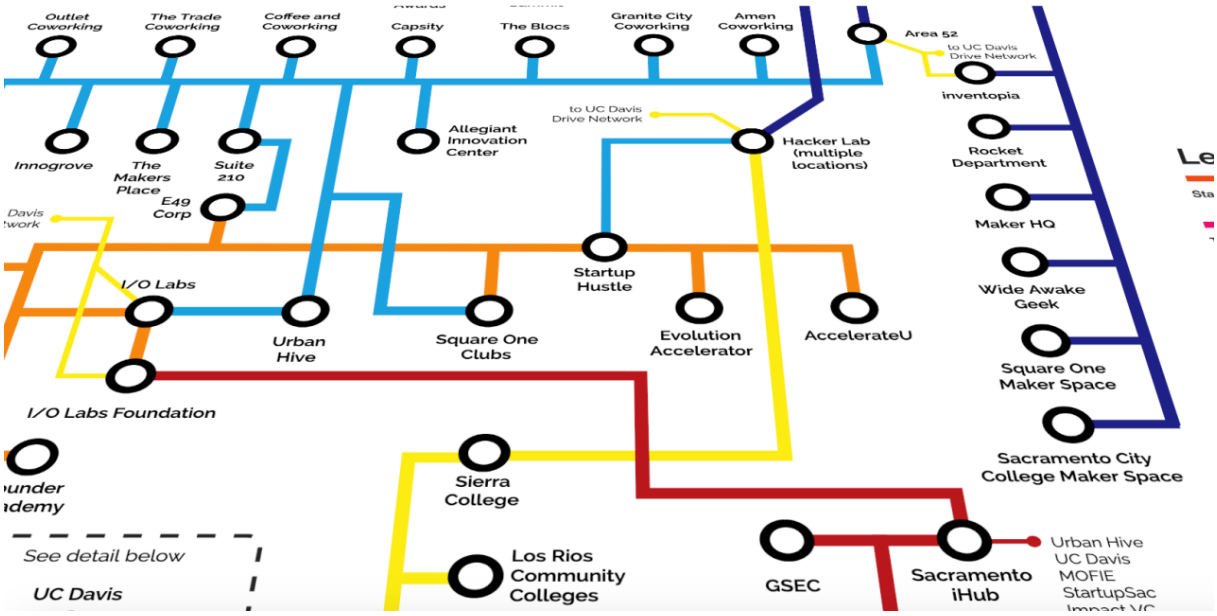
FUNDING TOOL	DESCRIPTION	ADVANTAGES	CHALLENGES
Project-specific loans	Loans linked to specific projects, e.g., in technology, repaid only if the projects succeed.	Recycles money. Straightforward offer, attractive to recipient as no repayment if project fails.	Less secure than loans secured against the firm as a whole (see above). Need to monitor project success to see if loan needs to be repaid (this can be gamed).
Convertible loans	Loans offering rights to convert into equity.	Gives lender chance to participate in upside in case of radical success, while still promising repayment in base case.	Can put off future equity investors as carried on recipient's balance sheet. Funder needs to manage conversion process.
Quasi-equity	Loans offering revenue participation rights (e.g., shares of revenue or profit over given levels).	Encourages business growth, recycles more money from successes.	General challenges of oversight and monitoring.
Impact Bonds (social, Development, Etc.)	Funding raised from philanthropy or capital markets with commitment of payments linked to outcomes.	Shifts risk from government; encourages focus on evidence and outcomes; can bring in new skills.	Relatively few fields with suitable conditions; still young model in experimental phase.
Venture equity investment (and impact venture investment)	Investment in equity in early-stage companies, usually with aim of significant growth in value and linked to active involvement in management, strategy, etc. Impact investment also aims for social impact.	Funder can participate in upside. Funder gains (some) control in firm. Allows rigorous linking of investment and outcomes (e.g., using standards of evidence).	Intensive management needed for realising value and securing following funding. If funder is charity, link to objects and public benefit must be monitored. Difficult to exit. Average venture capital returns very low.
Intermediary funding	Funding directed through intermediaries (e.g., on Big Society Capital model) which then invest loans, equity, etc., in firms or social enterprises. Usually, investors represented on investment committee.	Can increase funding flows (e.g., with co-mingled funds); creates more specialist capacity and some healthy competition. When working well, interest from loans covers management costs.	Sometimes challenges raising matched funds; achieving sufficient scale; and handling timescales of investments and returns.

FUNDING TOOL	DESCRIPTION	ADVANTAGES	CHALLENGES
Challenge prizes	Commitments of funding tied to proof of ability to solve a novel problem.	Good for where market incumbents have little incentive to innovate. Raises awareness and attracts new entrants. Favours technological/product-based innovation.	Challenge of setting the right goal requires expertise and is difficult to change once set. Success needs to be well-defined. Requires firms to spend money ahead of government funding.
Revenue-based funding models	Releasing grants or loans in response to reaching revenue targets.	Aims to encourage trading and entrepreneurship, as opposed to grant dependence. Used in development, technology, self-employment and other fields.	Revenue results achieved can have many causes, therefore may provide capital where it's not needed; conversely can push recipients to maximise short-term revenue rather than long-term business building.
Golden share	Equity finance linked to a special share which cannot be diluted or offers special voting rights.	Opportunity to participate in upside without follow-on investment. Gives funder control over firm.	Represents a significant concession for organisation receiving funding. May deter future equity investors.
Services contract to support innovations	Procurement of services from small firms, charities or social enterprises as a way of helping them grow or innovate (e.g., SBIR).	Uses procurement process to support small innovative entities.	Reliance on relatively untried service provider.

2. Entrepreneurial Clustering

A. Definition

Entrepreneurial clustering is the process of development and proposing a **ROADMAP** to enforce entrepreneurship in different TCI sectors. The roadmap sets the needed support for development and growth of new start-up businesses in the textile and clothing industry. The roadmap reveals the "stops" of the entrepreneurial idea from the very beginning to the growth of the TCI business. For example, the TCI entrepreneurial Academy / education could be the common stop / crossroad for each different textile cluster. It is based on the proposed in Figure 2 **Environmental set** of the Model of Entrepreneurial process and includes the innovative idea seed funding (Figure 5).



Source: *Bennett Jeff (Oct 8, 2019) How to Get Started Mapping Your Entrepreneurial Ecosystem, [How to Get Started Mapping Your Entrepreneurial Ecosystem | Ecosystem Builder Hub]*

Figure 5. Entrepreneurial Roadmap Model

B. Main STOPs on the TCI Entrepreneurial Roadmap

The importance of textile and apparel SMEs in Europe and the need to facilitate their establishment and growth could be presented by the next example (Source: HomeNet Newsletter, 1995 in D McCormick, Hubert Schmitz· (2001), Manual for Value Chain Research on Homeworkers, Wiego Manual end Nov01.PDF)

- *The island of Madeira is an autonomous region of Portugal, famous for its fine embroidery. Embroidery, which has been an industry in Madeira since the 1850s, has always depended on the work of homeworkers. Factory workers cut the cloth, transfer the designs for embroidery onto the cloth, and prepare the materials before the work is sent out to homeworkers. The homeworkers embroider the articles by hand, following the prepared designs. The work is then brought back to the factories where it is recorded, washed, and ironed. Factory workers also finish and pack the garments for shipping.*

According to the importance of textile SMEs for EU economy, there are some important stops of the entrepreneurial roadmap.

NEW MATERIAL RESEARCH CENTRES

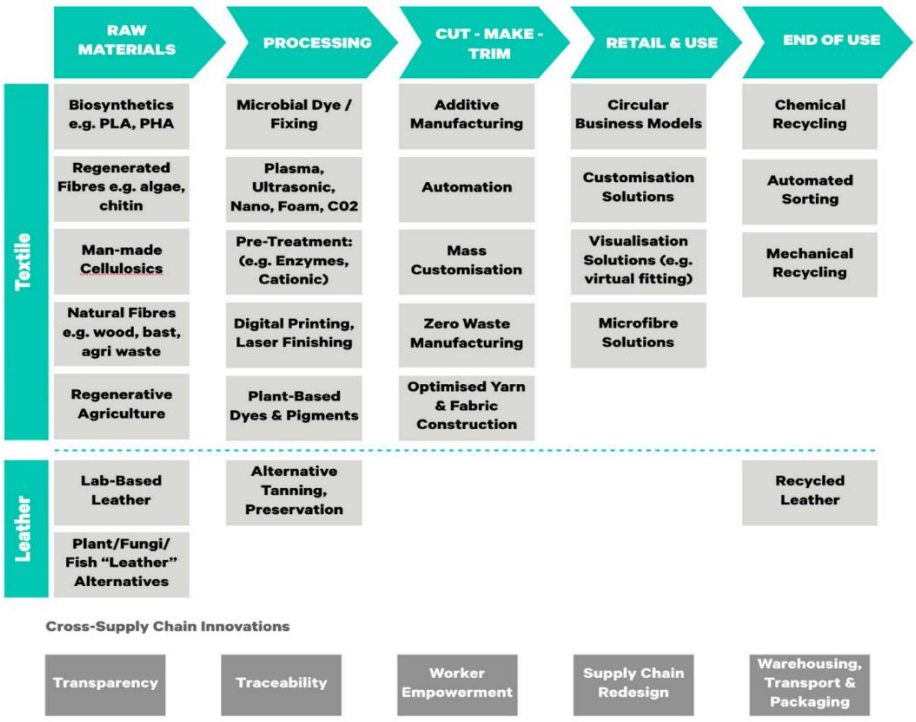
As there is reported, due to an intense competition from low-wage countries, the European textile industry is under a lot of pressure for product innovation. As many of the firms in the textile and clothing industry are SMEs, they are mostly outsourcing research and development and overall TCI innovation is often fragmented. Nevertheless, the fashion SMEs need innovation to fight against:

- Customisation and consumer co-production: for example, *ADIDAS* allows the customer to personalise a range of design elements for sports shoes;
- Smart Textiles and Product Innovation: Success may be contingent upon effective collaboration (e.g., with other sectors, universities, etc.);
- Digital manufacturing technologies: Textile organisations could support developments in the area of digital manufacturing by highlighting opportunities for SMEs and improving their capacity to develop strategies.

The contemporary new material research in TCI is given in Figure 6.

Summarizing the main textile organizations that support textile and apparel innovations are following:

- University Textile Research Centres (TRC): independent research centres working in the field of textiles and apparel;
- (Textiles) Research Institutes: applied and application-oriented research in the field of special textiles, especially smart textiles. Based on the conventional textile technology as well as on flexible materials, the institute is continuously developing high-tech textiles in order to create new materials;
- Journals of the Textile industry: These journals publish impactful papers that shapes the discipline, publication studies on clothing, textiles, and related topics across the discipline;
- Textile and apparel associations: focuses on effective textile and apparel research, innovation and skills development, sustainable textile and apparel supply chains.



Source: *Fashion for Good, 2019:6*

Figure 6. New material research in textile and apparel

he main results of the research opportunities are:

- Applied research from molecules to products;
- R & D service provider;
- Delivering knowledge and technology to industry;
- Teaching and practical training.

ENTREPRENEURIAL LEARNING IN APPAREL AND TEXTILE

Fashion and apparel design entrepreneurial education needs to be planned in relation to the education of the enterprise, for the enterprise and through the enterprise.

Entrepreneurial education **of** the enterprise: Fashion and apparel design is a specialized sector which requires the aspiring entrepreneurs to be introduced to the fashion entrepreneurship and fashion entrepreneurial traits such as:

- Ability to develop a style that is distinctive, consistent and new;
- Ability to manage the process of communication on which fashion depends;
- Ability to manage strategic and marketing issues.

Entrepreneurial education **for** the enterprise: This includes imparting knowledge and skills required to start and grow the enterprise. It includes entrepreneurship education through a program of action learning that deals with real-world problems and adopts many of the entrepreneurship education principles (Kirby, 2002).

Entrepreneurial education **through** the enterprise: This includes education using the new venture creation process. This would help the students acquire the business understanding and skills required to run a particular enterprise.

The entrepreneurial traits required for the enterprise such as creativity, innovation, identifying opportunities in a climate of change, practice of entrepreneurship and characteristics of entrepreneurs needs to be a part of the curriculum. Spotting innovative opportunities and making them happen at the calculative risk should be the focus. This would prepare the students for the enterprise.

START-UP CENTRES

The development of TCI Entrepreneurial business needs support from the other related industries. The main textile and apparel new-starting companies follow the main changes of the environment: digitalization. Thus, some main challenges for supporting TCI start-ups are found as follows (Cooper DW, 2010):

- Virtual Supply chains: it flexible on market chain of independent suppliers that has control ability of chain nodes integration. The virtual chains are structured mainly according to core fashion retailers. The main effect is prize-off by establishing virtual supply chains. The modern information systems as: ERP /Enterprise Resource Planning/ and APS /Advance Planning and Scheduling/ systems are main reason for establishment those virtual chains. Furthermore, the new software decisions for management the

virtual supply chains, incl. cloud technologies, force-up the establishment new technology-based TCI enterprises as a part of fast changing virtual chains;

- Green textile and apparel: the TCI technology was stable for a long period, for example, looms used for production in the late 1970s were mainly produced in the 1900s. Then, the textile and apparel technology became to develop to answer the need to faster operation process of fibre cutting, sewing thermoplastic yarn usage in knitting etc. Nowadays, the expansion of fibre and textile production that reduces the pollution and climate change is put on top. So, modern automated textile plants and large amount of textile finishing consumption as well as apparel production, should cover not just the increasing demand but also the increasing of the global green effect. Thus, TCI start-ups have to follow the greener line of textile and apparel production.

Summarizing, 3 main role-players could help development of the textile start-up establishment:

- Apparel Incubation Centers;
- Textile Start-ups platforms (angel.co/textiles);
- Start-up Textile Grand Challenge Programmes support;

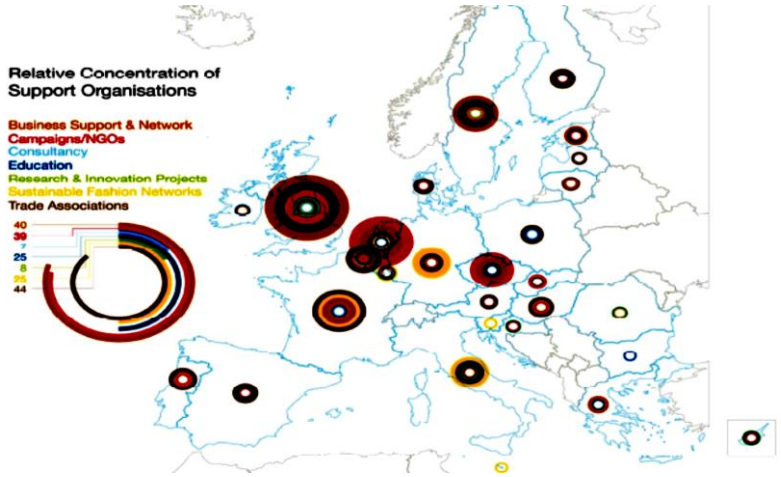
START-UP TEXTILE FINANCING

Investors must advance their industry expertise and join forces with brands, supply chain partners, and innovators to develop investment propositions that match their risk-return profiles. In addition, new sources and vehicles of investment—such as blended finance combining public capital with private or philanthropic capital—need to enter the space.

- Long-term bank loan (Debt Financing);
- Selling share (Equity Financing); in case of a public limited company;
- Or you can choose both debt financing and equity financing (the ratio of debt to equity will depend on the financial strength and the business risk of that company).

