

# MANAGING A COMPLEX ADAPTIVE ECOSYSTEM: TOWARDS A SMART MANAGEMENT OF INDUSTRIAL HERITAGE TOURISM

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## ABSTRACT

This paper is focused on the concept of business ecosystem, which is a relatively new field in management research. Furthermore, there is a second emerging research approach in social sciences named “complexity theory” that considers ecosystems, and business ecosystems, as complex adaptive systems. The main aim is to connect both by bringing new insights under the basis of a smart vision of tourism. In particular, we propose a theoretical discussion of the aforementioned concepts by applying them to the specific context of Industrial Heritage Management. The Industrial Heritage (i.e.: mining sites, old infrastructures, museums and historic places related to industry...) is chosen because it appears well representative: it is characterized by a complex and dynamic structure which consists of an interconnected population of stakeholders and several tangible and intangible resources to recover, organize and then manage. It follows that the management of this ecosystem should take into account many factors simultaneously. Based also on the emergent initiative of Smart Tourism, a conceptual model is presented, in which each component is explained and the focal complexity aspects appearing in this business ecosystem are highlighted. We conclude with a set of propositions for recommending new paths for future studies.

**Keywords:** Business Ecosystem, Complexity Theory, Industrial Heritage Management, Smart Tourism.

**JEL Classification:** Z31, M19, M29.

## 1. INTRODUCTION

The increasing importance of the recovery of Industrial Heritage (IH) has highlighted the depth and the distinctiveness of the work places that belong to complex systems and complex mechanisms. Such complex systems which, according to the importance of the factories and their productive specialization, are articulated in space, connoting entire cities, entire territories and, consequently, entire destinations. All of this has contributed to make visible the importance of existing assets (archives, machines, buildings, infrastructure, etc.) and, at the same time, to affirm the necessity of a working specialist, scientific and unified methodology to manage this complex system. Since the second half of the 1990s there has been an increasing awareness of management scholars and the issues related to the management of IH and the reflexes that the reinforcement of this sector can have in ensuring the development of the area by increasing tourism and the involvement of many actors.

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Starting from the need to proceed with unitary projects - which include the set of all the components present in the perimeters concerned - the central problem is that of a recovery and management approach in a smart vision. Working in this direction means taking attitudes that must be accompanied by a set of interdisciplinary skills. The panorama becomes even more complex when a mix of other disciplinary approaches is involved, such as environmental and urban studies, humanities, sociology, and others. Thus, the revitalization process involves economic, social and cultural transformations that require sophisticated management strategies (Lashua, 2013).

Projects of IH retraining and subsequent management involve complex forms of connection between the plethora of involved stakeholders. It requires an approach in which stakeholders do not create value in isolation (Hakansson & Snehota, 1989), but are involved in processes of value creation and cooperation (Pralhad & Ramaswamy, 2004). It follows that the value is not simply exchanged within a transaction, but it is created by everyone who takes part, in an interactive ecosystem view as a complex adaptive system, to a process that involves all stakeholders, each with his own perspective and his aim.

For these reasons, the main aim of this paper is to contribute to the definition of a conceptual model of Smart Tourism based on Industrial Heritage Management (STIHM). The chosen research method is conceptual analysis with a model proposal. Data is gathered through literature research, which takes into account articles written about complexity in the field of management, business ecosystems and smart tourism. Finally formation and reasoning of our own interpretation in the field of Industrial Heritage Management are shown.

In this line, this work has been structured as follows: the first section on complexity theory in the field of management; the second on the concept of business ecosystem as a new form of organization; the third on the concept of smart tourism; and the last one, on the base of this theoretical approach, is on our contribution related to the STIHM conceptual model. The work concludes with a set of propositions for recommending new paths for future studies.

## **2. THE COMPLEXITY THEORY IN THE FIELD OF MANAGEMENT**

The complexity theory, relatively new in science in general and in the social sciences in particular, specifically addresses the phenomenon of “complexity” and explains the behavior of complex systems (Johnson, 2011).

