

INDUSTRIAL TOURISM AS NEW PATH FOR SYSTEMIC DEVELOPMENT OF THE TERRITORY

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SUMMARY

Purpose of the study. The vitality and sustainability of a territory is achieved with the enhancement of its historical “roots”(historical-industrial foundations), but also and above all with the innovation of what is “new”. The real challenge for the economy of our territory is being able to link the “old” with the “new”, not a mere coexistence, but the former used as a lymph for the latter. This premise leads to the research question which is how the industrial patrimony can become a sort of fly-wheel for those individuals who need to generate/consolidate the outlook of their own business model.

Methodology. These research hypotheses have been analyzed by means of a simulation model, based on computational agents, developed by the authors within the IcxT L@B. The model, once parameterized, was applied to the local system of Biella.

Findings. A proposition of an “itinerary” (the territory of Biella) where it is possible to retrace the entrepreneurial history (for instance “ the Road of Wool”), locate the old establishments (narrating their entrepreneurial tradition) and highlight new (successful) firms. The value proposition of the “industrial tourist” can be combined with the “narration” of the industrial heritage and the “sharing” of entrepreneurial enterprises for new business opportunities.

Research limits. Having undergone the planning phase, this research proposition is entering the implementing phase with the involvement of local institutions, universities and local companies.

Practical implications. Both the described approach and the planning idea can form a loanable and scalable model able to revitalize different and competitive local contexts (Valleys).

Novelty of the paper. This research proposition is based on similar experiences implemented by the authors, but in foreign territorial contexts (Silicon Valley).

Keywords: Industrial Heritage, network, textile industry, simulation.

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1. The social system and sharing identity: a new role of the territory

The new transformations which are typical of the world's economy encourage social science scholars, managers and state administrators to test new observation perspectives that can interpret emerging logics on which lie, on the one hand, the company's competitive advantages and, on the other, the rivaled advantages of the territories.

The scientific interest in the industrial district model, a localized network of firms which cooperate together, has evolved towards three research fronts.

The first identifies the industrial district as a "self-organized" system, or rather a complex social and economic system resulting from a series of recursive interactions between its components and which is, at the same time, autonomous for what concerns the external environment (Biggiero, 1999). The second front suggests the application of analytical instruments that go from the firm's competence based theory to the industrial district model, conceived as a learning system and as a "deposit" of (latent) competence and tacit knowledge (Belussi, Pilotti, 2002). The cognitive perspective (Nonaka, Takeuchi, 1995) adopted by this front of studies emphasizes on both the acquisition and the development of knowledge. Finally, a third and more recent approach applies the ecological theory (Hannah, Freeman, 1989) to the industrial district analysis (Lazzaretti, Storai, 1999).

The managerial literature is almost unanimous when representing a sort of synergic cycle, virtuous in some cases but vicious in others, between the development/decline of the firm and the development/decline of the territory, in a process where firms and territories co-evolve as they are, reciprocally, resources and competitiveness for each other (Valdani, Ancarani, 2000). Moreover, there is a wide acknowledged agreement that competitiveness sources, whether of the firms or of the territories, have progressively shifted from tangible factors to intangible factors connected with knowledge (Brondoni, 2010).

The core of knowledge for development purposes now represents a paradigm and human capital seems to be the main factor suitable to guarantee a long-lasting development for the society in which we live (Rullani, 2004; Deiana, 2007).

The importance of knowledge as a strategic productive factor for those firms looking for a technological and organizational change is better understood if we make use of a systemic model able to explore not only the dynamics from likely interactions between human capital and other resources inside the company, but also the access to outside sources from which the firm can attain in order to combine the internal learning system with the external knowledge and competence, from the very first phase of the human capital development process within the organization. A model that also requires the creation of long-lasting relationships with external knowledge organizations (universities, local communities, other educational organizations).

The development of knowledge also depends on the interaction between economic operators and the system in which they operate, thus obtaining a dimension of common assets belonging "to those who have shared a story, a life or work context, a cultural matrix which gives meaning to some things, but not others" (Rullani, 2009). In particular, the enhancement of knowledge in its different forms goes through the integration of contributions made by several individuals who belong to the local reference system. In fact, these learning processes produce the best results thanks to the exchange of knowledge made between different people and different firms (Brondoni and Pironti, 2015).

Thus, a local economic development depends more and more on long-lasting interactions that involve a society and a territory, which results in supplying material and immaterial infrastructures, logistics hubs, and scientific knowledge.

The role that the territory can have in this circuit is that of "cognitive multiplier" which preserves the contextual knowledge generated by collective learning and favors a formal and informal exchange of knowledge, both codified and tacit.

A network model is, therefore, the model that can remove economic and institutional barriers and spread knowledge among the actors of the system.

This way every territory is redefined by being absorbed in a global chain logic. The global economy, along with the pervasive use of ICT, has shortened the distance between different places and inserted single territories in global chains which enhance their specialization and distinctive differences. This way every territory becomes a potential competitor of all the others, if it offers an imitable or replaceable competence or function. However, it can also be a potential complement if it specializes in distinctive functions and competences that can link it to other territories, in the co-production of values achieved by the same chain. Consequently, today the identity of every single place is starting to be defined as a condition of interdependence which, when consolidated, ends up modifying the distinctive traits of every territory. In the past, the inhabitants of a particular place felt like they belonged, whether they liked it or not, to a specific history and a territorial layout inherited from the past, and they accumulated experience, emotions and relationships which were mainly local. Today, along with these distinctive elements, each firm, person, community has learned to hybridize their place experience with the experience made in global networks and in exchange fluxes with the outside world.

The territory becomes an unfinished system (Rullani, 2010), that is a system which is always trying to regenerate its identity in relation to external events that de-construct it, but that – for various reasons- does not have the will or the power to close the circle. Its feedbacks can never completely reconstruct the system or its identity, but leave space to experiment new and unexpected solutions, making room for creativity of both the individuals and the solutions.

The territory that becomes a specialized hub or anchorage of trans-territorial chains is bound to change its historical identity, to a greater or lesser extent, in order to meet the functional needs and opportunities offered by the inter-exchange with the chain and the other territories it connects. In this transformation, which changes business models and distinctive factors day by day, the identity of the territory stops being given (by nature or history) and becomes instead, at least in part, a choice of those individuals who live or work in the territory.