C. TCI Entrepreneurial Roadmap

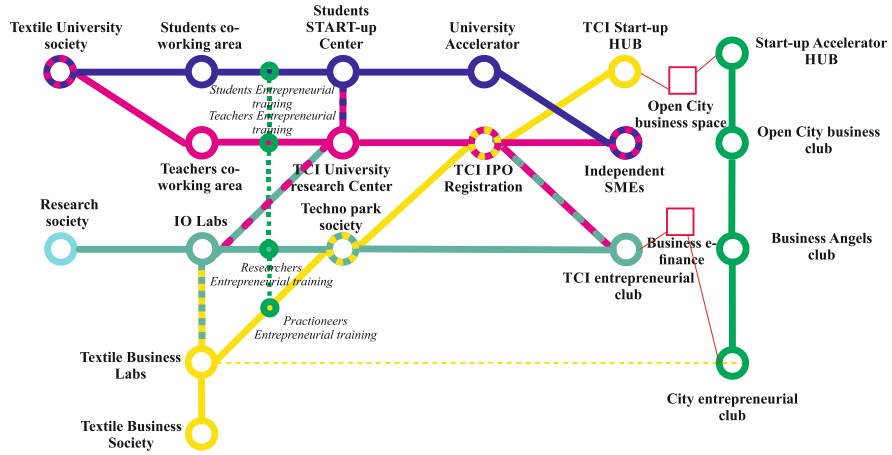
In summary, some of the main supporting TCI start-up institutions in EU are presented on Figure 7.



Source: *EU, 2019:31*

Figure 7. Map on supporting industries for TCI in EU

Finally, the TCI entrepreneurial roadmap could be displayed as follows (Figure 8).



Source: *own contribution*

Figure 8. TCI Entrepreneurial Roadmap

ENTREPRENEURIAL PROCESS IN Textile and Clothing Industry

EUROPEAN PRACTICES RESEARCH

GAP Analysis

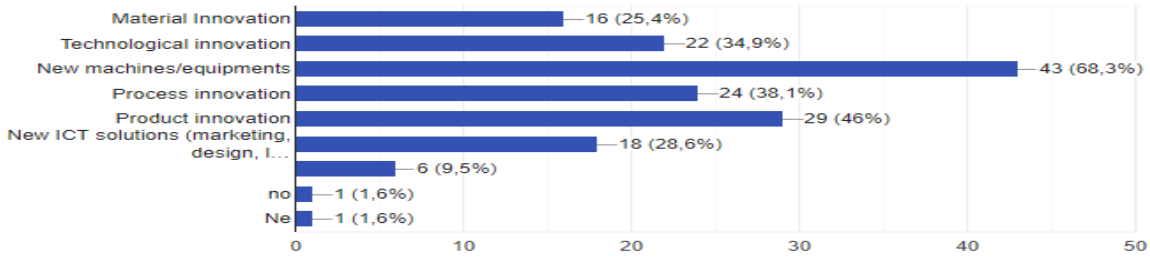
Some preliminary issues concerning entrepreneurial potential of the EU fashion companies have been found and set in GAP Analysis Report (ICT-TEX, 2021, WP 4 GAP Analysis Report).

These preliminary expectations that could explain the state of ENTREPRENEURIAL PROCESS IN TEXTILE AND CLOTHING INDUSTRY can be repeated.

The quality and innovation propensity of the T&C sector is confirmed by the fact that most of the companies that participated in the questionnaire affirmed to have a special research and innovation department with a percentage that stands at 39.7%, while another 19% stated to be in the process of creating one. Anyway, the percentage of the companies that do have not a dedicated department for research and innovation, at the moment is still the majority with 41,3% (plus that19% which foreseen to have one in the near future) of the total interviewed, even if 12,7% of this portion recognize the importance of research and innovation declaring to need a R&D department, while no one replied they did not need it.

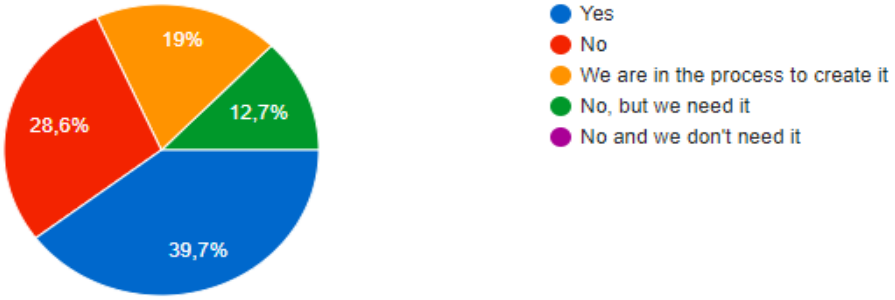
As regards to the type of innovations most adopted by companies in the last 5 years, the most occurring is certainly the one concerning new equipment and machines with a percentage of 68.3%. Immediately after, with a very remarkable percentage of 46%, we find product innovations. While innovations in production processes are 3rd in importance with a percentage of 38.1% and then follow the technological innovations with a percentage of 34.9%.

28.6% of the companies replied that the most adopted innovation in the last 5 years are new ICT solutions and 25.4% material innovations. Only 9.5% of companies in the last 5 years have adopted the principles of circular economy and about 3% of companies have not adopted any innovation.



Source: *WP 4 GAP analysis Report, ICT-TEX*

Figure 9. Distribution of entrepreneurial fashion innovation appearance



Source: *WP 4 GAP analysis Report, ICT-TEX*

Figure 10. Distribution of departments dedicated to TCI innovations

Some gaps of entrepreneurial skills in the TCI industry explain a basic need to promote an entrepreneurial mind-set in the companies interviewed. It means to have possess a broad spectrum of entrepreneurial abilities that let individuals achieve their professional objectives in textile companies.

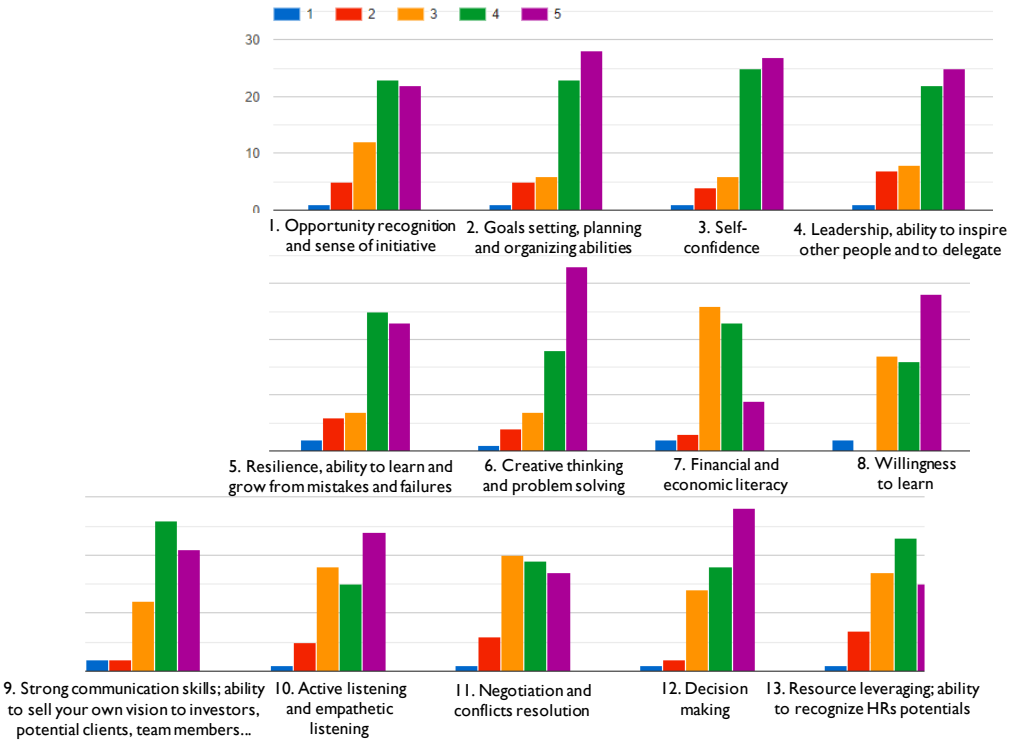
Among the personal skills they are in most need of, we acknowledge: creative thinking and problem solving, self-confidence, goals setting, planning and organizing abilities, decision making, willingness to learn and leadership.

On the other hand, among the skills that need to be improved, we have conflict resolution, ability to recognize other employee potentials, financial and economic literacy.

Table 3 Distribution of GAPs of entrepreneurial skills in fashion industry

Variable	Score					Global score
	1	2	3	4	5	
6. Creative thinking and problem solving	1	4	7	18	33	**267**
3. Self-confidence	1	4	6	25	27	**262**
2. Goals setting, planning and organizing abilities	1	5	6	23	28	**261**
12. Decision making	1	2	14	18	28	**259**
8. Willingness to learn	2	0	17	16	28	**257**
4. Leadership, ability to inspire other people and to delegate	1	7	8	22	25	**252**
9. Strong communication skills; ability to sell your own vision to investors, potential clients, team members...	2	2	12	26	21	**251**
5. Resilience, ability to learn and grow from mistakes and failures	2	6	7	25	23	**250**
1. Opportunity recognition and sense of initiative	1	5	12	23	22	**249**
10. Active listening and empathetic listening	1	5	18	15	24	**245**
11. Negotiation and conflicts resolution	1	6	20	19	17	**234**
13. Resource leveraging; ability to recognize HRs potentials	1	7	17	23	15	**233**
7. Financial and economic literacy	2	3	26	23	9	**223**

Source: *WP 4 GAP analysis Report, ICT-TEX*



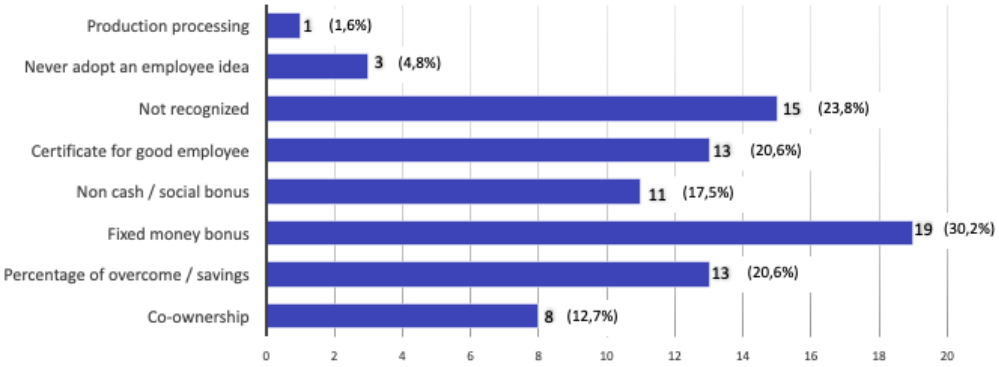
Source: *WP 4 GAP analysis Report, ICT-TEX*

Figure 11. Distribution of GAPs of entrepreneurial skills in fashion industry

The answers obtained show that the majority of the companies, about 66.7%, do not keep a register of the innovative ideas proposed by the employees, however, when employees share their innovative ideas, the ownership usually gives economic incentives, in 20.6% of the cases it can be a percentage of revenues or for another 30.2% a fixed money bonus.

Instead, we also find companies recognizing no-monetary incentives as for example a good employee certificate, used by 20.6% of the respondents and social bonus adopted by 17.5% of the companies interviewed. 12,7% recognize the co-ownership of the possible new venture.

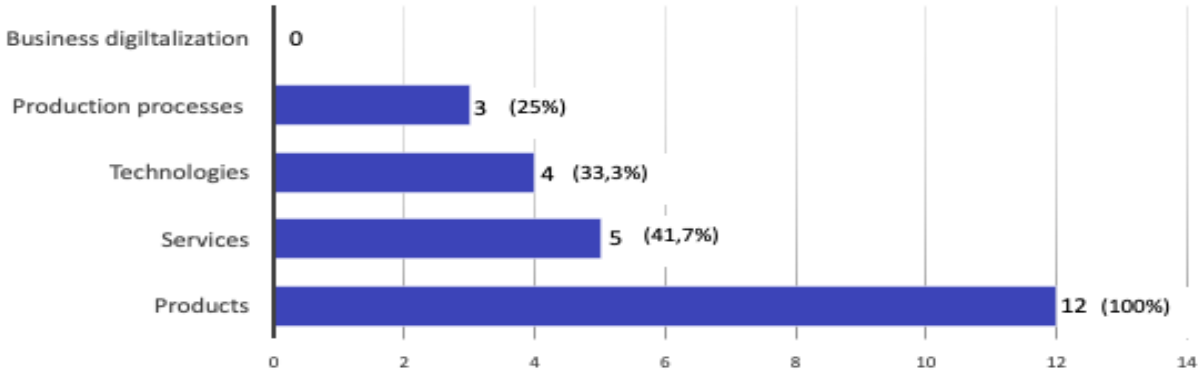
However, it has to be underlined that a considerable percentage of companies (23,8%) does not recognize any benefits.



Source: *WP 4 GAP analysis Report, ICT-TEX*

Figure 12. Distribution of employees' inclusion in innovation process in fashion industry

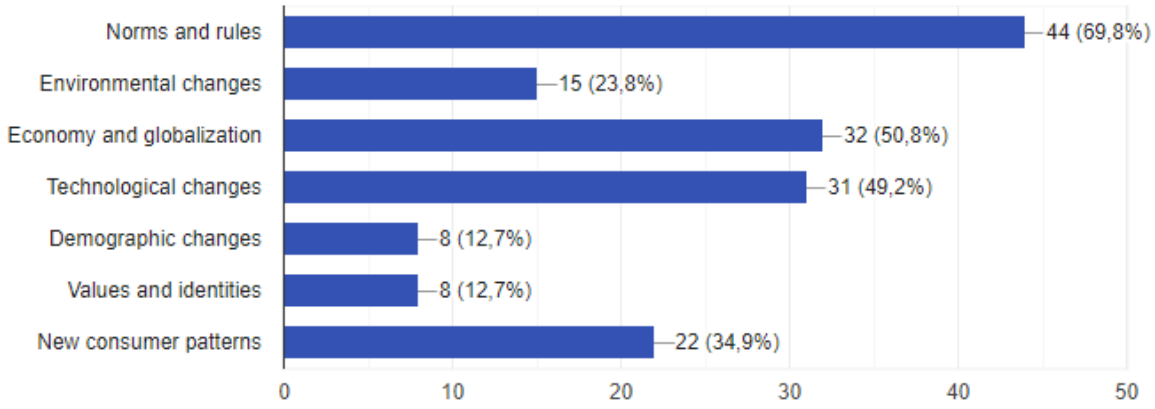
For the ones who responded affirmatively, the peculiarities of the new created enterprises are mainly connected to new products (70,6%). Following we have new services (29,4%), new technologies (23,5%) and innovative production processes (17,6%).



Source: *WP 4 GAP analysis Report, ICT-TEX*

Figure 13. Distribution of type of innovation in the entrepreneurial fashion industry

Regarding the main drivers of changes having a major impact on a given company business model, variations in "norms and rules" are indicated as the factor most affecting the business, with a percentage of 69,8% of the responses collected. "Technological changes", "economic trends and globalization" also register a high percentage of 50%. A remarkable impact is also assigned to "new customer patterns" (34.9%) and "environmental changes" (23.8%). Finally, we find "values and identities" shifts and "demographic changes" with a percentage of only 12,7%.