Early approaches to complexity arise with studies on Cybernetics in 1942, during the World War II and many of the concepts developed in its field have merged in maturing theoretical corpus of complexity. In 1984, a diverse interdisciplinary group of researchers spanning physical, biological and social sciences were brought together to study complex systems based on nonlinear thinking from the cellular level to human society (Gell-Mann, 1994). In fact, the complexity theory draws on diverse fields, such as meteorology, mathematics, physics, chemistry and biology and the field of research has grown over the last two decades bringing together a variety of associated models, theories and institutional research programs (Burnes, 2005). It has also been identified (Manson, 2001) that the field builds upon a variety of earlier research including: the philosophy of organism (Whitehead, 1925); neural networks (McCulloch & Pitts, 1943); cybernetics, as we said (Wiener, 1961); cellular automata (von Neumann, 1966); and General Systems Theory (von Bertalanffy, 1968).

Within these scientific disciplines, took place an array of transformations, known as chaos, complexity, non-linearity and dynamical systems analysis. There is a shift from

reductionist analyses to those that involve the study of complex adaptive (“vital”) matter that shows ordering but which remains on “the edge of chaos” (Urry, 2005).

Widely recognized as the leading institution on complexity is the Santa Fe Institute, composed by a diverse group of researchers: biologists, physicists, economists, computer scientists, chemists and mathematicians. Over the past 30 years, the work of the Santa Fe Institute and others have shaped our understanding of complexity with a rapidly growing body of literature that examines the characteristics of complex systems and complexity approaches (Waldrop, 1992; Kauffman, 1993; Lewin, 1993; Gell-Mann, 1994; Casti, 1994; Capra, 1996; Flake, 1998).

The Santa Fe Institute developed the initial framework from which most other research evolved and it is from the premise and basic work of Santa Fe that the other major contributors in this area started their work on Complex Adaptive Systems (CAS) to describe a system that adapts through a process of “self-organization” and selection into coherent new behaviors, structures and patterns (Dann & Barklay, 2006). Many disciplines involved copious research of Santa Fe: all, however, revolve around concepts such as emergency, non-linearity, self-organization, adaptation, co-evolution, experience, learning, multiple equilibrium and margin of chaos. Wanting to trace a common unit of analysis, this could be recognized in the complex system, expression with which researchers denote any phenomenon that emerges from the interaction of the elements that it consists of.

The complexity arises because many elements interact simultaneously and self-organize locally (i.e. from the *bottom-up*); the complexity is, therefore, in the organization of the elements of the system, or better in their self-organization; it is the system that selects, that opts for one of the countless combinations in which its members can interact: it is the system that chooses one of the possible models of orderly and coherent interaction, without the intervention of any external agent in the selection. Complex systems are characterized by the following properties (Cilliers, 1998; Manson, 2001; Norberg & Cumming, 2008; Mitchell, 2009):

1. Non-linear relationships between entities which are most often from the immediate surrounding; thus lacking an overarching control or unified purpose. These interactions are mostly local and rather simple. What this implies is that given this large number of non-linear relationships, it is very unlikely that there is a unified purpose of the system (Cilliers, 1998; Manson, 2001; Mitchell, 2009).
2. Internal structure to dictate that sub-systems of close entities are formed within the system. Manson (2001) describes internal structure as being formed by tight connections between components, thus forming sub-systems. This means that relationships of varying strengths dictate which components will be close together forming sub-systems within the system;
3. Open systems that interact with their environments.
4. Learning and memory to process information concerning their environment, storing it as to survive (Cillier, 1998; Mitchell, 2009).
5. Self-organization in order to change and adapt when necessary; specifically self-organization refers to the changing of internal structure to better adapt to its environment, thus change and evolution are inherent in complex systems. Complex systems organize from within, responding and adapting collectively to stimuli external to the system boundary (Johnson, 2011).
6. Emergence as a result of non-linear relationships between a system’s components and a form of synergism between them (Mihata, 1997).

Since the open-systems view of organizations began to diffuse in the 1960s, complexity has been a central construct in the vocabulary of organization scientists (Anderson, 1999). As argued by Anderson (1999), the first article published in *Organization Science* suggested

that it is inappropriate for organization studies to settle prematurely into a normal science mindset, because organizations are enormously complex (Daft & Lewin, 1990). It means that the behavior of complex systems is surprising and is hard to predict, because it is nonlinear and one or two parameters can change the behavior of the whole system. Complex systems change inputs to outputs in a nonlinear way because their components interact with one another via a web of feedback loops (Anderson, 1999).