I am not a firm from Biella because my headquarter is in Biella, but I am such because I choose to be part of one of those territorial systems by sharing those features which are positive to me and I choose to become part of it because, being the territorial system in evolution, I can exploit the energy that moves this macro transformation to my advantage, and consider to change – in part – the quality of the territorial system I have joined.

Local systems work mainly on the advantages/disadvantages of the physical or geographical distance, which are not only related to transportation costs (at a close distance), but concern the costs and benefits of knowledge, competence and relationship clusters that materialize in a specific territorial context.

Thus, a union of the chain's generative and connective activities (cognitive networks, relational networks) and proximity economies can be achieved within the territory for all those things that are generated or decentralized outside the ownership borders of a single firm and move towards a territory's synergic economy (Pironti et al, 2015).

From this perspective the territory has been effectively defined as a “complex, unique and hardly imitable relational space” (Rullani, 1999), which goes beyond the meaning of physical space and includes social and cultural connections. In our opinion, such a definition, when underlining uniqueness and hard imitability, makes us think about the pertinence of the territory's governing models that aim at elevated levels of general and abstract nature and that, to say it in Hayek's words, include a great “pretense of knowledge” (Hayek, 1989).

On the other hand, even firm models have shown several changes in the growing levels of vertical disintegration, labelled in various ways in literature – “extended” firms, “widespread” firms– all urging to indicate that activities carried out by the same organization at first are reallocated in distinct multi-territorialized entities (firms and others) but which were once territorially rooted.

2. Recovering territorial identity: the case Biella

We cannot talk about sustainable development of a territory without first conducting a knowledge project on it, that is without a periodical analysis of the transformation processes, in order to understand internal changes and broad spectrum relationships (Comoli, 1996). To come up with a growth plan and a possible enhancement it is necessary to identify the territory's prerequisites using its identity elements which analyze the present on the basis of its historical background, so there can be a projection of mid and long term scenarios in harmony with specific vocations, without neglecting that "the investigation of knowledge is not only of scientific and cultural value, but also an economic repercussion that would be foolish to ignore" (SETTIS, 2005).

Thus, the project of knowledge takes on a central role and provides ideas both for the conservation of valuable elements and for the planning of territory development and regeneration strategies, and also meets the awareness requirements of safeguarding the cultural heritage – in this specific case the industrial heritage – and provides a detailed background so that the values needed to identify present and future potentials can be acknowledged when planning encouraging actions and the economic-cultural support of the territory.

What is sustainable development? To say it in Claude Raffestin's words (2005) "it is the companies' ability to conserve or increase their autonomy in their relationship with material reality, and this can disappear, decrease or increase. Autonomy is the ability to make choices, and sustainable development is the ability to conserve the possibility of making choices." In other words, it is the essence of true development that combines economic growth with the greatest wellbeing for those who live in and make use of the territory. An economic growth that does not jeopardize progress conservation for future generations, but safeguards quality and quantity of their cultural and natural heritage.

The study of transformation processes and of the actors who have established them makes us compare the events, whether completed or still in progress, which have characterized the landscape defined by the European Landscape Convention as "an area of the territory, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors."⁴ Ironically, what emerges from these studies is that, besides the oldest characteristics whose consequences shaped the territory but, at the same time, remained indelible and integrated with each other, the cultural and social identification elements that stand out today, but are not yet completely assimilated, are the proto-industrial and industrial activities, testimonies of a working civilization that, since medieval corporations until today, have intertwined the history of Biella with that of the textile production, gaining extraordinary importance between the XIX and XX century.

In the middle of the XX century Biella's industrialization process was subject to machinery modernization and the spreading of complete cycle woolen factories which dominated the textile scenario until after the second world war. The industrial facilities triggered the beginning of other companies that improved the quality of the workers' employment and relational life and the agility of communications inside and outside the district, generating new architectures that substantially modified the original program, but did not blend with it. From multi-floor buildings patterned with a long sequence of nineteenth century homogeneous windows we went to new factory models that developed horizontally with shed depots that guaranteed the best lighting and made of reinforced concrete support structures with electrical power. These innovations revolutionized work perspectives and space management.

Biella's industrial heritage, which developed mainly along the vector, which is today called Strada della Lana (Wool Street), provides a multidisciplinary reading because it is both a cultural heritage and an economic engine historically connected with the manufacturing of wool. Starting from this awareness and in view of an enhancement that takes into account the cultural and socio-economic meaning of the place, the

⁴ See Art. 1, comma a), *Convenzione Europea del Paesaggio (Landscape European Convention)*, Florence, 20 October 2000.

old textile factories could become subject of cultural tourism and economic renewal, thus introduce heterogeneous activities and multiple experiences, global productions or, even more generally, co-operations with today's excellences, and look for new economic models suitable for the current needs of the market.

The process of de-industrialization in progress in Italy as well as in the rest of Europe must be perceived as an opportunity and stimulus to identify alternative ways to economic progress, starting from those excellent cases which can be found on the territory. The acknowledgement of cultural roots is very strong in Biella's industrial heritage – in the broadest sense of the term (Ronchetta, Trisciuglio, 2008) - not only because it is one of the major industrial systems in Europe but also because, thanks to its recovery and relationship re-appropriation, its social identity and local territory have regained importance.

Biella's district has been one of the greatest wool industry centers at a global level since the 19th century, with special mention to the textile sector. Its history is made of men and families who embraced two thirds of the looms in the Savoy State: solid family groups with total dedication to their work, open to new technologies, market growth and advanced industrial patterns (Castronovo, 1964). This determined the beginning of the industrial aristocracy, a social class whose work was not restricted to the wool industry alone, but also included the financial and estate sectors, and investments made in other textile segments such as cotton.

From the early days of domestic production and direct selling, production automation and the concentration of all the various working phases in the same place within the factory at the beginning of the XIX century caused a downstream movement of the factories, whose number had increased so much that the territory was marked permanently. In the seventies of the XX century Biella's production system went from a "vertical" organization, where the entire production cycle occurred inside the same company, to a "horizontal" one. This generated factories with specialized skills in a single production phase which gave rise to a technological transformation and a growing centralization of product design and marketing.