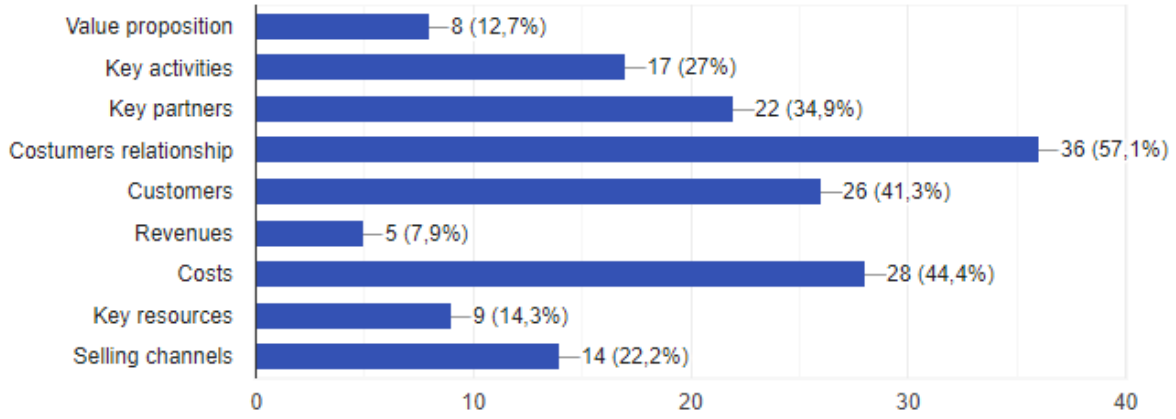
Source: *WP 4 GAP analysis Report, ICT-TEX*

Figure 14. Distribution of factors that push-up fashion business to start an innovation process

To conclude our analysis, we explore the main aspects that the companies innovate the most taking inspiration from the Canvas Business Model elements.

With a high percentage of 57.1% we can see that the customer relationship is certainly the item that the companies interviewed take more into consideration in their innovative initiatives we also find with good percentages: customers segmentation (41,4%) cost structure (44,4%) key partners (34,9%) key activities (27%) and selling channels (22,2%).

On the other side the objective of a lower innovation level of the business model element is the composition of the key resources (14,3%), the value propositions (12,7%) and the revenue streams (7,9%).



Source: *WP 4 GAP analysis Report, ICT-TEX*

Figure 15. Distribution of key description of the innovation process in fashion industry

1. TCI ENTREPRENEURIAL QUESTIONNAIRE

According to the literature preview, there are some important questions that explain entrepreneurial focus of the Textile and Clothing Industry (TCI). These questions focus on the product/technology development, technology transfer and investments in new product/technology innovations, and financing instruments for technology transfer of the company.

The preliminary thesis is that:

THE ENTREPRENEURIAL TCI ARE DEVELOPING NEW FASHION PRODUCTS AND/OR TECHNOLOGIES "ANNUALLY" AND/OR PURCHASING THEM ON THE MARKET OF TCI TECHNOLOGY TRANSFER BY USING MAINLY NON-FINANCIAL MARKET INSTRUMENTS.

A questionnaire was prepared to find out the entrepreneurial attitudes of the selected TCI entrepreneurs.

QUESTIONAIRE

I. Entrepreneurial attitude in general

1. How often has an entrepreneurial idea been proposed in your TCI business /generally/?

TYPE OF TCI INNOVATIONS	ANNUALLY	1 - 3 YEARS	3 – 5 YEARS	5 -10 YEARS	more than 10 YEARS	NEVER
New textile and/or clothing design						
New textile fibres or materials						

New textile and/or clothing production instruments/ machinery/ equipment	
New textile and/or clothing production techniques	
New textile and/or clothing production technologies	

2. How would you allocate the distribution of the new innovative idea development in your TCI business /generally/?

CORPORATE SYNERGY	SHARE
New independent company	
New alliance company	
New department inside company within existing company departments	
TOTAL	**100**

3. How would you evaluate the INNOVATIVE POTENTIAL in your TCI business /generally/?

TYPE OF TCI INNOVATIONS	GREAT 5	EXCELLENT 4	GOOD 3	BAD 2	SCARE 1	NA
Originality						
Related to existing business						
Workability						
Applicability						
Specificity						

4. How would you evaluate the SEED FINANCING in your TCI business /generally/?

TYPE OF TCI INNOVATIONS	GREAT 5	EXCELLENT 4	GOOD 3	BAD 2	SCARE 1	NA
Company investments						
Grants						
Crowdfunding						
Loans						
Venture equity investment						

II. Entrepreneurial attitude inside the TCI company

5. How often has an entrepreneurial idea been proposed in your TCI company?

TYPE OF TCI INNOVATIONS	ANNUALLY	1 - 3 YEARS	3 – 5 YEARS	5 -10 YEARS	more than 10 YEARS	NEVER

New textile and/or clothing design	
New textile fibers or materials	
New textile and/or clothing production instruments/ machinery/ equipment	
New textile and/or clothing production techniques	
New textile and/or clothing production technologies.	

6. Have you applied a new innovative idea for development in your TCI company?

CORPORATE SYNERGY	YES/NO
New independent company	
New alliance company	
New department inside company within existing company departments	

If you answer is NO for all rows, please go to question 11

7. How would you evaluate the INNOVATIVE POTENTIAL in your TCI company?

TYPE OF TCI INNOVATIONS	GREAT 5	EXCELLENT 4	GOOD 3	BAD 2	SCARE 1	NA
Originality						
Related to existing business						
Workability						
Applicability						
Specificity						

8. How would you evaluate the SEED FINANCING for your TCI company?

TYPE OF TCI INNOVATIONS	GREAT 5	EXCELLENT 4	GOOD 3	BAD 2	SCARE 1	NA
Company investments						
Grants						
Crowdfunding						
Loans						
Venture equity investment						

9. How much money has your TCI company invested in innovations over the last 3 years?

YEAR	INNOVATION INVESTMENTS (EURO)	NA

2017	
2018	
2019	

III. General characteristics of TCI Entrepreneurs

11. Your TCI company operates in the specialization /TCI business/ ……

12. Your TCI company employs ……employees, incl.

…… innovation employees.

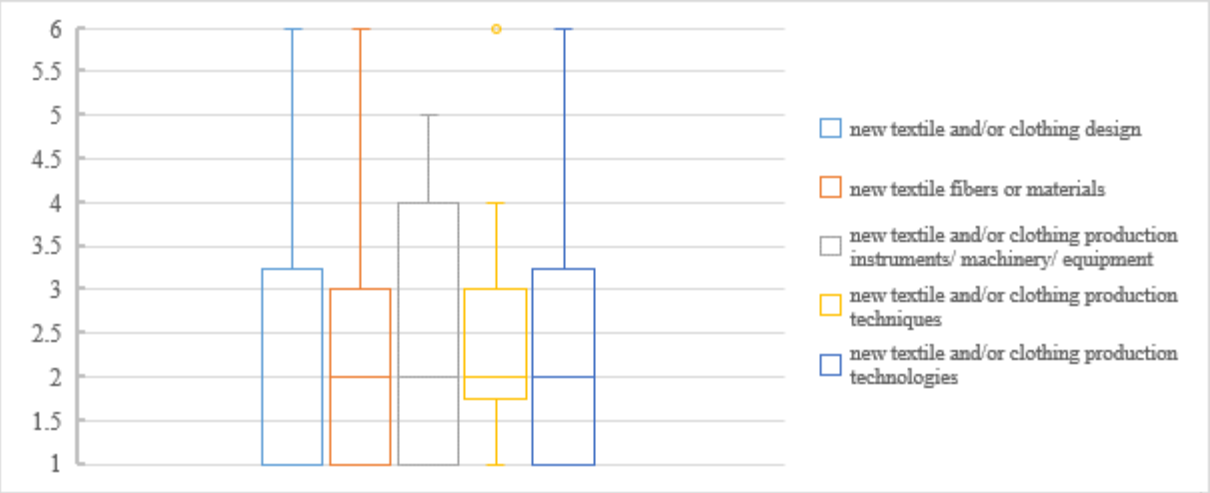
13. Reported Turnover for 2019 in your TCI company is ……

2. TCI ENTREPRENEURIAL RESULTS

The analysis of the 20 TCI entrepreneurs across Europe could be summarized in the next fields:

I. Entrepreneurial attitude in general

1. How often has an entrepreneurial idea been proposed in your TCI business /generally/?

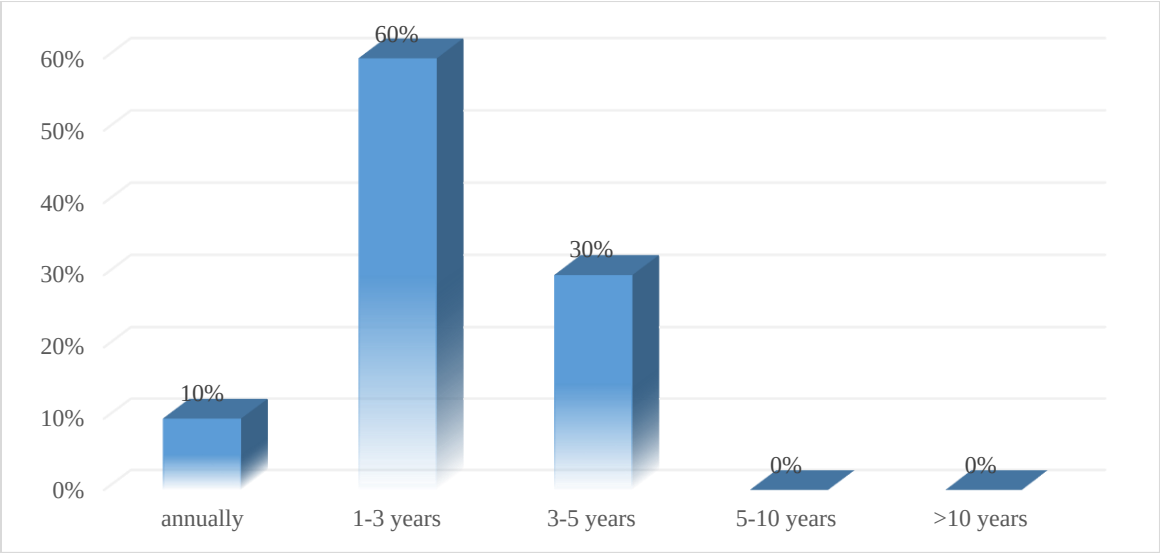


Source: *own contribution*

Figure 16. Sequence of entrepreneurial idea appearance

The figures show that a new fashion design is applied every 1 – 2 years as the new textile/clothing technologies are applied every 2 – 4 years and the other entrepreneurial ideas appeared once for 3 – 5 years.

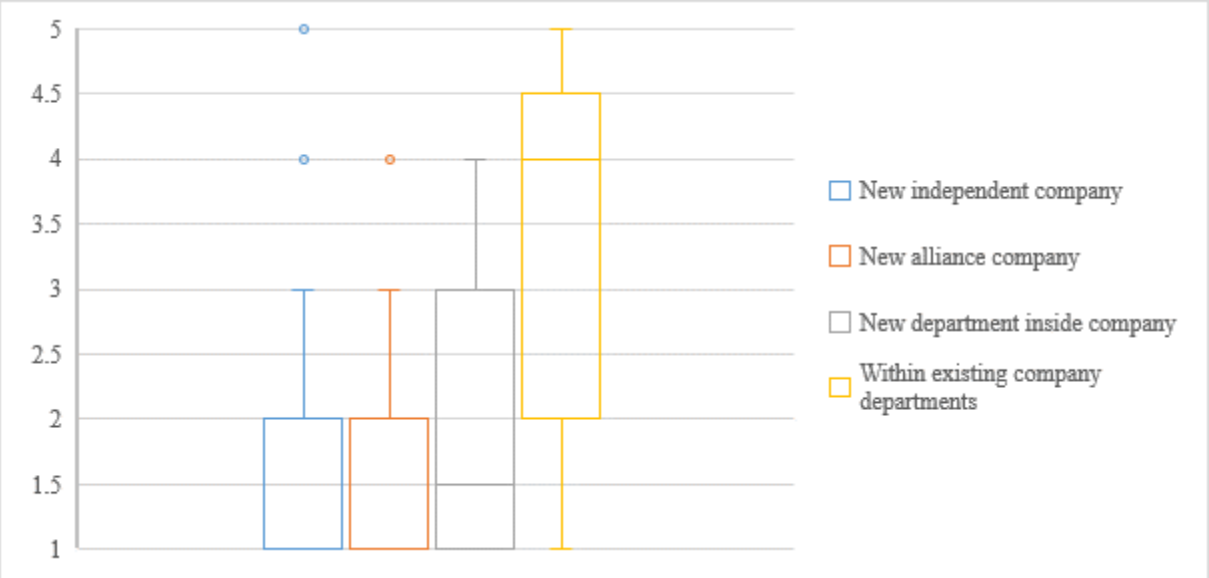
For 10% of the companies, entrepreneurial ideas appear annually, for 60% of them every 1 – 3 years and for 30% - more rarely, e.g., between 3 – 5 years.



Source: *own contribution*

Figure 17. Time distribution of entrepreneurial idea appearance

2. How would you allocate the distribution of the new innovative idea development in your TCI business /generally/?

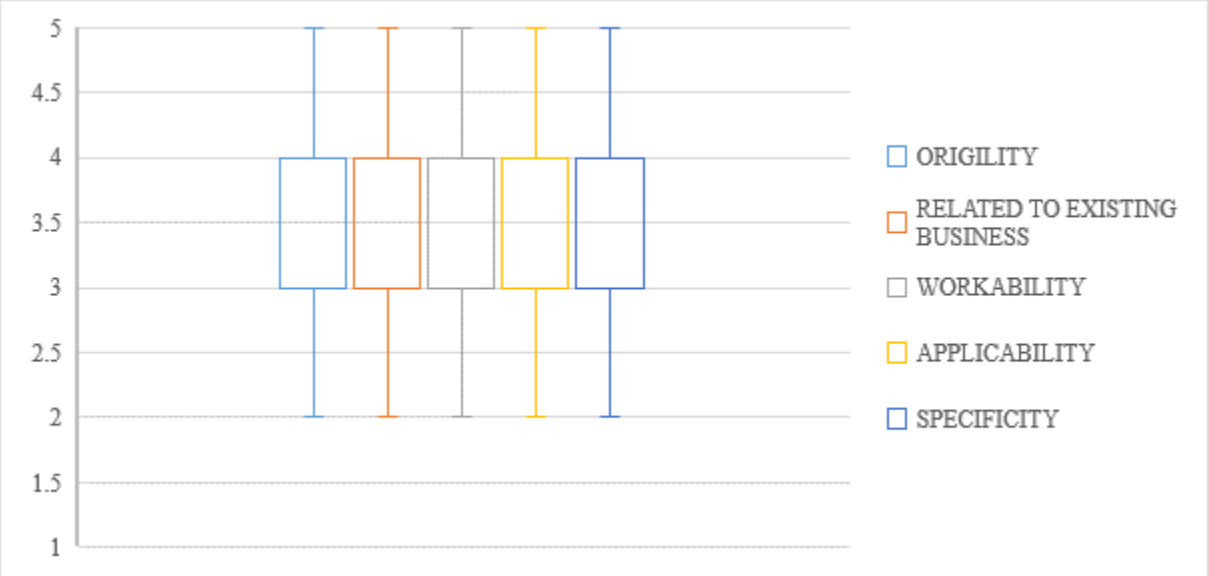


Source: *own contribution*

Figure 18. Sequence of entrepreneurial idea manifestation

The figures show that the internal entrepreneurship is larger than the external one. Most TCI companies declare that more than 60% of innovative ideas have come from existing departments. In comparison, less than 40% of innovative ideas have come from newly established departments of the company and less than 10% of ideas have been developed in alliance or/and independent companies of the fashion industry.