During the 1990s, there was an explosion of interest in complexity as it relates to organizations and strategy. Complexity theory offered a number of new insights, analytical methods, and conceptual frameworks that have excited many scholars of management in recent years. It suggests that simple deterministic functions can give rise to highly complex and often unpredictable behavior, and yet this complexity can still exhibit surprising order and patterns. It may offer a synthesis of two competing perspectives on how organizations adapt to their environments, organizational adaptation and population ecology (Levy, 1992).

If we consider the nature of the organization, the classical model considers the organization as a “one mind” system typical of organic models, while in the complex model is considered as a “many minds” system. This is what Gharajedaghi (1999) defines “social model” as follows: in a perspective of self-organization, the individual elements contribute to the absorption of the complexity through a *bottom-up* process. Thus, applying the typical approaches of complexity to management implies the adoption of “complex” managerial models as opposed to the “classic” managerial models. Significantly, complex theory challenges both the source and characteristics of order in complex systems, traditionally associated with linear relationships and incremental progression governed by globally optimized decision making.

Economic and social systems are not only evolving, for example, because of technological innovation, but are also governed by the actions of intelligent, cognizing, strategy forming individuals and organizations. In seeking a new basis for understanding and making decisions, we should therefore look at complexity theory and its insights when looking at creative, evolutionary, and strategic behavior.

We have to consider that the complexity theory is also a broad-based movement that contains new tenets about a type of system, referred to as Complex Adaptive Systems (CAS). According to Holland (2002), a scholar of the Santa Fe group, the CAS add to features already described for complex systems a key one: adaptation or learning. He argued that the CAS not only denote mostly a non-linear behavior, but they are adaptive, in the sense that do not simply react passively to events, but shall endeavor proactively to turn any circumstances to its own advantage (Holland, 2002).

Actors, with their various roles and becoming increasingly important, often prove to have the ability of a greater understanding of the external variability. Instead, complexity theory argues that adaptive strategies not dependent on rational choice or full information hold sway. The consequences are emergent changes or self-organization as a result of localized decisions by operating agents in the system, which deny the traditional prediction capacity, since in CAS “*small inputs can lead to dramatically large consequences and very slight differences in initial conditions produce very different outcomes*” (Lewin, 1993: xx). This is the so-called “butterfly effect”, which basically means that small causes can have large effects because of such complex interactive feedback-driven nonlinearities; in other words, small changes of one variable in a CAS can produce major differences in the system’s behavior over time (Waldrop, 1992; Lorenz, 1993; Coveney & Highfield, 1995; Holland, 1995; Kauffman, 1995; Capra, 1996; Flake, 1998; Lewin, 1999; Selten, 2001). Therefore, the eventual outcome of a system’s behavior is highly responsive to very minor variations in its initial state and therefore, again, inherently impossible to predict.

There is at present no generally agreed definition of what counts as a CAS. However, four traits are commonly found in the literature.

- First, CAS consists of agents (e.g., cells, species, social actors, firms and nations) assumed to follow certain behavioral schemata.
- Second, as no central control directs the behavior of agents, self-organization occurs when agents are acting on locally available information about the behavior of other nearby agents.
- Third, as a result of this, co-evolutionary processes driven by agents' attempts to increase individual it gives rise to temporary and unstable equilibriums, which in turn generate the shifting system behavior with limited predictability (often denoted emergent properties) associated with CAS (Holland & Miller, 1991; Levin, 1999; Anderson, 1999).

Thus, each CAS is formed by a network of many agents that operate in parallel: each of them is located in an environment determined by its own interactions with the other agents of the system. Each agent acts and reacts continuously based on the actions and reactions of others; in a word, it co-evolves, or rather it tries to adapt constantly.

CAS are unique and desirable in their ability to adapt rapidly and creatively to environmental changes. Complex systems enhance their capacity for adaptive response to environmental problems or internal demand by diversifying their behaviors or strategies (Holland, 1995). Diversification, from the perspective of complexity science, is defined as increasing internal complexity (number and level of interdependent relationships, heterogeneity of skills and outlooks within CAS, number of CAS, and tension) to the point of, or exceeding, that of competitors or the environment. Adaptive responses to environmental problems include counter-moves, altered or new strategies, learning and new knowledge, work-around changes, new allies, and new technologies. By increasing their complexity, CAS enhance their ability to process data (Lewin, 1992), solve problems (Levy, 1992), learn (Levy, 1992), and change creatively (Marion, 1999).