Among the most significant family groups were the Vercellones, an educated bourgeoisie that died out after the Unity of Italy. They stood out for their early ability to technologically modernize their machines and for their attitude of having business relations outside their family environment. The pioneers of the mechanical upgrade and production enhancement were the Piacenza family, since the XVIII century they were at the peak of the local textile aristocracy. They diversified investments and imported expertise from London markets and from French and Belgian woolen mills bringing to Biella new taste, new fashions and new working techniques. They also dedicated themselves to «typical activities of a capitalism actively involved in the economic and civil progress of the Country » (Castronovo, 1964)⁵ such as the creation of the railway line Santhià-Biella, the cooperation between industrialists, the introduction of power energy inside factories, and the technical training for the workers, which led to the opening of the Woolen-School in 1911. Today, the Piacenza brand is still present in the market with its historical background and high quality products, strong enough to overcome any economic crisis and able to supply an entrepreneurial model capable of updating itself.

The family in Biella who distinguished themselves in Piedmont for being the greatest entrepreneurial group were the Sella family. Manufacturers since the XVII century, they have given life to an industrial dynasty. Giovanni Antonio, belonging to the first family branch and being an army officer, predominated over his peers and achieved an industrial endowment which was one of the most remarkable in Piedmont. Pietro, belonging to the second family branch, contributed to mechanizing production which was enriched with the experience made during his trips abroad where he learned new ways of finding raw material and more advanced production systems and innovations which made him the emblem of the Industrial Revolution.

The symbol of the dynasty was the Italian Kingdom's Economic Prime Minister, Quintino Sella, who brought his family of manufacturing bourgeoisie to the highest degree by reorganizing production and promoting new road/railway infrastructures and training schools for factory workers. Starting from 1850

⁵ CASTRONOVO, 1964, pg. 142.

Giuseppe Venanzio, another member of the Sella family, renewed the industrial business by transferring to Biella the notions of chemical colors, trimming and dye-works from abroad. And in 1886, with Pietro Paolo, the Sellas joined the financial business and founded one of “the first banks aimed at encouraging a savings influx towards industrial investments”: the Bank Gaudenzio Sella, today’s Banca Sella. The woolen mill Maurizio Sella, which flourished on the banks of the Cervo river, ceased to work in 1965, but was reconverted with a new type of production, digital technology. In 1991 it became the premises of the Sella Onlus Foundation and in 2013 it was the home of SELLA LAB, an accelerator of ideas, a co-working space, a place where ideas could become enterprises. The entire building complex was subject to legal preservation under the Ministerial Decree of 29 July 1988 and restoration was agreed upon with the Superintendence of the Architectural and Landscape Heritage.

After the Italian Unity, there was the beginning of a new generation of entrepreneurs in the Biella area, the working children, who reversed the equilibrium of the existing entrepreneurial class. These were the families: Rivetti, Lanzone, Reda, Lesna Tamellino, Tabaldo Togna, Garlanda, Botto, Bertotto, Giletti, Zegna, Bozzalla Pel, Ferrua – Agostinetti, Mosca, Somano, Trossi and Boglietti. Having learned the trade, these entrepreneurial workers took over the old companies or areas that had abandoned machineries and started their own business. Among many of them were the Rivettis, workers in the Sella factory, who started their first company in Vallemosso where they brought forward revolutionary ideas like the use of regenerated wools or the design of an extremely modern wool brushing machine⁶. In 1930 they founded Gruppo Finanziario Tessile (Textile Financial Group) in Torino, where they made garments, reason for which they left the woolen mills in Biella.

Since 1910 Zegna’s history has been on the upsurge, confirming them today one of the major international textile groups. Along with Ermenegildo Zegna was the beginning of the first woolen mill in Trivero, a historic venue specialized in high quality yarns, still working today. He committed himself to perfecting production, but also to conveying the wellbeing founded on his company onto the territory and its inhabitants. For this reason he had a congress hall, a library, a gym, a cinema/theatre and a swimming pool constructed, and a little later even a medical centre and a kindergarten. He also dedicated himself to the local environment and landscape by planting trees and building the “Panoramica Zegna” road, a 14 km route linking Trivero to the skiing station Biemonte.

Among Vallemosso’s small textile workers who knew how to transform their knowledge into enterprises were the Reda family, whose business started in a mill in the second half of the XIX century and ended up having representatives who distinguished themselves for production, planning and professional training. Today the “Lanificio Reda” (wool mill) holds the complete production chain that goes from wool to fabric, and has diversified its interest with the use of artistic sponsorships.

Both in the first and in the second expanding phase of the industrial markets, despite their individualism, family groups were able to find dialogue and cooperation grounds in delicate socio-political and economic transformation moments. There was a broad consensus and a general will in 1855 when the construction of the railway line Santhià-Biella was approved, a very important line that connected the infrastructural systems in the north of Italy; or when they supported the achievement of important trading road links like the line Biella-Mosso-Valsesia (Castronovo, 1964); when they sponsored workers’ schools and kindergartens to help women workers; when they took part in the Associazione Italiana Laniera (Italian Wool Association) – whose vice-president was Felice Piacenza when it was first founded – and supported the birth of the Lega degli Industriali di Biella (Biella’s Industrial League) which had among its highest exponents Corradino Sella, already president of the Associazione Italiana Laniera (Italian Wool Association) since 1897.

In the twentieth century Biella’s woolen textile industry encountered great contrasts. An important moment of transformation was between the fifties and the sixties, when the equilibriums of the textile chain were revolutionized by fashion designers for whom exclusive fabrics were produced. Thus, producers lost

their fame in behalf of the stylists, subordinating their textile companies to transformation ones. This phenomenon increased in the seventies with the spreading of prêt-à-porter which required a great deal of fabrics exclusively linked to a label, decreasing even further the trading exposure of textile suppliers. During the 1963-1967 recession there was a loss of 7000 jobs in the Biella area but, at the same time, this forced a restructuring of the companies. Great establishments were broken down into pieces and integrated into small companies with sectorial specializations, this condition made Italy competitive both in the fabric sector and in the fashion industry (Fontana, Gayot, 2004).