3. How would you evaluate the INNOVATIVE POTENTIAL in your TCI business /generally/?



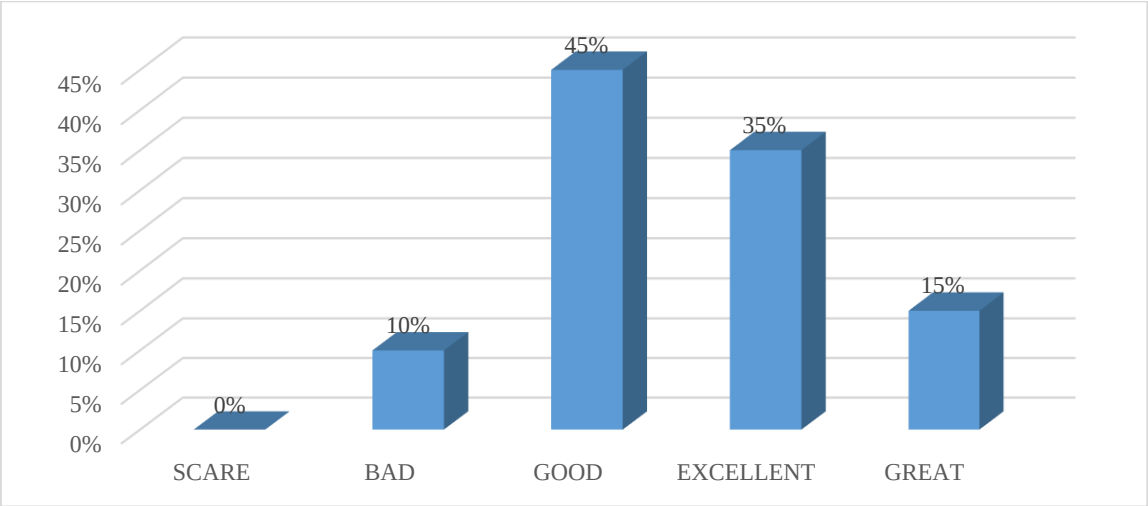
Source: *own contribution*

Figure 19. Sequence of entrepreneurial potential factors' appearance

The figures show that the entrepreneurial potential of the TCI companies in all fields is almost the same: at the middle between good and excellent level. The differences between the elements of the entrepreneurial potential are less than 0.2.

Nevertheless, the success potential of fashion innovations is established mostly by the level of relation to the existing business (3.57 of 5.00) and by the applicability of the idea (3.52 of 5.00). The lower impact factor of entrepreneurial potential is the specificity of innovative idea (3.38 of 5.00).

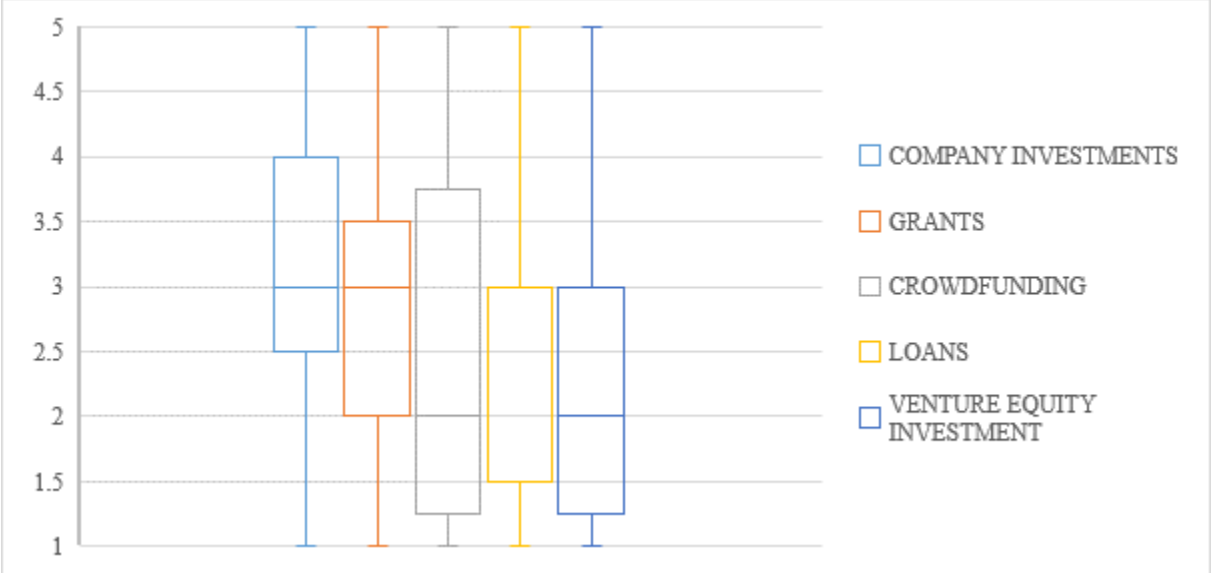
The entrepreneurial potential is not equally distributed across the TCI companies. As the figures show, 15% possess great potential in all fields, 35% - excellent potential, 45% - good potential and 10% - bad potential to innovate successfully their ideas.



Source: *own contribution*

Figure 20. Quality of entrepreneurial potential factors appearance

4. How would you evaluate the SEED FINANCING in your TCI business /generally/?

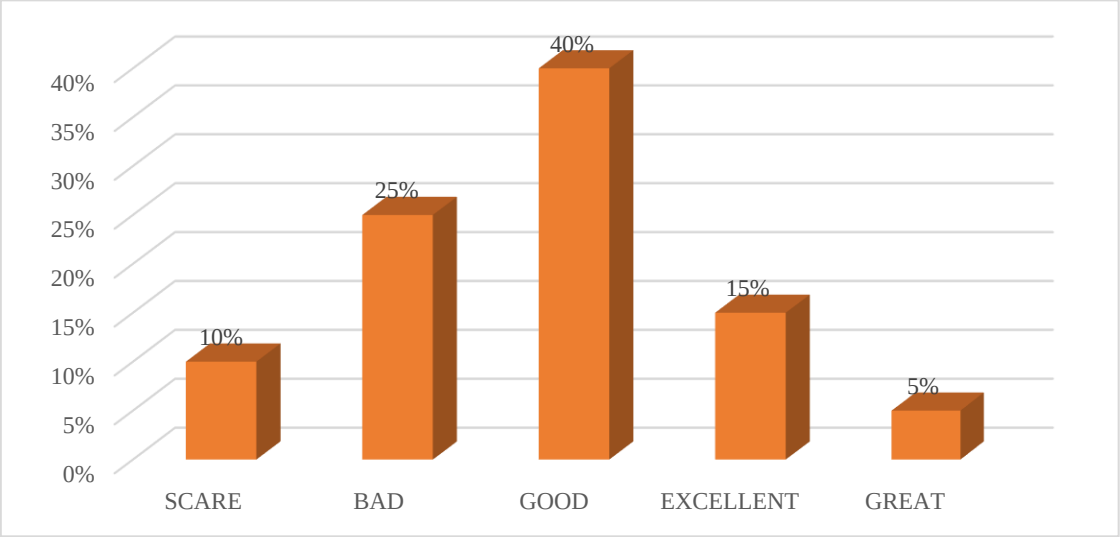


Source: *own contribution*

Figure 21. Sequence of entrepreneurial seed financing manifestation

The innovative fashion ideas are mainly seed financed by own investments. It is typical for innovations that could not be proposed on the financial market. It is a very interesting situation that a lot of fashion innovations are pre-seeded by different EU and national grants. Crowdfunding and venture equity investments are not good evaluated.

Seed financing is also not equally distributed across fashion entrepreneurs. 10% of TCI companies have SCARE access to any of the seed financing instruments, 25% - BAD access, 40% - GOOD access and 20% - EXCELLENT and GREAT access of the whole number of seed financing instruments.

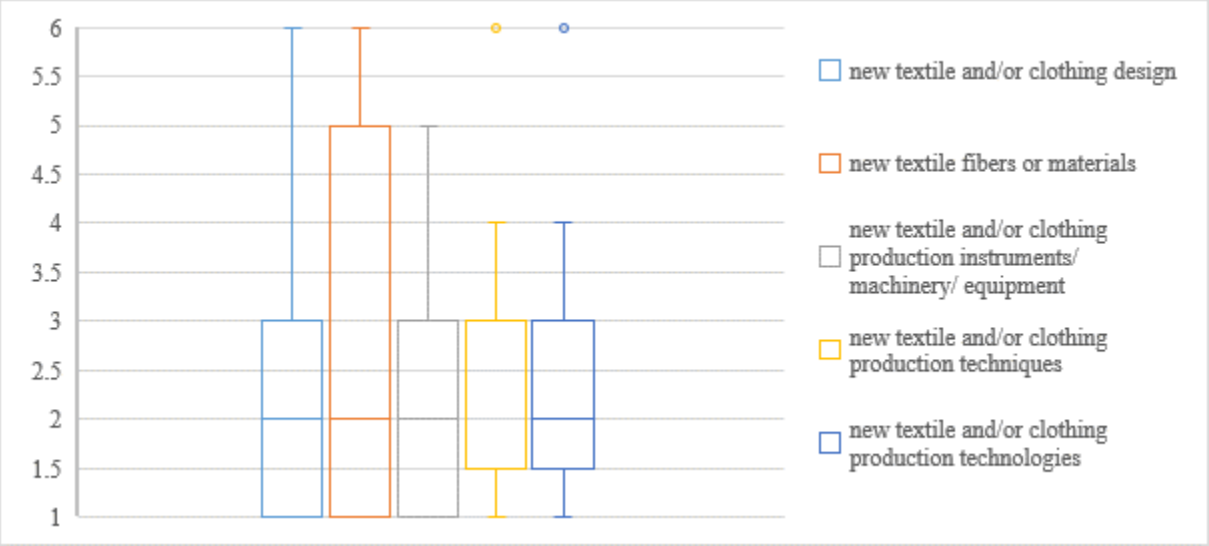


Source: *own contribution*

Figure22. Quality of entrepreneurial seed financing manifestation

II. Entrepreneurial attitude inside the TCI company

5. How often has an entrepreneurial idea been proposed in your TCI company?

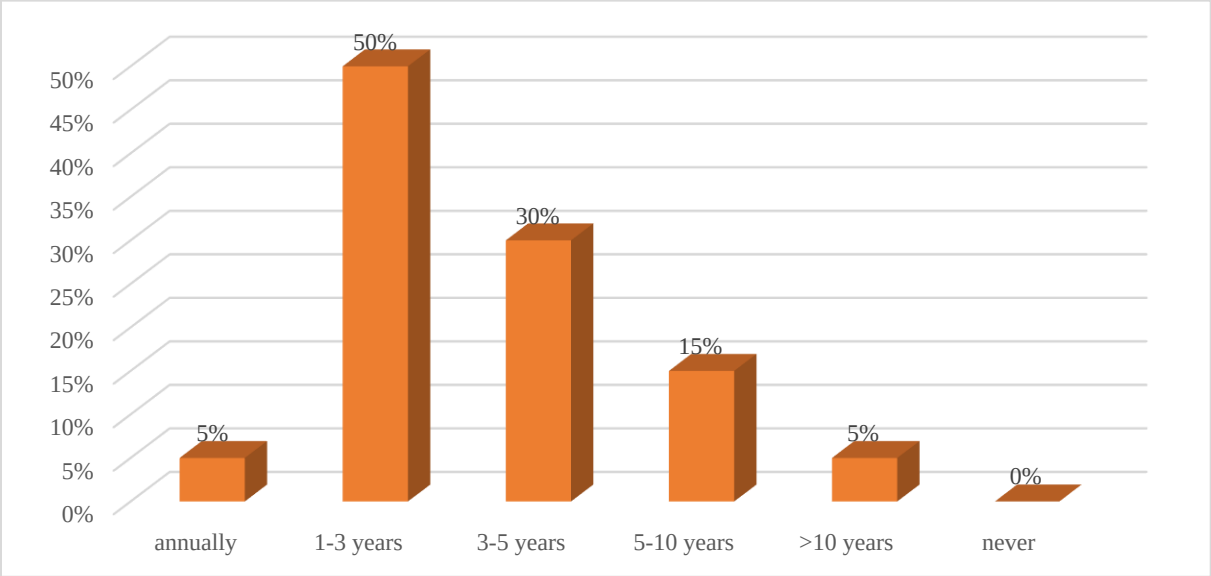


Source: *own contribution*

Figure 23. Sequence of entrepreneurial idea appearance in fashion business

As it was expected the fashion innovation in the established TCI companies does not appeared so frequently. The new textile/clothing design is promoted every 2 – 4 years as the promotion of the textile/clothing instruments are developed and transferred to them. Less rarely, e.g., every 3 – 5 years new textile fibres or materials are promoted.

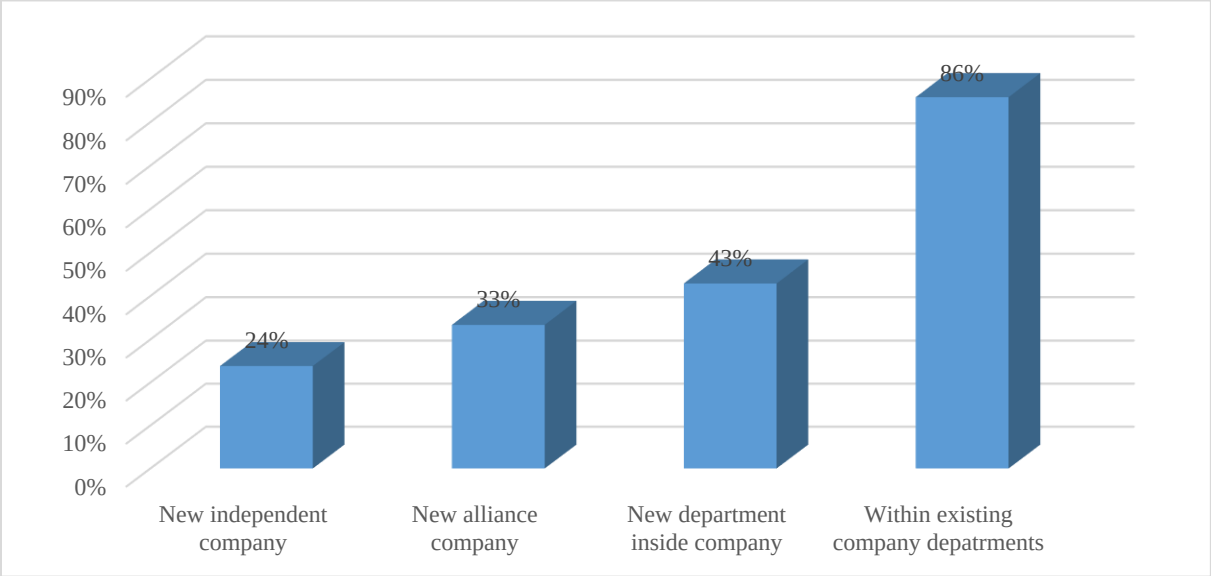
From this point of view, just 5% of the companies innovate annually, 50% - between 1 – 3 years and the rest 45% much more rarely or never.