In CAS, governance systems have been characterized by five elements (Vargas, 2016):

1. An adaptive system embraces an undefined set of interrelated agents or elements. These agents influence each other in mutual and multiple ways. At the same time, all agents are assumed to have relative autonomy. This means that each agent is capable to respond to external events and pressure in an individual way (Eldelson, 1997; Chiva-Gómez, 2003).
2. CAS are nested, in the sense they have a hierarchy of embedded layers, which are, however, hard to define. The layers and subsystems co-evolve with each other.
3. The external context can be of great importance for the evolution process. Adaptive system development depends upon the interaction between the composing agents and their surrounding systems. The interaction between a nested governance system and its context can be visualized as a set of negative and positive feedback loops.
4. A complex system will normally develop in a non-linear pattern. The interactions between agents will be changing over time and this will create a whimsical pattern. It is almost impossible to predict the dynamics in interaction, because each agent can decide to change course.
5. The course of development of complex systems depends upon the initial conditions of each new step of action. Relatively small changes in those conditions may generate a significant system leaps.

In this sense, applying CAS theory to management not only will have consequences for the analysis of stability and change, but also for the view on leadership. Traditionally, leadership is about one person and one single actor in charge. In CAS, we have an adaptive leadership. It is an emergent, interactive dynamic that produces adaptive outcomes in a social

system (Uhl-Bien *et al.*, 2007). Adaptive leadership is a collaborative change movement that emerges nonlinearly from interactive exchanges, or, more specifically, from the “spaces between” agents (Bradbury & Lichtenstein, 2000; Lichtenstein *et al.*, 2006). That is, it originates in struggles among agents and groups over conflicting needs, ideas, or preferences; it results in movements, alliances of people, ideas, or technologies, and cooperative efforts. Adaptive leadership is a complex dynamic rather than a person (although people are, importantly, involved); we label it leadership because it is the proximal source of change in an organization (Uhl-Bien *et al.*, 2007).

In addition to suggesting new ways to model nonlinear, dynamic behavior in organizations, CAS theory has rich implications for the strategic management of organizations; CAS models afford exciting new opportunities for analyzing complex systems, as business ecosystem, without abstracting away their interdependencies and nonlinear interactions, and this is particularly important for our research. For these reasons, the conceptual leap to be taken in the next section is to define the concept of business ecosystem to highlight how different complexity aspects appear in it.

### **3. COMPLEXITY AND A NEW FORM OF ORGANIZATION: THE BUSINESS ECOSYSTEM CONCEPT**

In today’s increasingly competitive world, organizations compete and interact among each other through innovative and unexpected ways and they need each other to survive. In it, a distributed, inter-connected, self-motivated and self-activated intelligence is critical. As we argued above, decision-making processes implemented according to the classical model are determined, following a specific procedure, whereas in the complex model they are unknown, constantly challenged and modified in real time. We should also consider that in an innovative economy, organizations do not act in isolation, but mature as a result of interacting with each other within a network (Davenport *et al.*, 2006; Amaral & Figueira 2016). This definition is known as the new world of business ecosystems, which indicate interactions among various actors (Chesbrough, 2007). Even if several academics have already commented on this concept, there is still a lot of work to be done to establish it, starting for example from the definition that is still vague (Shang & Shi, 2013). However, business ecosystem is a highly descriptive expression for the complex business environment which is the reality for most organizations nowadays.

The term “Business Ecosystem” was first used by Moore in 1993 and was subsequently developed by various scholars who studied it from different perspectives (i.e.: den Hartigh *et al.*, 2006; Anggraeni *et al.*, 2007; Wan *et al.*, 2011). The origins of the concept can be traced in the theory of ecology. In fact Moore (1993) analyzed and defined the concept based on the analogy with biological ecosystem. As biological ecosystems, business networks are characterized by a large number of loosely interconnected participants who depend on each other for their mutual effectiveness and survival (Lewin, 1999).