Biella's companies that survived the recession radically renewed themselves in order to find new development trends. The Zegna family faced the decrease in wool demand by looking for new fine material and high performance fabric: machine washable woolen sailing-wear in 1974, summer wool in 1985, elegant and light fabric able to withhold heat in 1993, and in 1998 elegant and resistant fabric for business men. Since the late Sixties they were able to diversify their business by opening up to new kinds of wear and by moving their factories around the world (Balestri, 1997).

Thus, what are the historical-cultural, material and immaterial values of this territory? Granted that all of the territory itself is a cultural heritage, to ensure that this does not emerge as a generic analysis, we have to break down reality into pieces and let the stratifications and relations that make its complexity come to light. For this reason, the answer is articulate and needs a multifocal look in which the historical knowledge is just the basis necessary to interpret transformation processes. From a social point of view, it is a value that traditions and attitudes in the textile industry have shaped many generations of people but, from a landscape point of view, it is also a value to have a dichotomic coexistence between nature, still primitive and uncontaminated, and the mighty industries. This duality, however, does not seem so mismatched as to make one of the two feel extraneous. Another value is the infrastructural system of waters and their productive use, as well as the archive of the companies and their machines no longer in use. Both the physical and immaterial signs of the investigated phenomena make up a system of assets on which we can establish the interpretation of the present landscape and on which we can lay projects for the territory and its coherent development.

Today, the current situation states that the result of the knowledge project was satisfactory throughout the past years, but we still haven't found the way to turn knowledge into a reality awareness which can trigger local development processes.

In the last ten years the deindustrialization process has created problems for the entire industrial district despite the presence on the territory of productive leaders from a consolidated market, who left a concrete sign of production cathedrals, complexes built side by side and that speak a language which is different from the one used in the rural-mountain type buildings found in small villages (Bonardi, Natoli, 2005). It is right from these places that we should start, from the architectural structure of the industrial landscape which is in fact the most evident and, despite its dichotomic look, it is the principal and most typical part of the territory, as well as the identity ingredient that marks both society and its cultural aspect.

For these topics Biella's industrial district has become part of the great international debate whose common theme is the deep change that the global industrial system is going through, which translates, especially in the old developments, into the abandonment and closure of productive areas, the evacuation of the territory around them, and the general loss of trust and innovation stimulus. These same subjects give rise to a new future challenge, that is trying to find in one's own roots the reasons, strengths and ideas to reconstruct a new productive landscape, transform inactivity containers into a potential chance of conversion by acknowledging the industrial heritage as a lever of identity, quality and competitiveness in support of the possible development.

3. The model based on Agent Based Simulation

Why do enterprises team up? There can be many reasons for this strategy, leading, in its widest extent, to the creation of joint-ventures, i.e.: a new economical subject formed by two or more enterprises with the goal of new projects, or of clusters and networks of enterprises (Rieple et al, 2012, Tresca, 2013)). The leading cause for these phenomena is the optimization of the production, by resources and competences sharing. Agent based simulation is an effective paradigm for studying complex systems. It allows the creation of virtual societies, in which each agent can interact with others basing on certain rules. The agents are basic entities, endowed with the capacity of performing certain actions, and with certain variables defining their state. In the model presented here, the agents are reactive, meaning that they simply react to the stimuli coming from the environment and from other agents, without elaborating their own strategies. When the model is formally built and implemented, it can be run by changing a parameter at a time, and emergence of a complex behaviour occurs.

Agent based Modelling is thus one of most interesting and advanced approaches for simulating a complex system: in a social context, the single parts and the whole are often very hard to describe in detail. Besides, there are agent-based formalisms which allow studying the emergence of social behaviour through the creation and study of models, known as artificial societies. Thanks to the ever increasing computational power, it has been possible to use such models to create software, based on intelligent agents, whose aggregate behaviour is complex and difficult to predict, and which can be used in open and distributed systems.

In Franklin and Graesser (1997) we read that: *“An autonomous agent is a system situated within and a part of an environment that senses that environment and acts on it, over time, in pursuit of its own agenda and so as to effect what it senses in the future”*.

Another very general, yet comprehensive definition is provided by Jennings (1996): *“...the term [agent] is usually applied to describe self-contained programs which can control their own actions based on their perceptions of their operating environment”*.

Agents have traditionally been categorized as one of the following types (Woolridge, Jennings, 1995):

- Reactive
- Collaborative/Deliberative
- Hybrid

When designing any agent-based system, it is important to determine how sophisticated the agents' reasoning will be. Reactive agents simply retrieve pre-set behaviours similar to reflexes, without maintaining any internal state. On the other hand, deliberative agents behave more like they are thinking, by searching through a space of behaviours, maintaining internal state, and predicting the effect of actions. Although the line between reactive and deliberative agents can be somewhat blurry, an agent with no internal state is certainly reactive, and one that bases its actions on the predicted actions of other agents is deliberative.

The agents used in this paper are reactive, but organized in the form of a MAS (Multi Agent System), which can be thought of as a group of interacting agents working together or communicating among each other. To maximize the efficiency of the system, each agent must be able to reason about other agents' actions in addition to its own. A dynamic and unpredictable environment creates a need for an agent to employ flexible strategies. The more flexible the strategies however, the more difficult it becomes to predict what the other agents are going to do. For this reason, coordination mechanisms have been developed to help the agents interact when performing complex actions requiring teamwork. These mechanisms must ensure that the plans of individual agents do not conflict, while guiding the agents in pursuit of the system goals. Many simulation paradigms exist; agent-based simulation is probably the one that best captures the human factor behind decisions. This is because the model is not organized with explicit equations, but is made up of many different entities with their own behaviour. The macro results emerge naturally through the interaction of these micro behaviours and are often more than the algebraic sum of them. This is why this paradigm is optimal for the purposes of modelling complex systems and of capturing the human factor. The model

presented in this paper strictly follows the agent based paradigm and employs reactive agents, as detailed in the following paragraph.