Source: *own contribution*

Figure 24. Timetable of entrepreneurial idea appearance in fashion business

6. Have you applied a new innovative idea for development in your TCI company?



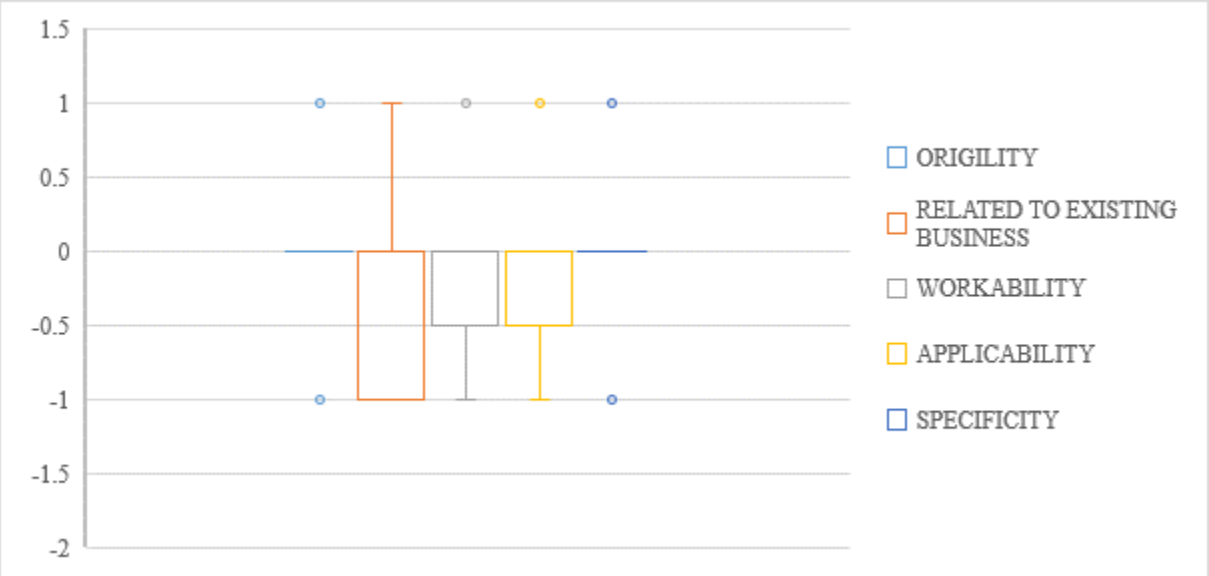
Source: *own contribution*

Figure 25. Sequence of entrepreneurial idea manifestation in fashion business

The figures are good enough as 24% of the fashion innovations have established a TCI start-up and around 40 -45% of innovations were transferred to new alliance companies or outside the company. Nevertheless, 86% of the TCI companies developed their innovations inside the existing company.

From the other perspective, 9% of the established TCI companies have never innovated themselves, the same number of companies – 9 % have established new fashion start-up, 32% have innovated just in their business, and the remaining 50% have used more than 1 way to transfer their innovation outside the existing company.

7. How would you evaluate the INNOVATIVE POTENTIAL in your TCI company?

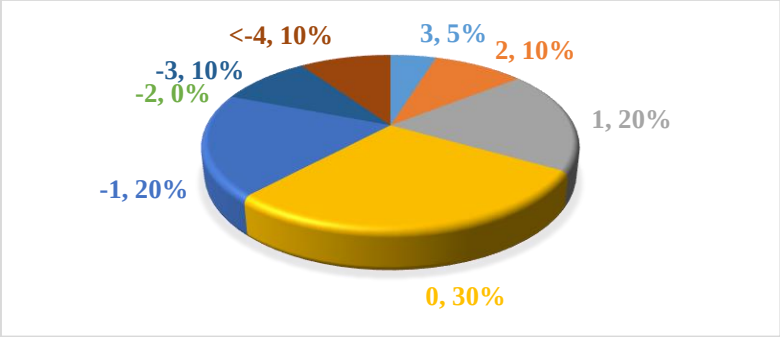


Source: *own contribution*

Figure 26. Sequence of entrepreneurial potential manifestation in fashion business

The TCI companies underestimate their innovation entrepreneurial potential. They give the lower value of their entrepreneurial potential by least 1 point. The biggest lag behind is in the field of workability and applicability as the Originality values are almost the same.

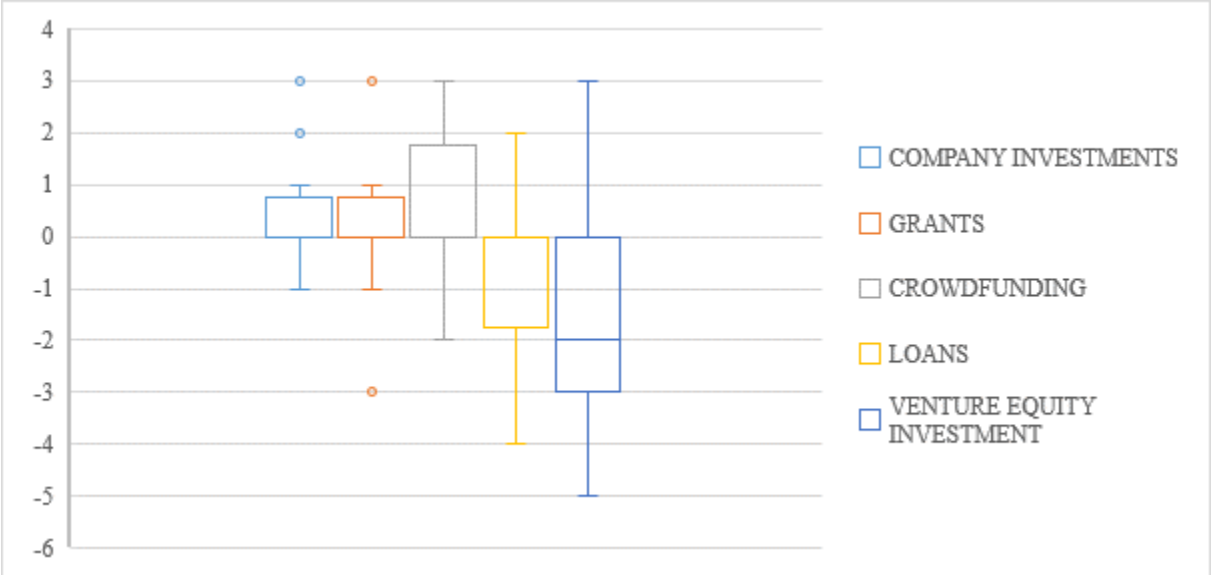
Nevertheless, 25% of the fashion companies evaluate their entrepreneurial potential as greater than the fashion business allows, 30% - the potential is equal and 45% - the potential is less.



Source: *own contribution*

Figure 27. Difference of entrepreneurial idea appearance between TCI environment and fashion business

8. How would you evaluate the SEED FINANCING for your TCI company?

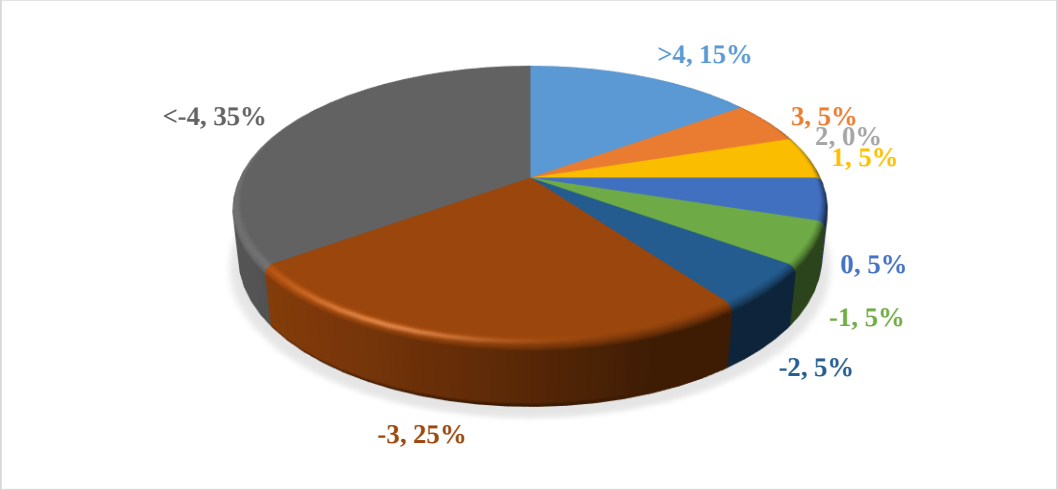


Source: own contribution

Figure 28. Difference of entrepreneurial seed financing manifestation between TCI environment and fashion business

The TCI companies have a different approach on opportunities for their innovation seed financing. They overestimate their opportunities for company investments and EU and national grants as they give a higher value of their entrepreneurial seeding potential by at least 1 point. But they underestimate and define themselves as big losers and lag behind in the field of financial seeding from loans and venture equity funds. Their opportunities for seed financing the fashion innovation from crowdfunding are also underestimated but less than from loans.

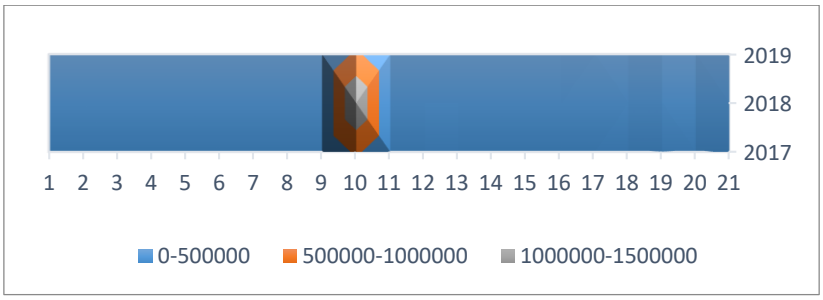
Nevertheless, 25% of the fashion companies evaluate their seed financing as greater than the fashion business allows, 5% - the potential is equal and 70% - the potential is less.



Source: *own contribution*

Figure 29. Difference of entrepreneurial seed financing manifestation between TCI environment and fashion business

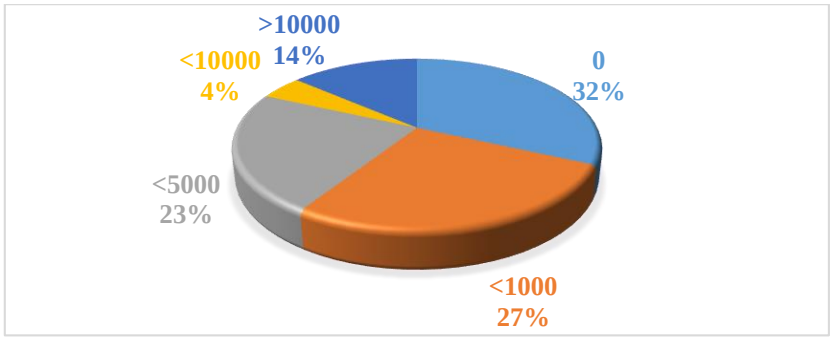
9. How much money has your TCI company invested in innovations over the last 3 years?



Source: *own contribution*

Figure 30. Fashion innovation investments

The difference between different companies is quite big. There are fashion companies (55 %) that invest in innovations, incl. technology transfer, less than 100 thousand Euro annually, and there are textile companies (15%) that invest in innovation, inc. technology transfer purchases, more than 10 million euro annually.

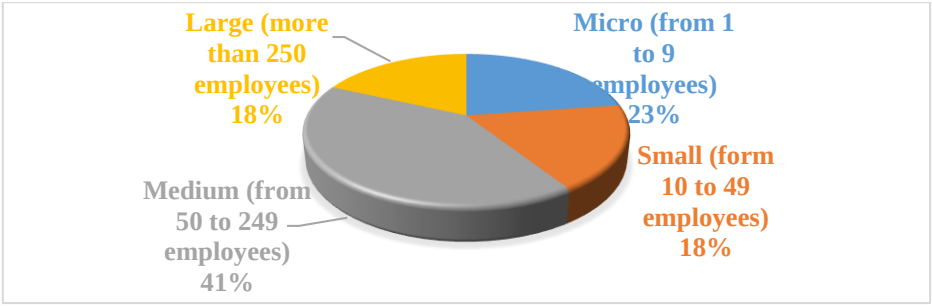


Source: *own contribution*

Figure 31. Fashion innovation investments distribution

III. General characteristics of TCI Entrepreneurs

10. Size of the TCI company



Source: *own contribution*

Figure 32. Fashion companies' distribution

The size of the chosen companies is well distributed, as 41% of fashion companies are small and micro, 41% are medium, in total SMEs are 82%, and 18% of them are large companies.

3. TCI ENTREPRENEURIAL CASE STUDIES

MAPPING AND CLUSTERING ENTREPRENEURIAL SKILLS IN TCI

SUCSESS STORY

Alma dooel is a company that has traditionally worked in the fashion industry. During this global crisis, we have adapted to produce COVID-19 protection gear and have deployed a fully online platform form our services ensuring the continuation of financial and job security for more than 120 workers in our community and company. With our efforts, we were able to give additional work to our more than 20 production partner in our county.

ALMA DOOEL

COMPANY PROFILE

Alma Dooel Kocani is a textile production and trading company, founded by Mr. Zoran Trendov in 1999, who is still the owner and the manager of the company. On a surface land area of 10.000m2, we cooperate in own facility of 2.500m2 workspace. In our own unit we produce middle, high and high-quality women's shirts, blouses, skirts, clothes etc. Parallel, we are lasting capacities of more than 20 other production partners, resulting in a monthly capacity of 60-80.000 pcs per month in the women's products. We are offering CM, CMT and ready-made product business options. Our offer includes high quality ready-made products, mainly shirts, pullovers, casual trousers, casual jackets, coats, which are produced in Macedonia and Bulgaria and appreciated by many of our European customers. Thanks to our sourcing know-how of fabrics, own production of high-quality buttons, trading and stock of other trimmings, we are controlling well all our production inputs.

"Adapting production capacities for COVID-19"

INNOVATION PROFILE

This was done in three steps; the first was to protect our work force, ensuring contact work and minimize layoffs. To keep ensure that work did not stop in our production facility we took protection steps for each worker; giving them personal protection and spacing work stations as to minimize contact.

The next step was to adapt production facility to produce COVID-19 protection gear and in turn ensured that the people we employ had financial and job security. Even at the beginning of the

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pandemic our production facility switched from fashion production to producing reusable masks as our production was more suitable for this type of product.

The final step was to enable fully online order making and production quotation request. All of our models including fashion and COVID-19 protection gear can be ordered and agreed upon directly from our website in turn minimizing personal contact and ensuring nonstop services to all our clients.

COMPETITIVE ADVANTAGE

Due to our efforts during this time, we enabled out clients to maintain their business with us from the safety of their offices and homes. We expect the online platform to grow as much as possible and to finally make it our primary way of working for both local and foreign customers and partners.

CONCLUSIONS

We will continue to expand our online operations and ensure the stability of our employees and community. We strongly believe that to expand business, we need to adopt new sustainable technologies for production and adapt to the demands of the market we are on.