Therefore, biological analogy is the starting point in defining business ecosystems and in the scientific literature a variety of business ecosystems’ models have been developed, from which the most important are the ones of Moore and Iansiti and Levien’s.

According to Moore (1993) the business ecosystem is an economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world. Organizations, similar to biological organisms, operate within a rich network of interactions, forming the local economy on a local scale and the global economy on the global scale. Consequently, a business ecosystem is composed by different types of species (market players, government, customers, etc.) that develop strong relationships in a

friendly environment based on specific activities and business networks (Moore, 1993). It can be considered as small business initiatives or vast collections of enterprises, where the boundaries can be fuzzy and include huge, inter-connected networks that interact with each other. As a result, organizations are simultaneously influenced by their internal capabilities as well as complicated interactions inside the ecosystem (Karhiniemi, 2009).

In the business ecosystem context, Moore (1993) described also the co-evolution as the complex interplay between competitive and cooperative business strategies. Moore (1996) emphasizes the evolutionary stages of the ecosystem and its evolvement, and describes the challenges in each stage. It follows that business ecosystem has its own life cycle. The analogy with biological ecosystem provides the most important findings for business ecosystem life cycle development. It evolves from “*random collection of elements to a more structured community*” (Moore, 1993: 76). From this point of view, four distinct stages of development have been identified: birth, expansion, leadership and self-renewal of business ecosystem.

1. Birth is the stage where the future value delivered by the product or service is defined and where the channels for value delivering are declared. New members are recruited into business ecosystem through cooperation (Moore, 1993). Also it is at the evolution level where new opportunities are identified in order to satisfy and create value for customers (Peltoniemi, 2004; Rong, Liu & Shi, 2011).
2. In expansion stage the innovation and creative thinking are the most important features for value creation for new customers (Peltoniemi & Vuori, 2004). The importance of scaling the potential opportunities and creative value creation were emphasized as two main conditions for this stage (Moore, 1993).
3. Leadership requires high profitability and growth of the companies from a business ecosystem. The key aspect of this stage is stability. This is the stage where control function is enabled, and, as a result, companies try to dominate most of the value elements.
4. Self – Renewal or Death is characterized by high threats from new business ecosystem arising (Peltoniemi & Vuori, 2004) and new innovation development. Moore (1993) compared this stage to an earthquake and concluded that it is defined by major changes. In this case the future success of business ecosystem consists in its ability to gain long-term progress and to renew itself.

The same approach as Moore was adopted by Iansiti and Levien in 2004 who also tried to compare the business ecosystem with a biological one. As they suggest, the biological ecosystem can provide a powerful metaphor for understanding the business networks: a business ecosystem is a non-homogeneous community of entities, made up of a large number of interconnected participants with different interests, which depend on each other for their mutual effectiveness and survival, and so they are bound together in a collective whole.

While Moore (1996) thinks that a business ecosystem consists of different levels of organizations and business environment, Iansiti and Levien specifically divide those organizations into four types, all of them with specific functions and strategies (Iansiti & Levien, 2002, 2004a, 2004b), which are: keystone player, niche player, dominator and hub landlord.

The keystone players set up a platform in order to involve contributions from other players (Iansiti & Levien 2004b; Quaadgras 2005). A keystone “*acts to improve the overall health of the ecosystem and, in doing so, benefits the sustained performance of the firms. It does this by creating and sharing value with its network by leveraging its central hub position in that network while generally occupying only a small part of that network*” (Iansiti & Levien 2004b: 72).

Niche players develop specialized capabilities to add value to business ecosystem. Niche strategies can be pursued by the much larger number of firms that make up the bulk of the ecosystem, focusing on unique capabilities and leveraging key assets provided by others. The

keystone players and niche players contribute to ecosystem health and sustainability (Iansiti & Levien, 2004b).

The dominator “*acts to integrate vertically or horizontally to directly control and own a large proportion of a network*” (Iansiti & Levien, 2004b: 74) capturing most of the value created by the network and leaving little opportunity for the emergence of a meaningful ecosystem.

The hub landlord extracts as much value as possible from its network without directly controlling it. A hub landlord, the most anti-social species of dominator, “*eschews control of the network and instead pursues control of value extraction alone,*” providing little new value to its network, leaving a “starved and unstable” ecosystem around it (Iansiti & Levien 2004b: 74).