The model is built in Java, thus following the Object Oriented philosophy (Barclay, Savage, 2004) and has been engineered and built at the *ICxT L@B*, University of Turin (Pironti et al., 2010). This is suitable for agent based modelling, since the individual agents can be seen as objects coming from a prototypal class, interacting among them basing on the internal rules (methods). While the reactive nature of the agents may seem a limitation, it's indeed a way to keep track of the aggregate behaviour of a large number of entities acting in the same system at the same time. All the numerical parameters can be decided at the beginning of each simulation (e.g.: number of enterprises, and so on). Everything in the model is seen as an agent; thus we have three kinds of agents: Environment, Enterprises and Emissaries (E³). This is done since each of them, even the environment, is endowed with some actions to perform.

Environment

This is a meta-agent, representing the environment in which the proper agents act. It's considered an agent itself, since it can perform some actions on the others and on the heat. It features the following properties: a grid (X,Y), i.e.: a lattice in the form of a matrix, containing cells; a dispersion value, i.e.: a real number used to calculate the dissipated heat at each step; the heat threshold under which an enterprise ceases; a value defining the infrastructure level and quality; a threshold over which new enterprises are introduced; a function polling the average heat (of the whole grid). The environment affects the heat dispersion over the grid and, based on the parameter described above, allows new enterprises to join the world.

Enterprise

This is the most important and central type of agent in the model. Its behaviour is based on the reactive paradigm, i.e.: stimulus-reaction. The goal for these agents is that of surviving in the environment (i.e.: never go under the minimum allowed heat threshold). They are endowed with a heat level (energy) that will be consumed when performing actions. They feature a unique ID, a coordinate system (to track their position on the lattice), and a real number identifying the heat they own. The most important feature of the enterprise agent is a matrix identifying which competences (processes) it can dispose of. In the first row, each position of the vector identifies a specific competence, and is equal to 1, if disposed of, or to 0 if lacking. A second row is used to identify internal competences or outsourced ones (in that case, the ID of the lender is memorized). A third row is used to store a value to identify the owned competences developed after a phase of internal exploration, to distinguish them from those possessed from the beginning. Besides, an enterprise can be "settled", or "not settled", meaning that it joined the world, but is still looking for the best position on the territory through its emissary. The enterprise features a wired original behaviour: internally or externally explorative. This is the default behaviour, the one with which an enterprise is born, but it can be changed under certain circumstances. This means that an enterprise can be naturally oriented to internal explorative strategy (preferring to develop new processes internally), but can act the opposite way, if it considers it can be more convenient. Of course, the externally explorative enterprises have a different bias from internally explorative ones, when deciding what strategy to actually take.

Finally, the enterprise keeps track of its collaborators (i.e.: the list of enterprise with whom it is exchanging competencies and making synergies) and has a parameters defining the minimum number of competencies it expects to find, in order to form a joint. The main goal for each enterprise is that of acquiring competences, both through internal (e.g.: research and development) and external exploration (e.g.: forming new links with other enterprises). The enterprises are rewarded with heat based on the number of competences they possess (different, parameterized weights for internal or external ones), that is spread in the surrounding territory, thus slowly evaporating, and is used for internal and external exploration tasks.

Emissary

These are agents that strictly belong to the enterprises, and are to be seen as probes able to move on the territory

and detect information about it. They are used in two different situation: 1) if the enterprise is not settled yet (just appeared on the territory) it's sent out to find the best place where to settle. 2) if the enterprise is settled and chooses to explore externally, an emissary is sent out to find the best possible partners

While moving, the emissary consumes a quantum of heat, that is directly dependant on the quality of infrastructures of the environment.

In order to formally describe the model, a set of equations is described in the following.

The multi agent system at time T is defined as:

$$MAS_T = \langle \bar{E}, \bar{e}, \bar{\epsilon}, \overline{link} \rangle \quad (1)$$

Where \bar{E} represents the environment and is formed by a grid $n * m$, and a set \bar{k} :

$$\left\{ \begin{array}{l} \bar{E} = \langle n * m, \bar{k} \rangle \\ n, m > 0 \end{array} \right. \quad (2)$$

Where the set \bar{k} defines the heat for each cell, \bar{e} is the set of enterprises with coordinates on the grid, and $\bar{\epsilon}$ is the set of the emissaries, also scattered on the grid:

$$\left\{ \begin{array}{l} \bar{k} = \langle k_{i,j} \rangle \\ \bar{e} = \langle e_{i',j'} \rangle \\ \bar{\epsilon} = \langle \epsilon_{i'',j''} \rangle \\ 0 < i, i', i'' \leq n \\ 0 < j, j', j'' \leq m \end{array} \right. \quad (3)$$

Each enterprise is composed by a vector \vec{c} , and an emissary (ϵ_e). The vector \vec{c} defines the owned competences, with a length L and competences C_l represented by a boolean variable (where 1 means that the l^{th} competence is owned, while 0 means that it's lacking):

$$\left\{ \begin{array}{l} e_{i,j} \ni \vec{c}, \epsilon_e \\ \vec{c} = (L, C_l) \\ 0 \leq l \leq L \\ C_l = \text{Boolean} \end{array} \right. \quad (4)$$

In $T = t > 0$, $k_{i,i}$ that's the heat of each cell on the grid, depends on the heat produced by the enterprises (K_e) and the dispersion effect (d). The heat of each enterprise is function of the competences it possesses and of the behavior it carried on in the last turns (b_e).

$$\left\{ \begin{array}{l} \text{if } (b = \text{success}) \text{ then } C_l = 1 \\ \text{else } C_l = 0 \\ b \in \bar{b} \end{array} \right. \quad (5)$$

In particular, a certain behavior can be successful, meaning that at the end of a phase of internal or external exploration, a new competence (internal or outsourced, respectively) will be possessed. Otherwise, a it's unsuccessful when, after some steps of research and development (internal exploration) or external market research to find a partner, nothing new is found, and thus the l^{th} competence remains zero.

At each time-step the set of links (connecting two enterprises together) is updated basing on the competences of the enterprises.

$$\begin{cases} \overline{\text{link}} = < \text{link}(e_{i,j}, e_{i',j'}) > \\ \text{link}(e_{i,j}, e_{i',j'}) = f(\overrightarrow{c_{e_{i,j}}}, \overrightarrow{c_{e_{i',j'}}}) \end{cases} \quad (6)$$

Specifically, when an enterprise does external exploration, it looks for a good partner, i.e.: an enterprise with a number of competences to share.