MAPPING AND CLUSTERING ENTREPRENEURIAL SKILLS IN TCI

SUCSESS STORY

Kübler Workwear is a German-based company which specializes in workwear for more than 65 years. It has a vast experience in this branch and its one of the founding companies which specializes in colores workwear and now one of the major workwear supplier in Europe. The company deals diverse industries workwear. It develops workwear for almost all major types of industries including the automobile industry, petrochemicals, machinery construction, handworkers, welding, construction, and agriculture. The company's main strength lies that it makes special workwear for every industry by understanding its technical needs.

Kremel Top for high-performance workwear requirements

P.H.Kübler Bekleidungswerk GmbH & Co. KG

COMPANY PROFILE

In 1956, the trained textile merchant Paul H. Kübler together with his wife Liesel and five seamstresses began to design and manufacture workwear which did not turn into the market leader in coloured workwear. The two brands KÜBLER and KEMPEL were merged lately. All sales and other business activities were bundled and integrated under the umbrella brand KÜBLER. Today KÜBLER employs 230 people at the Plüderhausen location. KÜBLER is one of the leading manufacturers of workwear and protective clothing in Europe.

"Kermel Top

INNOVATION PROFILE

The company works in very diverse industries workwear. It develops workwear for almost all major types of industries including the automobile industry, petrochemicals, machinery construction, hand workers, welding, construction, and agriculture. The company's main strength lies in that it makes special workwear for every industry by understanding its technical needs.

Research and product development have top priority at KÜBLER. The constant development of existing products and ensuring optimal production conditions thanks to their on-site technicians. Another advantage of their production is the fact that their textile supply chain also covers the raw material.

The company works with traditional fibres as well as high-performance fibres like in its Kremel Top brand which is composed of 99% of meta-aramid, that offers excellent protection against fire and flame and excellent mechanical properties.

Kübler Forest (above) and Kübler Refelectiq (below)

Contact of the Company

Paul H. Kübler Bekleidungswerk GmbH & Co KG

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There are lots of other brands like Bodyforce, Protectiq, Refelectiq, Forest, Pulsschlag, Identiq, etc. which are designed according to the specific needs of the special industry. KÜBLER Workwear is designed and developed exclusively at its location in Germany. A team of more than ten specialists works on new ideas every day - for more comfort, even better material, innovative protective functions, or completely new designs. In addition to its product development and design departments, they employ over 70 highly qualified seamstresses at their location in Plüderhausen. This is not only unique in the workwear industry, but it also ensures that they have consistently high quality and extremely flexible procurement options.

COMPETITIVE ADVANTAGE

The company is based in Germany and has a production facility also in Germany. The research and development of products take place in its facility in Germany. The production takes place in the company's production facilities spread worldwide. Therefore, the sourcing and price negotiations are avoided and transparency in their supply-chain is realized. A total of more than 4,500 sewing machine operators work for KÜBLER at 21 production sites worldwide. For long-term and flexible production, at the end of which there is an optimal price-performance ratio for our customers.

CONCLUSIONS

It can be concluded, from the historical development of the company, that it is the focus on the product that matters for the success of the company. Since its inception in the 1950s until now the company has focused only on workwear and has established itself as the market leader in this branch. Kübler workwear can comprehend sustainability and ecological aspects in their supply chain and products which are innovative and according to the latest standards set by standardization organizations.

MAPPING AND CLUSTERING ENTREPRENEURIAL SKILLS IN TCI

SUCSESS STORY

PaperTale AB is a Sweden-based doorway to enter into the world behind every product that we buy. Based on Blockchain, PaperTale technology aims to ensure that the great craftsmen behind products are being paid lawfully as well as that the product has the lowest possible environmental footprint. First in focus is the fashion and textile industry because that's one of the most affected industries regarding human rights and environmental issues. Right after launching the initial idea in the shape of a concept collection in 2019. PaperTale's share value has raised more than 1000% and has attracted the fashion industry stars to be part of its dynamic board. Late 2020, PaperTale launched its first test collection and showed the world that the technology can be used on industrial scale

PaperTale AB

COMPANY PROFILE

PaperTale AB was established in 2018 and is a Public Limited Company. At this stage, the company can be categorized as a medium-sized company that employs more than 100 people. The professional board runs the company. The board members are top executives from Ikea, Lindex (Swedish Fashion Brand), Property business, and academia (Universities). CEO has over 20 years of experience in textiles value chains and entrepreneurship.

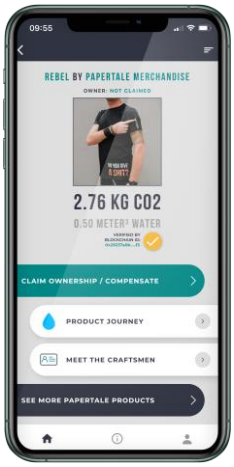
"PaperTale Smart Tag

INNOVATION PROFILE

The fashion & textile industry is considered one of the most polluters on the planet and one of the biggest contributors to an estimated 36 million forced labour in the world. Today almost every other brand claims to source organic cotton but the whole world's organic cotton production is less than 0,6%. This means almost every brand is bending the truth. Consumers are becoming increasingly aware of these issues, but they have no way of taking action. After trying to engage different stakeholders of the industry, Bilal Bhatti (CEO) decided to work out a business model that is built on a unique approach of businesses transparent and making more money.

PaperTale technology offers benefits to the main key stakeholders of the industry i.e., consumers, brands, and the factories. Consumers can trust the product claims because they can see that the products are made with each step of production as verified and logged on the blockchain.

What is the type of innovation: It is a new technology platform which comprises web and mobile apps and ties up the consumers, brands, and the factories in a unique way of trust. Consumers can see that there is no slave labour involved in the supply chain. They can also see that the compensation is also traceable. The technology brings good feeling, higher social status, money, ethical, and responsible mind-set. The workers in the garment factories are protected. The technology involves new product instruments in textile and clothing and its patent is applied and trademark is registered. The finances are made through owner equity and state loans. Paper Tale AB cooperates with universities in Europe and manufacturing countries in Asia.



Blockchain based technology tells the complete supply-line history and origin of product and impacts made on environment

Apps available in Google and Apple store

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COMPETITIVE ADVANTAGE

PaperTale Technology is one of the first companies which offer first-hand information about the product the consumer is willing to buy with complete information that influences the purchase of a responsible buyer. The in-house unique team of engineers, Secured contracts, Patent filed, an intensive knowledge of manufacturing and the brands work are the key strength of PaperTale AB.

The technology which is brought to market can also be used in other products like medicine, cosmetics, food, etc.

CONCLUSIONS

“The new ideas are always risky, but the greatest idea is not formed by a single moment but with continuous team effort, consistency, and commitment. There are enough good people on earth who would like to join the bus, once we have the first commitment”. Says Bilal Bhatti the CEO. It may be optimistically stated that such technology can revolutionize the transparency in TCI supply chain and may develop responsible consumer behaviour.

MAPPING AND CLUSTERING ENTREPRENEURIAL SKILLS IN TCI

BELGINOVA (30Seven)

SUCSESS STORY

With the emergence of smart textiles and the availability of electro-conductive fibres and yarns from the Belgian company Bekintex, together with a big amount of knowledge and innovation driven spirit, a former manager decided to start his own company (2009) to make and commercialise active heating clothing. The brand name (30seven) revealed the purpose of the products and initially mainly aimed to keep outdoor sportsmen warm. The product range has since gradually increased, covering nowadays also work and health wear.

COMPANY PROFILE

Belginova is a Belgian company established by Pol Speleers that launched its first active heating textile products in 2007 under the brand name 30seven®. The former Bekintex manager had years of experience in the automotive sector, more specifically in the production of car seat heating based on electro-conductive fibres and yarns. Belginova is a small company, located in Kortrijk, in the heart of Flanders. The company develops, manufacturers, markets and sells the 30seven® heating clothing, which is based on Novaheat® technology.
In 2017 80% of the turnover of Belginova was accomplished by the sports products and 20% by the workwear. The company does not give further details on the sales.

"SUCESSFUL INNOVATION" /30seven/

INNOVATION PROFILE

Bekintex (as part of Bekaert) is a manufacturer of stainless-steel based textile products for, amongst others, the automotive industry. The idea arose from heating car seats, which they had been producing for many years. The fine electro-conductive fibres could also be used to manufacture heating pads to be integrated into clothes. The idea was patented and the Novaheat® technology was born. The 30seven® heated textile clothing is powered by this technology. The heat is generated by ultra-fine corrosion resistant and unbreakable (stainless steel) fibres that are equally spread over the heating zone. A battery is fully integrated into the textile products and has an autonomy of around 6 hours.
Nowadays there is a broad range of products available, for skiing, cycling, motorcycling, hunting, camping, work and health, including softshell jackets, gloves, mittens, socks and insoles.
Because the products are well-designed by a team of engineers and designers, a safe product is guaranteed, without the risk of overheating or causing burns.

30seven: innovation in practice/

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competitive advantage

30seven® is the only heating clothing brand that offers the unique system of a removable heating element to make it washable. However, this also implies that the clothing can be worn without the heating element present, thus during all seasons. A high-quality lithium-ion battery powers the clothing and can be recharged at least 1.000 times. Heating is supplied for a period up to 7 hours. The garment itself can be washed at a temperature of 40°C, while the heating element is washable at 30°C without detergent.
Furthermore, 30Seven® uses an e-commerce platform to offer its heating products to the entire world. With a clear navigation structure and a comprehensive description of the products it offers its customers the information they need.

CONCLUSIONS

The 30seven® heating clothing range was launched in 2009 thus has already been on the market for over 10 years. Being at that time an entirely new type of clothing (smart clothing) with an integrated active heating system, it was important to gain the trust of the customers by offering a stable, long-lasting product. Furthermore, reliable and clear product information is a necessity to make the potential user become familiar with this new class of clothing. And lastly, patenting the innovation protects the company, gives exclusive right, and increases the competitive advantage. Belginova® is considered as one of the important smart textile clothing players on the European market.

MAPPING AND CLUSTERING ENTREPRENEURIAL SKILLS IN TCI

SUCSESS STORY

A R&D department with specific CAD allows to design collections in-house and to develop exclusive fabrics for the customers. Here, we study the best yarns, graphics, constructions, colour variants and finishes to best suit each fabric. Prototypes of electro-welded and thermoformed fabrics are developed. We study the product industrialization in order to obtain the best possible quality in extremely short timescales. Personalised product presentations are designed, together with simulations, catalogues, swatches, sample bunches and stands.

FIDIVI TESSITURA VERGNANO

COMPANY PROFILE

IDIVI is a weaving company with a dyeing (in yarn and piece), warping, weaving (dobby, jacquard, knitting), finishing (also for resin, flame retardant, oil-water repellent treatments), bonding (with 2 to 10mm foams), electrowelding, thermowelding and sewing department.

Founded in 1941 by grandfather Pinin, FIDIVI is still owned by the Vergnano family today.

Our current directors, Giuseppe and Enrico Vergnano, are the third generation to work in this company. In the early 1940s, the factory produced blankets and curtains for household use, then fabrics for clothing, through to technical fabrics for cars, contract, luggage, offices and trains. For many years, it was the most important textile supplier for the Fiat Group and has created many of the fabrics used in their cars, buses, and lorries.

Today, the automotive branch of the company has been transferred to AUNDE Italia, with FIDIVI retaining an important share. This has enabled us to develop a remarkable experience in technology, service and research that today are the basis of the current organization of FIDIVI Tessitura Vergnano. The new FIDIVI's headquarter is located in Poirino, about 15 km far from Turin and Caselle Airport.

"SUCESSFUL INNOVATION" ***SEALIFE***

INNOVATION PROFILE

SEALIFE is a cross-functional fabric made of SEAQUAL® YARN, a special polyester fibre made entirely from post-consumer recycled plastic: from plastic fragments and debris retrieved from our oceans to post-consumer PET from land sources.

SEALIFE is GRS (Global Recycled Standard) certified, which guarantees the presence of post-consumer recycled materials in the fabric.

Name: Sealife

Contact of the Company

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https://www.fidivi.com/

COMPETITIVE ADVANTAGE

With a rich colour palette of 12 solid hues and 18 melange tones, SEALIFE is available in pastel, vibrant and natural shades.
Hard-wearing and durable, this upholstery fabric is highly suitable for both contract and offices.
With the fabric SEALIFE, FIDIVI is collaborating with SEAQUAL INITIATIVE to help clean our oceans while transforming marine litter into beautifully crafted fabrics.
SEAQUAL INITIATIVE is a unique collaborative community that works with ocean clean-up programs around the world to transform the marine litter they recover into Upcycled Marine Plastic; a new, fully traceable raw material with the power to raise awareness of the issue of marine pollution and highlight those helping to fight it.
Application
Office, Contract
Weight: 460 g/lm - 330 g/m²
Height: 140 cm
Composition: 100% Recycled Polyester - SEAQUAL Certified

CONCLUSIONS

FIDIVI joined the SEAQUAL INITIATIVE to help clean the oceans while transforming marine litter into beautifully crafted fabrics.

SEAQUAL INITIATIVE is a unique collaborative community that works with ocean clean-up programs around the world to transform the marine litter they recover into Upcycled Marine Plastic; a new, fully traceable raw material with the power to raise awareness of the issue of marine pollution and highlight those helping to fight it. In choosing products containing Upcycled MaSEAQUAL® YARN is the only certified yarn to make SEAQUAL products. It is made with at least 10% Upcycled Marine Plastic; the rest is Recycled Polyester from land plastic (PET bottles). Every product (fabric, garment, etc.) must contain at least 20% of SEAQUAL® YARN to be labelled as SEAQUAL.rine Plastic, you are helping to clean our oceans. Every piece of fabric is fully traceable back to the yarn it is made of. It is a system that works as long as every player of the process is part of the SEAQUAL INITIATIVE. That means that any company that buys SEAQUAL products from FIDIVI has to join the SEAQUAL INITIATIVE. This is done by subscribing the 'SEAQUAL Trademark & Copyright License Agreement'. This is a free of charge agreement that certifies your company can buy and sell SEAQUAL products. You may also support the project with a donation that will help the involved NGOs in their efforts to free our oceans from litter.

Learn more: www.seaqual.org
https://www.youtube.com/watch?v=rT6faJ47B1M

MAPPING AND CLUSTERING ENTREPRENEURIAL SKILLS IN TCI

LIEBAERT

SUCSESS STORY

Liebaert is a textile company with a long tradition in unique quality fabric production, 100% made in Belgium. It seems to be always up-to-date with the trends and the customers' contemporary needs, yet always meeting highest quality standards. Today it implements new technologies and highest sustainability practices, something crucial for the eco-system as well as for the market needs of the third decade of the 21st century. The secret to success seems to be the dedicated and excellently trained personnel and the care for the well-being of each individual within the company.

Nanostitch® Cuprana fabric

COMPANY PROFILE

Liebaert is a private family company existing since 1887, with the leadership being transferred over 5 generations. It is a medium sized company (151 employees in 2019) in the textile manufacturing sector and generates 17.47 million in sales (USD) per year. There are 2 companies within the Liebaert corporate family, including its own clothing sportswear line since 2019 (RectoVerso brand). The company is vertically integrated, with departments from design, yarn, fabric production, dyeing, printing, finishing, confection and testing. Its facilities include 175 knitting and weaving machines and there are around 300 new products made each year. Moreover, Liebaert is certified with the highest quality standards ISO and Oekotex. Liebaert develops products for a variety of sectors, from fashion to the automotive and aeronautical industry.