Another difference between Moore and Iansiti and Levien is that the second ones went further and have paid special attention to ecosystem’s health: if an ecosystem is healthy, then its community will flourish. Three are key-elements in an ecosystem’s health: productivity, robustness and niche creation (Iansiti & Levien, 2002; Davenport *et al.*, 2006; Den Hartigh *et al.*, 2006).

Productivity is understood as the efficiency with which an ecosystem converts inputs into outputs (Iansiti & Levien, 2002). It reflects the ability of actors to transform existing resources into significant results and to create value for business.

Robustness is the capability of an ecosystem to face and survive disruptions (Iansiti & Levien, 2002). It has the meaning of achieving sustainability: a healthy ecosystem should adapt easily to environmental changes so that it can meet the conditions of sustainable development (Iansiti & Levien, 2004a).

The final determinant of the health measurement is niche creation that is the capacity to create meaningful diversity and thereby novel capabilities through two factors: the variety, related to the number of new options, technological building blocks, categories, products, and/or businesses being created within the ecosystem in a given period of time; and the value creation, related to the overall value of new options created (Iansiti & Levien, 2002).

Business ecosystem has also various characteristics: inter-dependence of its components, cooperative evolution, simultaneous existence of competition and cooperation, the existence of numerous role players, dynamism and flexibility, shared fate, contribution to making innovations and achieving business successes (Peltoniemi, 2005; Hearn, *et al.*, 2006). Whereas the organizing principles are: interconnectedness, that involves the type of relationships established between ecosystem’s actors and aims to reveal the bilateral relationships between them, through cooperation between different organizations (Iansiti & Levien, 2004a; 2004b); diversity, that represents the existence of business ecosystem through different type of species (SMEs, governmental organizations, etc.), cooperation and data; and complexity, a principle emerged as a result of a complex and systemic analysis based on interactions between business ecosystems elements (Peltoniemi, 2005).

As suggested by Iansiti and Levien (2004), a business ecosystem can be understood as a nonhomogeneous community of entities, made up of a large number of interconnected participants with different interests; they depend on each other for their mutual effectiveness and survival, and so they are bound together in a collective whole.

The ecosystem analogy, based on this review, has been widely used for describing different kinds of structures and processes. These analogies emphasize different aspects of biological ecosystem and are applied in business fields. As argued by Peltoniemi and Vuori (2004), they can offer insights for using the ecosystem analogy but they cannot be drawn together to form a theory of ecosystem in social sciences and economics. However, treating business ecosystems as complex adaptive (or complex evolving) systems, it is possible to understand the principles of their formation, evolution and interdependence in a broader context and exploit the research made in other sciences.



#### 4. SMART TOURISM

The term “Smart Tourism” comes, by analogy, from the term of “Smart City” that represents an environment where technology is embedded within the city. In fact, the Smart Cities concept has typically been associated to technology embedded ecosystems that attempted to build synergies with their social components in order to enhance citizens’ quality of life and to improve the efficiency of the city services (Egger 2013). This technology will synergize with the city’s social components in order to improve citizens quality of life while also improve the efficiency of city services (Vicini *et al.*, 2012). Indeed, Information and Communication Technologies (ICTs) support cities in addressing their societal challenges. The development of Smart City also facilitates seamless access to value-added services both for its citizens and tourists as city visitors, such as access to real-time information on public transportation networks (Buhalis & Amaranggana, 2013). In this sense, a city could be categorized as smart when sustainable economic growth and high quality of life were achieved through investment in human capital, adequate level of government participation and infrastructure that support proper dissemination of information throughout the city (Caragliu *et al.*, 2011). Thus, Smart Cities should base their smartness on three main pillars, namely: human capital, infrastructure/infostructure, and information (Komninos *et al.*, 2013). Furthermore, the city should therefore directly involve citizens in the co-creation process of products or services (Schaffers *et al.*, 2011; Bakıcı *et al.*, 2013). To this end, Smart Cities are not only considered as the outcome of innovative process but also as innovation ecosystems that empower communities’ co-creation for designing innovative living resulting in constant dynamic innovation and engagement with all stakeholders (Schaffers *et al.* 2011).