4. An empirical analysis

Why does the competitive context identified as “Strada della Lana” (Wool Road) seem to have lost its competitive boost?

The diagram confrontation (see fig. 1 and 2) shows, despite the necessary reductions and simplified illustrations, the scenario’s evolution in the last century. In fact, you can see a slow and progressive movement that goes from a chain economy to the emergence of specialized operators who have limited activities of collaboration and exchange. Few of them can link their market image and brand to the value of territorial identity.

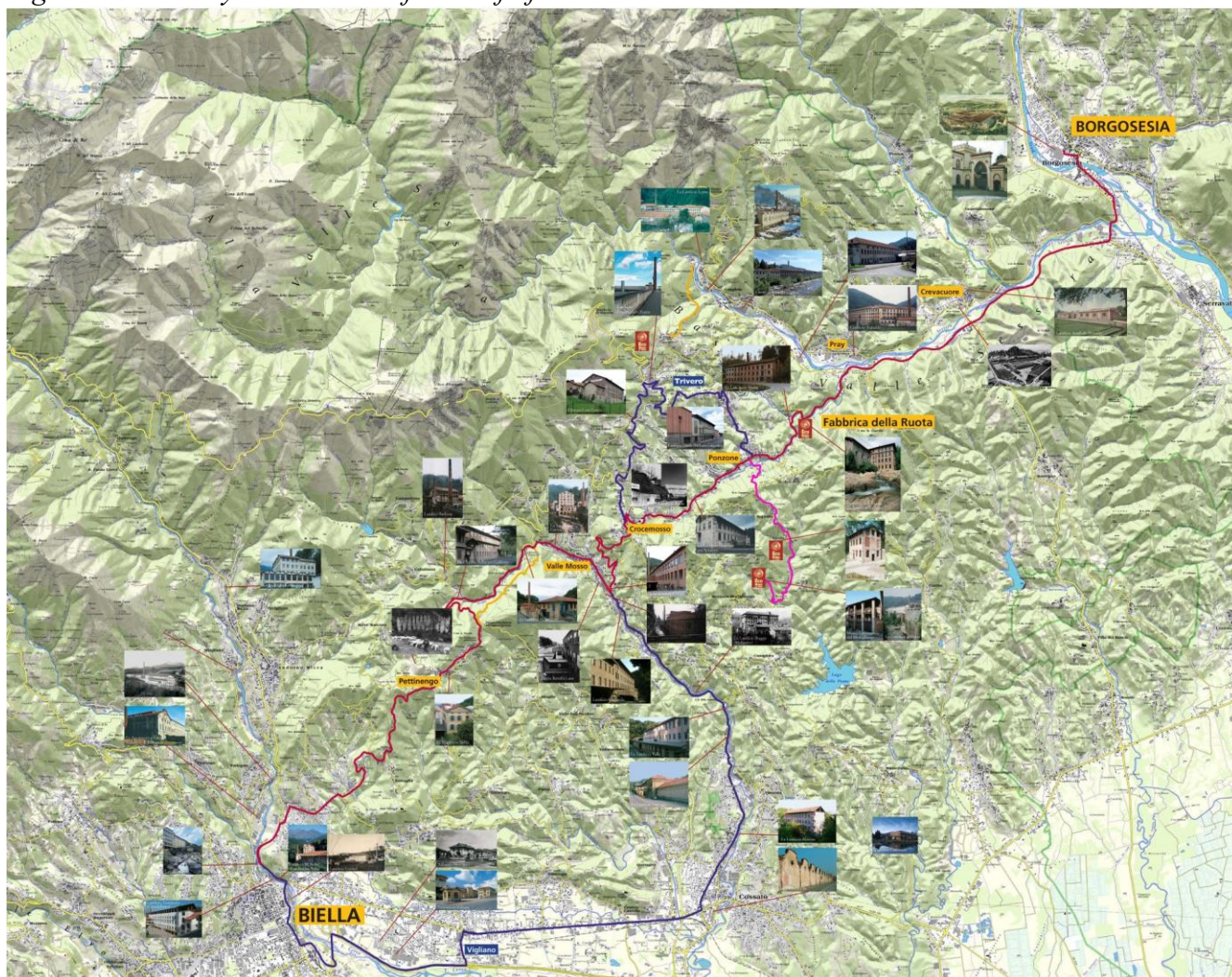
Hence, the growing emphasis of the firm’s supply models that – first the design, but also the brand (a generator of meaning and identity) and the distribution (a range of experience in which the consumer perceives the brand’s value and identity) – outline and defer to the several dimensions that characterize a cultural experience.

These symbolic dimensions of consumers’ experience are very important when managing operational and organizational processes in the textile industry, whose benefits have a very intensive role in the processes of construction, communication and development of the consumer’s identity. Of course these are extremely intimate benefits for the individual and, thus, directly involved in the consumer’s introspective dialogue. At the same time, they are also instantly social benefits and, thus, play a role of communication channels in dialogues with others. Being at the origin of innovation processes for fashion products, creative skills are fundamental to handle this critical relationship between firms and consumers. Therefore, their development and enhancement take on a major strategic value for the fashion industry’s competitiveness, as well as for any industrial policy on this key component of products Made in Italy.

In a more and more aggressive competitive global context the choice of counting on the distinctive value of creativity is definitely not new. It has already been adopted by many leading Italian producers, who have made design and communication processes their central component. A little more uncertain is understanding how creativity can be a key competitive driver even for that –incredibly wide - part of the textile industry that cannot count on brands or on consolidated sales networks, or that acts as a service provider to support the leading industries of this sector. Especially more complex seems to be the task of outlining all the different types of competences, not just the strictly creative ones, involved in the stylist innovation process, but understanding how they are distributed along the chain and how they can be integrated in the development phase of new fashion ideas.

Thus, the ability of the textile system to consolidate a creativity based competitive ranking cannot overlook the wide distribution of skills needed to obtain an offer full of high creativity not only for the ultimate industry, but for all the stages of the chain, knowing that creativity is a kind of knowledge that requires a great deal of experience and that, in order to be enhanced, needs to be integrated with manufacturing practices and skills.