INNOVATION PROFILE

NANOSTITCH TECHNOLOGY

The company invests 10% of its profits in research and puts product innovation as key to their success, collaborating with different industries, laboratories and universities, including Ghent University. The Nanostitch technology is used to produce a new generation of high-performance stretch fabrics knitted with Lycra fibre, which are a signature Liebaert product, specifically engineered for the sportswear segment. Produced on the finest warp knitting machines, they provide premium thermal and sensorial comfort, along with different fabric specifications, including lightweight and highly breathability, moisture wicking and cooling and heating fabrics. These fabrics are up to 20% lighter than comparable compression fabrics and provide 2 to 3 times more compression than standard tricot fabrics. Moreover, in

2020 they have been investing in their medical products range to develop fabrics against COVID-19 and similar viruses. These developments have been under collaboration with the textile laboratory Centexbel which is entitled to give such certifications. For example, their Nanostitch® Cuprana fabric contains special Cupron (copper infused yarns) and EMANA (far-infrared yarns with bioactive minerals) that support ultimate skin comfort and anti-infection benefits. Moreover, copper has been found as very effective against COVID-19. The fabric is washable and can be used as an inner layer in facemasks, available in more colours. Cuprana® has been CNAS certified, copper containing and has antibacterial properties.

COMPETITIVE ADVANTAGE

Although there are many facemask materials available on the market, especially in the last year, Liebaert's innovation lies in the development of unique facemasks that meet the highest standards in terms of protection, comfort as well as environmental aspect. The facemasks are therefore washable, can be used both from the inside and outside, and most importantly, are COVID-19 approved by a known textile research centre, which only ensures consumers trust in the protection properties of the fabric. They are produced using the nanostitch patented technology, which is very well known for great comfort. Also, the fabrics are fully made in Belgium, which brings 100% transparency and trust.

Conclusions

In the last few years, Liebaert has been shifting its product range from fashionable products towards more technical textile production, in order to meet consumer needs and keep its competitiveness with other European textile manufacturers, taking advantage of what is Europe well valued for – technological development and premium quality guarantee. It is a great example of successful implementation of high-performance knitwear technologies and use of novel functional yarns for sportswear, fashion and various other industries, such as medicine and automotive. The success lies primarily in the quality, in the flexibility of the product range, in constant investment in innovation and in keeping up with the market demands. The company's name is associated with sustainability and ethical principles which indeed increase the strength and success of the business.

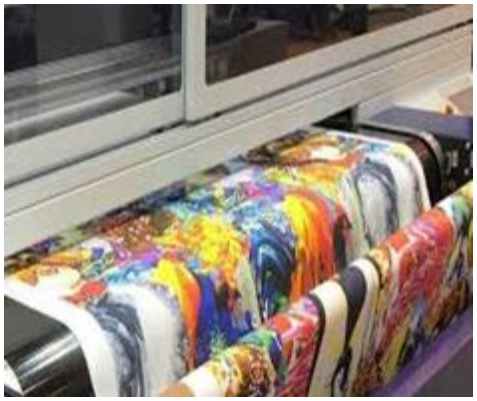
MAPPING AND CLUSTERING ENTREPRENEURIAL SKILLS IN TCI

SUCSESS STORY

The challenge of Miti SPA is to create uncompromisingly performing fabrics that respect nature. Greenperfoming is the concept that best summarizes our relentless commitment to developing solutions that are sustainable and performing at the same time, offering the best functional and aesthetic performance.

Some key elements that characterize the path:

- 30% M3 of water consumed per kg of fabric produced
- 25% tons of C02 emitted equivalent to +21,000 tall trees
- 90,000 plastic bottles and cups consumed per year



Miti Spa

COMPANY PROFILE

Since 1931, the Polli family has been at the helm of the company, guaranteeing not only continuity, but its natural predisposition for innovation. This attitude is part of the Company's DNA. After each milestone reached M.I.T.I. it never stopped.

Its path is constantly evolving and the company is supported and driven by the stimuli that the Polli family has never stopped giving. Thanks to M.I.T.I. continues to stand out on the market, making itself appreciated for the maximum attention paid to details to guarantee performance and quality of service.

M.I.T.I, a leading company in the production of warp-knit stretch fabrics, has the recognized ability to stimulate the creative spirit and transform the ideas of its customers into concrete realities.

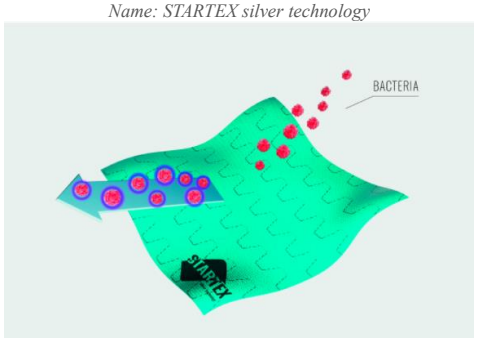
One of the most important values of M.I.T.I. lies in the ability to accompany its customers in discovering the trends of the future of warp-knit fabrics, guiding them towards the best solution for their business needs.

"SUCESSFUL INNOVATION" STARTEX silver technology

INNOVATION PROFILE

STARTEX silver technology is the technology dedicated to fabrics for industrial and medical applications. The combination of a sophisticated production process and special fibers such as carbon, complete the wide selection of fabrics developed by M.I.T.I. in this area.

Name: STARTEX silver technology



Contact of the Company

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The warp-knit fabrics with STARTEX silver technology are made by M.I.T.I. using polyester fibers with antibacterial properties. Long-term performance is achieved thanks to silver ions incorporated into the fibers by nanotechnology.

COMPETITIVE ADVANTAGES

STARTEX silver technology is tested and certified for long-lasting performance up to 300 washes at 40 ° C.

These fabrics are mainly designed for the medical sector but can be used for multiple applications: internal helmets, chamois, orthopedic supports, medical clothing, laminated and coupled fabrics.

STARTEX silver technology is fully certified by manufacturers in accordance with ISO: 20743: 2007 and JIS 1902: 202. Fabrics with STARTEX technology are BLUESIGN certified.othing, laminated and coupled fabrics.

Personal health is one of the sectors where technology and reliability are essential. Busts, insoles, knee pads, elbow pads, elastic bands: our fabrics are effectively used in technical orthopaedic material and medical clothing.

The STARTEX silver technology is suitable to:

- Snug compression for better comfort
- Carbon yarns
- Permanent antibacterial options
- Antimicrobial / sanitary effect
- Exceptional moisture management and breathability
- Freshness in contact with the skin

CONCLUSIONS

The combination of technological innovation and production sustainability increase the strategic choice to undertake actions aimed at defining and managing the sustainability of one's business can be summarized as follows:

- Reduction of operating costs; - Acquisition of new market shares with the strengthening of marketing and branding reputation actions; - Continuous improvement of its performance in terms of safety, quality of the finished product, protection of the Environment and energy efficiency;

- Effective communication of corporate image, values and

MAPPING AND CLUSTERING ENTREPRENEURIAL SKILLS IN TCI

SUCSESS STORY

Directa Plus is a leading producer and supplier of graphene nanoplatelets-based products targeting the markets of consumer and industrial applications.

In November 2016 the company launched Directa Textile Solutions, a subsidiary focusing on the creation of innovative textile products designed and made to measure.

Directa Textile Solutions S.r.l.

COMPANY PROFILE

Founded in 2005, Directa Plus is one of the largest manufacturers and suppliers worldwide of graphene nanoplatelets-enhanced consumer and industrial products. The company's patented graphene nanoplatelets-based products are natural, chemical-free and manufactured with reduced environmental impact processes.

Directa Plus has developed a proprietary scalable, modular manufacturing process to produce and supply high quality engineered graphene materials – marketed under its 'Graphene Plus' (G+®) brand – which can be used by third parties in a wide variety of industrial and commercial applications. The production facility is capable of producing up to 30 tonnes per annum of graphene-based products.

Directa Textile Solutions is a subsidiary of Directa Plus offering a wide range of multifunctional textile products and membranes enhanced with the company's patented G+® which are suitable for a variety of textile applications.
For 2017 the company reported a total income growth greater than 50% - EUR 1.23 million versus EUR 0.82 million in 2016 - with 15,000 metres of G+ printed fabrics being sold, corresponding to sales for EUR 0.77 million versus EUR 0.08 million in 2016.

" G+ Co-Mask"

INNOVATION PROFILE

Following the Covid-19 spread, in 2020 the company released a range of face masks featuring antiviral properties under the brand name G+ Graphene Plus®. Over 180 materials were tested during the development phase and finally the choice fell on a highly breathable jersey fabric. The masks feature a special three-layer

protective three-layer construction: G+® Printed Jersey + G+® Impregnated Cotton + G+® filters

G+ Graphene Plus®

Contact of the Company

construction: G+® Printed Jersey + G+® Impregnated Cotton + G+® filters. G+ Graphene Plus® is antiviral and proves to be very effective against SARS-CoV-2. Tests were carried out following ISO18184. Furthermore, the masks were dermatologically tested and are hypoallergenic, intrinsically antistatic and thermally comfortable thanks to Planar Thermal Circuit® (PTC), a further patented technology by Directa Plus, which allows heat to move from hot spots to colder ones, thus creating a thermoregulating effect. In 2017 the company was allocated a grant for a biannual research project on the use of graphene in advanced textiles and fashion called GRATA (Graphene for Advanced Textiles and Fashion).

COMPETITIVE ADVANTAGE

The company's Textiles vertical can print its G+® nanoplatelets on synthetic, natural and artificial fabrics, and is able to offer G+® enhanced membranes. Main applications include sportswear, city wear, jeans and workwear.

G+ Graphene Plus® fabrics feature antibacterial properties and are certified antibacterial according to ISO 20743:2013. Furthermore, G+ Graphene Plus® provides a filtration efficiency of 95% according to EN 14683. Coronavirus put the spotlight on the relevance of empowered personal and environmental hygiene and these specialty features make the company products suitable for meeting the resulting strict safety and hygiene requirements by providing antibacterial solutions with proven effect.

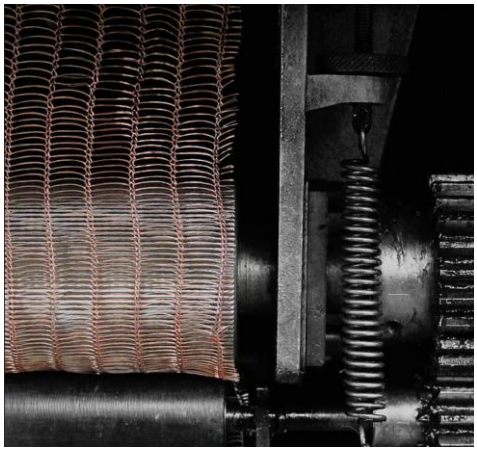
CONCLUSIONS

Given the unpredicted large-scale outbreaks of infectious diseases, the pandemic has the power to cause sudden, widespread mortality and morbidity, as well as social, political, and economic disruption. As explained in a public statement, ever since the risks of COVID-19 pandemic became clear, Directa Plus has been determined to contribute to the fight against the spread of the disease by using the unique properties of graphene and the strength of Directa Plus IP portfolio to enhance personal protective equipment and redirect its Advanced Development Area efforts and resources to achieve this. The G+ Graphene Plus® mask range has been designed for use for commuting, at workplaces and during sport and exercise.

MAPPING AND CLUSTERING ENTREPRENEURIAL SKILLS IN TCI

SUCCESS STORY

Using conductive metal (copper, brass and stainless steel) yarns and specialty knitting machinery, Knitronix manufactures all-fabric knitted sensors and limit switches for the detection of temperature, occupancy, pressure, moisture and GSR.



IoT textile sensor for temperature, pressure, liquid

Knitronix

COMPANY PROFILE

The company was originally founded in 1949 under the name of Scomar S.r.l.: design and manufacturing of automatic flat knitting machines. In the following fifty years, Scomar manufactured and exported more than ten thousand knitting machines, with a sales network of 40 representatives across five continents. Following the significant change in the Western textile market which took place in the early 2000s, the company was renamed Inntex and evolved into a manufacturer of innovative knitted metal fabrics resulting from the specialty technical know-how gained over the years using Scomar machines duly modified to properly handle the new yarn materials.

Today Inntex produces and markets metal fabrics for interior design and high frequency electromagnetic shielding, while Knitronix, a separate entity since 2016, designs and manufactures sensors from knitted metal wire. The company's proprietary knitting machinery and material combinations are protected by EU and US patents. All products are entirely designed and manufactured in factories in Tuscany, Italy, using proprietary technologies.

" Temperature, Pressure and Liquid Sensors"

INNOVATION PROFILE

Being entirely made of fabric, textile metrical pressure sensors are soft and conformable. Knitronix developed a range of lightweight and breathable specialty sensor types based on proprietary wire knits. By combining fine metal wires with non-conductive fibres, the company designs and manufactures high duty cycle (HDC) textile sensors measuring temperature, pressure and the presence of liquids. Among these, high duty cycle IoT sensors are suited for the monitoring of soft or large surfaces. Target markets are industrial safety and occupational health, patient monitoring and performance tracking.

Contact of the Company

The company acts as manufacturer and, at the same time, as specialized consultant providing bespoke solutions for companies and research institutes, including the Institute for Microelectronics and Microsystems (Rome, Italy), the Department of Textiles at Ghent University (Belgium), the Department of Social Science at Siena University (Italy), the ICT department at the University of Florence (Italy), and The BioRobotics Institute, Scuola Superiore Sant'Anna (Pisa, Italy). Knitronix has been coached by EIT Digital and has won an innovation grant from SmartX.

COMPETITIVE ADVANTAGE

Temperature detecting sensors are breathable, formable and stretchable single layer items suitable for direct skin contact. Being based on the RTD principle, the temperature they measure is the average T measured over the entire surface of the sensor. Basic pressure detecting sensors are dual-layer contact switches combining conductive and non-conductive fabric components, developed for embedment in mats, seating or other surfaces to signal bodily contact. Matrix pressure sensors feature piezoresistive elements in a matrix configuration yielding dozens or hundreds of continuously varying values across the entire sensor surface. They are flexible and lightweight and suitable for broad-range pressure monitoring. Liquid detecting sensors are breathable single-layer items able to detect as little as 1 ml of liquid anywhere on their surface. They can be wrapped around pipes or integrated into roofing materials.

CONCLUSIONS

In 2005 co-founder and CEO Riccardo Marchesi began wondering if a fabric featuring conductive fibers could be used to measure environmental data, which brought to the company's further evolution and expansion: in 2016 the spin-off Plug & Wear, later renamed Knitronix, was started to manufacture textile sensors for the detection of tactile pressure, temperature and the presence of liquids/humidity. Through the introduction of the smart textiles division in addition to the industrial product range and the interior design textiles collection, the company succeded in diversifying its range. Textile sensors have several advantages over traditional ones and can be used in several applications.

MAPPING AND CLUSTERING ENTREPRENEURIAL SKILLS IN TCI

SUCSESS STORY

MAK PLC is company with tradition that is looks forward to the future. The company continues the journey of many textile manufacturers who have established traditions in these industries between the two centuries. MAK entered the 21st century as a modern company, with a closed production cycle. Their journey will continue with the sustainable development of the company based on the needs of the market, and the growing consumer demands, which they achieve with the well trained and motivated personnel.