Fig. 1: “Biella’s system” “in the first half of 1900”

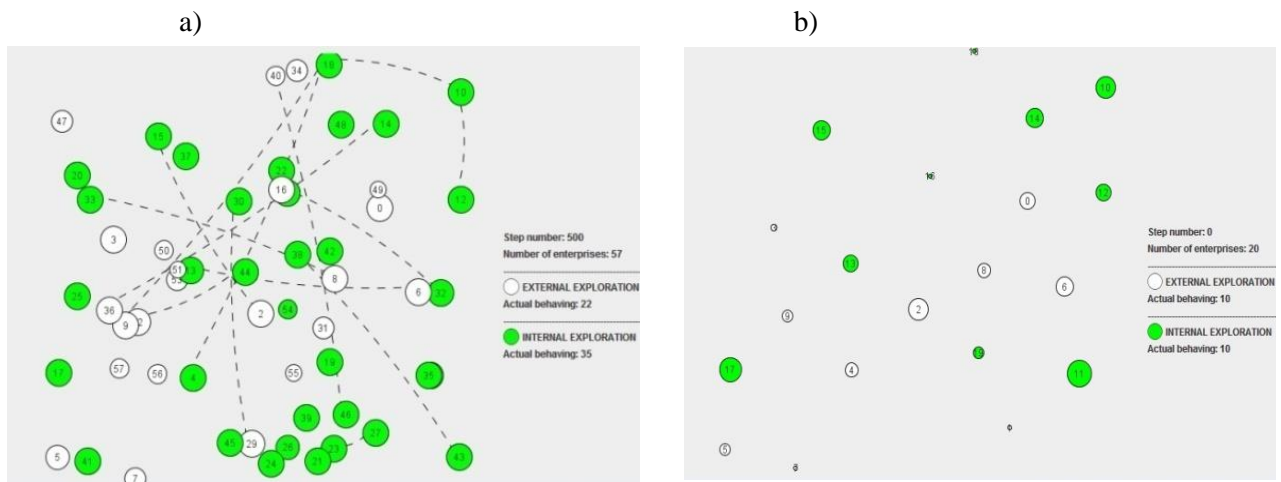


Source: DOCBI- Centro Studi Biellesi (Biella's Center of Studies)

Fig. 2: “Biella’s system” “today” (b)



Fig. 3: Output of the simulation model E3 in $T = t < t'$ applied to “Biella’s system” “in the first half of 1900” (a) to “today” (b)



Source: Processing our agent model

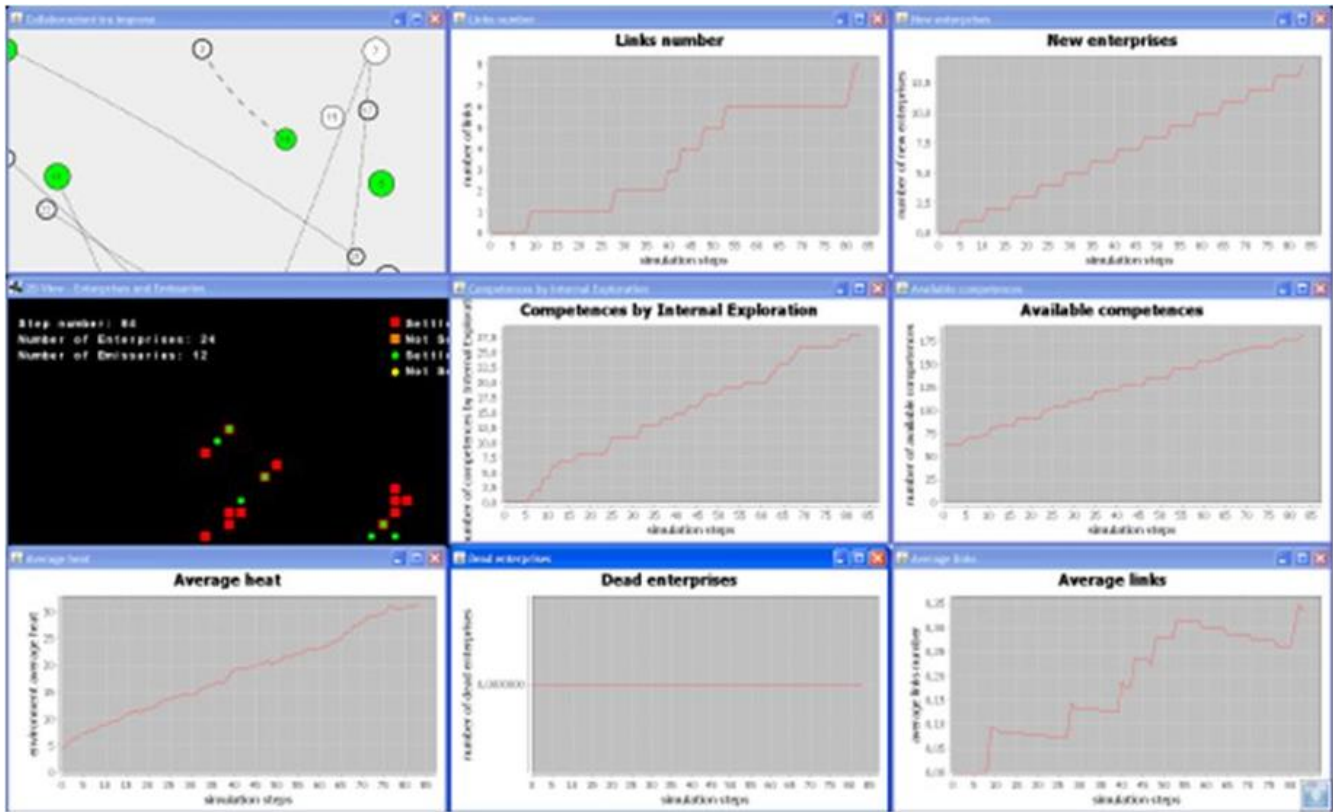
When simulating a different inclination towards the exploration of an internal exploitation focus, you can note (see fig. 4) the effect on both contexts in terms of network density, innovation distribution rate, and the number and dimensions of links (nodi).

Fig. 4: Panel of simulation indicators

Maximum number of steps (0 no limits)	<input type="text" value="15"/>		
Initial number of Enterprises (0 random)	<input type="text" value="10"/>		
Initial heat for Enterprises	<input type="text" value="20"/>	Mean	<input type="text" value="5"/> Variance
Number of competences	<input type="text" value="10"/>		
Competences possessed at startup for each enterprise	<input type="text" value="6"/>	Mean	<input type="text" value="2"/> Variance
Threshold for new Enterprise to enter the market	<input type="text" value="1"/> %		
Infrastructure quality	<input type="text" value="1"/>		
Minimum heat threshold	<input type="text" value="4"/>		
Minimum percentage of competences to share for link creation	<input type="text" value="1"/> %		
Emissary step cost	<input type="text" value="5"/> %		
R&D internal exploration duration (steps)	<input type="text" value="3"/>		
Internal exploration cost (per step)	<input type="text" value="1"/> %		
Environment control cycles	<input type="text" value="5"/>		
Threshold for infrastructure improvement	<input type="text" value="0"/> n.a.		
Index for infrastructure improvement	<input type="text" value="0"/> n.a.		
Heat dispersion index	<input type="text" value="9"/> %		
Lattice dimension	<input type="text" value="10"/> x <input type="text" value="10"/>		
Initial External Exploration cost	<input type="text" value="15"/> %		
Propensity to External Exploration of new Enterprises (average n. of links)	<input type="text" value="0"/> . <input type="text" value="2"/>		
Number of initial Enterprises doing External Exploration	<input type="text" value="5"/>		
Propension to Internal Exploration for externally explorative Enterprises	<input type="text" value="6"/> %		
Propension to Internal Exploration for internally explorative Enterprises	<input type="text" value="4"/> %		
Value of internal competences	<input type="text" value="1.1"/>	Value of external competences	<input type="text" value="1.0"/>

1.1.1

Fig. 5: Output diagrams for the analysis of simulation results



Fonte: Processing our agent model

5. Conclusion

The vitality and sustainability of a territory requires the enhancement of its historical “roots” (historical-industrial sub-layer), but also and above all the innovation of what is “new” (new businesses, consolidated businesses with new innovation-based business models, business networks, and networks of profit and non-profit companies/institutions/organizations).

The real challenge for a territory’s economy is the ability to integrate the “old” with the “new”, the former should be life for the latter, not just a simple coexistence- often forced and/or endured. In order to do this, all of the stake-holders must have the need and convenience to share this co-evolution journey.

Given these conditions, the research issue is based on how the industrial heritage can become a leverage for those subjects who must generate and consolidate their own eventual business model.

This research idea focuses on the definition of a “journey” hypothesis (for example Biella’s territory) where the entrepreneurial history can be relived (for example the “Strada della Lana”) by collocating the old industries (narrating their industrial traditions) and underlining their new (successful) enterprises.

The value proposition of the “industrial tourist” is connected to the “narration” of the industrial heritage and the “sharing” of new enterprises for business opportunities in terms of industrial, technological partnerships or as acquisition markets.

These research hypothesis have been analyzed using an agent simulation model developed by the authors at ICxT L@b. The evolution of the subjects that make up the network and their dynamics have been assessed with statistics and data mining⁷ instruments.

The model created, suitably parameterized, was applied to Biella’s local system in order to analyze the main dynamics that enabled, at a first stage, to adapt to continuous competitive changes and, at a current

⁷ The use of these instruments has enabled to compare the results of the model with those empirically observed.

stage, to gradually lose their competitive drive, except for a restricted number of companies consolidated on national and international markets.

The application of model E³, created by the authors, to the evolution models that Biella adopted in the last century shows, in fact, how the different initial structure of the regional network and its evolution can affect the development of external economies (developed within the model through external exploration strategies) and competitive advantages based, in particular, on spreading and sharing innovative skills and knowledge.

In the first half of 1900, Biella was much more than a built up area of single companies, expert workers, capital assets and technology. It was a complex scheme of an inter-enterprise network of producers who tried to support both innovation and group growth, a solid network system that helped to spread innovation in a more effective way, a scenario in which companies tried to define their contractual relationships with external suppliers by creating strong connections based on consolidated partnerships in a sector that showed a greater and greater intensive capital and that took on the full responsibility for product design and innovation process.

A scenario that today sees the established relationships between large companies and small and middle sized subcontractors, and each of them contributes to providing technology and productive capacity, with a limited contribution to the coevolution innovation process but without creating stable and strategic connections.

As Renzo Piano says about the Italian cultural heritage and the need to revitalize it with actions by those actors who can be found in the current competitive arena, “we are dwarfs on giants’ shoulders”. The industrial heritage, as cultural heritage, especially the one connected with the manufacturing that in the past was a distinctive trait of the Italian firms’ competitiveness in the global scenario, is our “giant” on whose shoulders are the “dwarfs” - the present economic, institutional and cultural operators - that, through actions of the “system” must try not to waste the enormous historical-industrial inheritance, but enhance it as a leverage of competitive advantage. A heritage consolidated through centuries of industrial history that no other economy in the world is able to “narrate” and that can become the motivation for relaunching new competitive models.

Several studies highlight the inadequacy of the traditional competitive view of the relationships between companies in favor of a market structure that, instead, sees companies ready to cooperate. Thus, cooperation describes a new competitive profile: from firm-to-firm competition to a network-to-network competition (Vicari, 1989).

Therefore, the authors’ proposition goes towards a change of the firms’ strategic attitude, aimed at overcoming what the geneticist Cavalli Sforza emblematically defined as the “Palio di Siena Syndrome”: the competitor’s goal is losing so that the opponent loses too, instead of winning together.

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ABSTRACT

The vitality and sustainability of a territory is achieved with the enhancement of its historical “roots”(historical-industrial foundations), but also and above all with the innovation of what is “new”. The real challenge for the economy of our territory is being able to link the “old” with the “new”, not a mere coexistence, but the former used as a lymph for the latter. This premise leads to the research question which is how the industrial patrimony can become a sort of fly-wheel for those individuals who need to generate/consolidate the outlook of their own business model.

These research hypotheses have been analyzed by means of a simulation model, based on computational agents, developed by the authors within the IcxT L@B. A proposition of an “itinerary” where it is possible to retrace the entrepreneurial history, locate the old establishments (narrating their entrepreneurial tradition) and highlight new (successful) firms.