COVID – 19 Protective suit

MAK PLC

COMPANY PROFILE

MAK PLC was established in 1912. The company is 100% private property.
MAK PLC is a vertically integrated company that produces **raw fabrics**, with production lines for finishing - dyeing and printing fabrics, with a variety of enrichment technologies, including – hydro/oleophobic coating, lamination, antibacterial finishing, flammability reduction, treatment against insects (mosquitoes) etc. The product cycle closes with the production of ready-to-wear garments like military and police uniforms, workwear of all kinds and leisure and sportswear
MAK PLC is certified according to standards: ISO 9001:2015, ISO 14001:2015, OHSAS 18001; OEKO-TEX 100, AQAP 2110

"COVID-19 PROTECTIVE SUITE"

INNOVATION PROFILE

Led by the continuous aspiration to meet the needs of the market, when choosing a product range, Company management is guided by fabric market topical issues and trends. One of the innovations that find significant application on the market, especially in the current situation with COVID-19, is the development of **fabrics with permanent antibacterial finishing**.
Another significant innovation is development of fabrics with anti-mosquito treatment, for which production the company possess license from WiWeB Institute –Germany.
Both innovations are financed entirely by own funds.
Development of the innovative fabrics was carried out together with Technical University of Sofia and in very close cooperation with Accredited Testing Laboratory in TEX CONTROL Ltd, where MAK accomplishes all its research and tests.

Anti-mosquito protective fabrics

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COMPETITIVE ADVANTAGE

Thanks to the anti-bacterial fabric development, MAK company adequately met the needs of the COVID-19 crisis, offering to the market reliable protective masks and certified overalls.
Anti-mosquito protective fabrics and possessing license form WiWeB Institute, enable MAK to become the main supplier of uniforms for the German army.
With the production of ready-made garments, the company closes its production cycle.
Expected turnover increase for 2021, only from anti-mosquito uniforms sales, is 1,5 million EUR.

CONCLUSIONS

During Socialism in Bulgaria dozens of weaving mills existed and operated. With the coming of Democracy, a significant part of them closed down their activities. Thanks to the innovation management approach, the company not only managed to keep going over the years, but also occupies a leading position on the local and European textile market, as well.

Based on the latest innovation MAK keeps following its main goal of becoming global-minded and a globally operating company, by constantly introducing new technologies, products and penetrating new market fields in textile and clothing industry.

MAPPING AND CLUSTERING ENTREPRENEURIAL SKILLS IN TCI

SUCSESS STORY

Tex Control Ltd. is laboratory with tradition that is looks forward to the future. Thanks to the motivation and high qualification of the staff, Tex Control will continue with the sustainable development of the laboratory, based on the needs of the market, and the growing consumer demands

Testing Laboratory in TEX CONTROL

COMPANY PROFILE

Tex Control Ltd. was established in 2008. Since 19.01.2011 the laboratory was accredited in accordance with BSS EN ISO/IEC 17025:2006, for more than 120 international standards.

With these capabilities the laboratory provides laboratory tests of over 80% of the features / indexes/ of textile materials, textile fabrics and ready-made garments. The trend is for its capacity to be expanded.

The test laboratory has at its disposal modern testing equipment and auxiliary equipment. The technical tools are of the latest generation of technology and manufacturing capabilities of the world's leading specialized companies (**SDL Atlas** - England; **JASCO CORPORATION**-Switzerland; **DATACOLOR INC** - USA; **CECIL INSTRUMENTS LTD** - UK; **WTW GmbH** Germany; **ZWEIGLE, GmbH**, Germany; **TEXTEST, INSTRUMENTS, AG**-Switzerland; **"BINDER"** Germany; **IKA**-Germany, etc.)

The company is 100% private property.

INNOVATION PROFILE

Led by its continuous aspiration to meet the needs of the textile market, when taking decision for the next investment, the Laboratory's management is guided by fabric market top issues and trends. One of the innovations that find significant application on the textile market is BUNDESMANN WATER REPELLENCY TESTER. This apparatus is an imitation of the rainy weather conditions in the various climatic zones. Determination of water repellence of fabrics by

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Bundesmann rain-shower test, is a main requirement of all European armies, especially of the German and Austrian.
Another significant innovation is investment in SWEATING GUARDED HOTPLATE which is used for determining the thermal and water-vapour resistance of the fabrics. This apparatus was extremely useful in the current COVID-19 situation, namely for testing water-vapour resistance of the membranes, used for protective suits.
Both innovations are financed entirely by own funds.

COMPETITIVE ADVANTAGE

Thanks to the investment in SWEATING GUARDED HOTPLATE, TEX CONTROL adequately met the needs of the COVID-19 crisis, offering to the textile market reliable test examination of protective laminated fabrics and protective coveralls
Performing tests in accordance with EN 29865 Bundesmann rain-shower test, is the reason why TEX CONTROL became a leading testing laboratory for the needs of the German army.
For the past 2020 year there was a turnover increase to the amount of 85 000 EUR, only from SWEATING GUARDED HOTPLATE tests.

CONCLUSIONS

Thanks to the innovative management approach, and the continuous expansion of the accreditation scope, TEX CONTROL not only managed to keep going over the years, but also occupies a leading position on the local and European textile market, as well.

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MAPPING AND CLUSTERING ENTREPRENEURIAL SKILLS IN TCI

Hrvatski kišobran

CROATIAN UMBRELLA & KISHA

SUCSESS STORY

The constant development of new products and production oriented towards quality and affordable price has ensured the expansion of the market in record time. From humble beginnings in cooperation with the Lipovica penitentiary where the first Croatian umbrellas were produced, to production in Zaprešić, the Croatian umbrella team has grown in numbers, knowledge and experience. In addition to the Croatian umbrella, the company Tabacco is the exclusive representative of the Kisha brand for Croatia, and it is a 'smart umbrella' designed by the Croatian innovators Marija Butkovic and Andrija Colak.

COMPANY PROFILE

The Croatian umbrella is owned by the Croatian company Tabacco d.o.o. founded more than 25 years ago. With continuous development and investment in business processes, Tabacco d.o.o., a few years ago, as an anti-recession measure, aimed at employing as many people as possible, introduced a brand called Croatian Umbrella. This brand currently includes the production of several product groups - umbrellas, raincoats, dog raincoats, shopping bags and school slipper bags - with the aim of continuous development of new products and ideas. In addition to the Croatian umbrella, the company Tabacco is the exclusive representative of the Kisha brand for Croatia, and it is a 'smart umbrella' designed by the Croatian innovators Marija Butković and Andrija Čolak.

INNOVATION PROFILE

Kisha, smart umbrella, uses a smartphone for its work and full potential. Kisha itself is an umbrella with a specially designed pocket in which there is a Bluetooth module, and with which the umbrella and smartphone are connected. In addition to the umbrella and module there is an application that must be installed on the smartphone. It is currently only available for iOS devices, but is expected to arrive on the Android platform as well. Kisha as a smart umbrella, i.e. the application installed, will warn the wearer of the expected rain. Furthermore, Kisha is an umbrella that cannot be lost. Every time the wearer is moved away from the umbrella, or one forgets it, the smartphone will warn the owner about it. This is one of the main reasons for the popularity of the Kisha smart umbrella. In addition to the KISHA smart umbrella, the Croatian Umbrella also developed their own innovative umbrella whose special feature is that it has a built-in microchip, which is bluetooth connected to the smartphone. When the umbrella is left somewhere and when the owner moves 30 meters away from it, the chip is activated, and the owner's cell phone starts ringing.

COMPETITIVE ADVANTAGE

Through continuous investment, development and realization of innovative and challenging projects, the Croatian Umbrella strive for secure future. The greatest advantage is understanding the needs of customers and the application of active listening at the workplace. Combining craft, good organization and coordination, but also using modern technology and automation, the Croatian Umbrella combines high-quality level with fast delivery and reasonable pricing. With constant investments in raw materials, production processes, innovation and development, the Croatian Umbrella strives to be ahead of the competition. The Croatian Umbrella umbrellas are special because of the way they are sewn, they are much stronger than usual, made of fiberglass, which means that they are very flexible.

CONCLUSIONS

The Croatian Umbrella is the only one in Croatia and one of a total of two umbrella factories in the whole of Europe. Formed after the crisis in 2008, and survived the Corona crisis, the Croatian Umbrella is a true success story employing 50 workers and producing 200 000 umbrellas per year. Also, they have developed their own IT management that allows individualization of design and independent development of umbrellas by the customer.

Contact of the Company

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MAPPING AND CLUSTERING ENTREPRENEURIAL SKILLS IN TCI

CATEKS

SUCSESS STORY

Cateks d.d. is a company specialized in the development, production and sale of special technical fabrics, polyurethane-coated and laminated technical materials, as well as final and ready-made products, which are of high quality. It is the development of quality products that is the key factor for successful business operations and for the achievement of a competitive advantage in the market, and the constant work on improving is their strategy for realizing this advantage. Cateks continuously invests in new equipment that enables the development of new products. Medical program within which is the production of materials waterproofing, antibacterial, antifungal and antidecubitus treatment. Protective program includes the production of a two-layer, three-layer and four-layer laminated materials with breathable membranes production of clothing (waterproof and windproof pants and jackets), and in the footwear industry for the production of special footwear (military and police boots).

COMPANY PROFILE

Cateks is one of the biggest textile producers in the Cakovec region and one of the oldest in the southeastern Europe. Thanks to technological development and innovation, today it consists of three production departments: Textile, Polytex and Confection. Such an organisation creates a vertical integrated production and allows for a better control of every phase of production and high degree of technological innovation by combining knowledge and experience of engineers in all production departments that has put Cateks in a position of a producer in technical fabrics and materials of special applications and a higher added value.

INNOVATION PROFILE

Constant investment in innovation has resulted in the development of new technical fabrics for special purposes. Their COMPAGO® Defend represents the top quality of production of special purpose fabrics used for the production of military and police uniforms, such as CORDURA® NYCO materials made of a mixture of polyamide and cotton fibres, a mixture of cotton and polyester, 100% cotton, materials with stainless steel or carbon threads for antistatic properties, or with FR fibres for non-combustibility. Fabrics are finished to meet special properties: Water repellence, Oil repellence, Anti-dirt, creasing, insect protection. A new fabric with significantly improved properties and a concealing pattern that is purposefully designed for the use of the Ministry of Defence, which proves Cateks as a fundamental fabric manufacturer that can follow research and development in this field in the regional, European and global markets. The COMPAGO® PROTECT brand includes high-quality technical materials that protect against weather conditions such as rain and cold, provide protection during work in hazardous conditions when handling flames, oils and petroleum products, when working in explosive

Contact of the Company

atmospheres (when exposed to electrostatic voltage) or in conditions reduced visibility. The materials are divided into three groups: Polyurethane-coated materials, Multilayer materials laminated by dot gluing technology and treated cotton fabrics or mixtures of cotton and polyester. COMPAGO® Medical are technical materials treated against burns, fungi and bacteria and meet standards such as BS 7175-CRIB 5, EN ISO 12925. The production is carried out in accordance with REACH. The products meet Oeko-tex standard 100, class I, which confirms that the materials can also be used to make products for children. Their main application is in the production of medical covers for mattresses, pillows and medical aids, as they are pleasant to the touch, antibacterial and provide long-lasting hygiene.

COMPETITIVE ADVANTAGE

In Cateks, the trends in detection and camouflage development are continuously analysed, concluding that today's high-level detection is far ahead of the covering one. The decision to turn to addressing and solving these problems was made, because the preliminary research has already shown that a shift is needed in this segment. Gathering knowledge and experience in 26 years of working with various military units around the world, Cateks has transformed this into a new recognizable product with a completely different way of construction, functioning and approach to solving this problem. Cateks has consulted the best experts in the field of detection, collaborated with many institutions and ultimately protected our results with industrial design for the whole of Europe. So, another innovation is the new camouflage pattern with a whole new perspective on the look of camouflage in a modern combat environment.

CONCLUSIONS

Cateks is one of the largest textile companies in the region and one of the oldest in the southeastern part of Europe. Cateks has positioned itself as one of the most important centres for the development and production of high-performance textile materials intended for military and protective purposes. An exceptional example of success that, with advances in technology and an innovative approach, is continuously working on the development of new products. Also, by optimizing existing processes, it increases the utilization of energy and resources, better waste management and thus further contributes to environmental protection.

About the authors

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Prof. Dr. Nikolay Sterev is a Doctor of economics and a full professor at the Business Faculty of UNWE-SofiaThe main courses he teaches are related to organizing, managing and development of business organizations, as well as the functioning of the business organizations themselves. Leading textbooks are in Business Economics, Leaders and Leadership, Marketing, Marketing Research and Marketing Management.
The main research interests are in the field of Industry 4.0, regenerative economy and business development and industrial growth. He has over 100 publications in books, journals and conference proceedings.
He has also been a guest researcher on growth at Imperial College (2009 and 2010), Bocconi University (2009), University of Agder (2016) and a guest lecturer on structural change at Suleiman Demirel University (2013) and Trakya University (2017 and 2018).
Outside of teaching and research, it consults companies and trains their staff in a number of areas, such as: trade negotiations; negotiation skills; export skills; prerequisites for sales in Bulgaria and abroad; business entrepreneurship and others. The consulting work includes the preparation and participation in projects under the EU Structural Funds and under the Erasmus + program.

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Dr. Petia Miluscheva is a senior European Project Manager and Coordinator of projects since 1994 (managed more than 20 projects financed by the German Agency for Technical Cooperation and 5 Bulgarian Government and European Projects). Dr. Miluscheva is a Chairman of SCIAT-Danube. Her key research topics include Collaborative Networks, Supply Chain Management, Knowledge Management, Production Planning and Control, Industrial Engineering, Team Management, Marketing, Cluster Development, Improvement of Organisation, Production, Quality and Work-flow, Auditing, Environment and Energy Management, Capacity Works, Implementation of Quality Standards EN ISO 9001, EN ISO 14001, Project Management, Gender, Vocational and Educational Training, Corporate Social Responsibility, Public Private Partnership, REFA- Consultancy.

Dr. Carla Hertleer

Textile Engineer works as a project coordinator at the Centre for Textile Science and Engineering at Ghent University.

She received a MSc. degree in Textile Engineering from Ghent University, Belgium in 1990.
For three years, she worked in a vertically integrated textile company that produces terry cloth. Then, she worked during six years in a bank office but in June 2000 she decided to return to her roots: textiles. She worked as a researcher at the Textile Department of Ghent University (current Centre for Textile Science and Engineering). She has given classes in weaving and Jacquard technology, but gradually (since 2000) her activities concentrated more on the new discipline of smart textiles, more specifically the research on electro-conductive textiles and on textile antennas. The latter research was carried out in collaboration with the Dept. of Information Technology of Ghent University and led to her PhD in 2009. Her research was carried out in the framework of national and European projects. She co-authored the first e-learning course on smart textiles and over 150 national and international publications on smart textiles. Since 2020, she is involved in the project coordination of several EU projects, amongst which an Erasmus Mundus Joint Master Degree WE-TEAM (World Textile Engineering).

Dr. Hassan Saeed

Dr. –Ing. Hassan Saeed is a textile engineering with specialization in garments manufacturing technology

Dr. –Ing. Hassan Saeed did his textile engineering with specialization in garments manufacturing technology from National Textile University Pakistan in 2005 and his M.Sc. in Textile and Clothing technology from ITM, TU Dresden in 2011. He has worked for the clothing industry in various positions in Pakistan and as a lecturer in Pakistan. Since 2013, he has been working as a research associate at ITM, TU Dresden where he received his doctorate in 2018. Dr. Saeed is also responsible for developing the curriculum, pilot syllabus, and digital course contents of other courses within the framework of the ICT-TEX project. He has expertise in clothing and textile production, product development, and quality management. His research interests are in clothing technology development, welding technologies, additive manufacturing, simulation, textile sensors, clothing comfort, and thermal Insulation.

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