From a tourist perspective, as argued by Buhalis and Amaranggana (2013), the new era of ICTs has also opened a wealth of new tools for the tourism industry. ICTs could contribute in terms of generating value-added experiences for tourists, efficiency and supporting process automation for the related organizations. Thus, the development of Smart City could also encourage the formation of Smart Tourism Destinations. With technology being embedded within the destinations environment, it can enrich tourist experiences and enhance a destination’s competitiveness (Buhalis & Amaranggana, 2013). The Smart Tourism Destination initiative was officially coined by China’s State Council of Chinese Central Government in 2009 (Wang *et al.*, 2013). Wang *et al.* (2013) illustrate how the notion of smart destinations has changed the way some Chinese destinations support tourism experience creation, communicate with consumers and define and measure destination competitiveness, suggesting that service-dominant logic permeates the smart tourism destination. Lopez de Avila (2015: xx) defined the smart destination as “an innovative tourist destination, built on an infrastructure of state-of-the-art technology guaranteeing the sustainable development of tourist areas, accessible to everyone, which facilitates the visitor’s interaction with and integration into his or her surroundings, increases the quality of the experience at the destination, and improves residents’ quality of life”. Buhalis and Amaranggana (2014) describe the smart tourism destination as requiring stakeholders to be dynamically interconnected through technological platforms to collect, create and exchange information that can be used to enrich tourism experiences in real-time. Lamsfus, Martin, Alzua-Sorzabal and Torres-Manzanera (2015) describe this technological platform or digital ecosystem that makes tourism destinations smart as encompassing intelligent systems, cloud computing, Linked Data, Social Networks, the Internet of Things and mobile applications. Context-awareness of mobile systems has also been emphasized in connection with smart destinations (Lamsfus, Xiang, Alzua-Sorzabal & Martin, 2013). Presently the concept may be considered to still be emerging, and the work of conceptualizing it and defining it still in progress (Del Chiappa & Baggio, 2015).

As stated by Gretzel, Sigala, Xiang and Koo (2015), “*in practice ‘smart’ has become a very fuzzy concept often utilized to drive specific political agendas and to sell technological solutions. This is especially true in the case of Smart Tourism, where it is frequently used in the context of open data initiatives or for rather trivial projects such as promoting free wifi or the development of mobile applications*” (p.180). However, they continue “while these technologies and new approaches to data collection, management and sharing are important stepping stones in implementing smart tourism, they do not provide the full picture of what smart tourism encompasses” (p. 180). From this starting point and in agreement with Höjer and Wangel (2015), smart is not so much the individual technological advances but rather the interconnection, synchronization and concerted use of different technologies that constitute smartness. Based on these considerations, always Gretzel *et al.* (2015) define Smart Tourism as “*tourism supported by integrated efforts at a destination to collect and aggregate/harness data derived from physical infrastructure, social connections, government/organizational sources and human bodies/minds in combination with the use of advanced technologies to transform that data into on-site experiences and business value-propositions with a clear focus on efficiency, sustainability and experience enrichment*” (p. 181). Thus, generally speaking, Smart Tourism aims to develop information and communication infrastructure and capabilities in order to:

- improve management/governance;
- facilitate service/product innovation;
- enhance the tourist experience;
- improve the competitiveness of tourism firms and destinations.

Recently, Gretzel *et al.* (2015), in another article, have also conceptualized the smart destination within the broader idea of a Smart Tourism Ecosystem, formed, also and jointly, by smart technologies and smart cities. Thus, according to them and considering also the theoretical background of our work, a Smart Tourism Ecosystem can be defined as “*a tourism system that takes advantage of smart technology in creating, managing and delivering intelligent touristic services/experiences and is characterized by intensive information sharing and value co-creation*” (Gretzel, Werthner, Koo & Lamsfus, 2015: 560). Moreover, it includes a variety of “species”: touristic and residential consumers, tourism suppliers, tourism intermediaries, support services, platforms and media, regulatory bodies and NGOs, transportation carriers, travel technology and data companies, consulting services, touristic and residential infrastructure and companies typically assigned to the other industries (Gretzel *et al.*, 2015).

This highlights how the ecosystem nourishes new business models, new interaction paradigms and even new species of tourism businesses, making the delineation of its boundaries very hard. For instance, touristic consumers have resources and because of their ability to tap into the digital ecosystem can organize among themselves or mingle with the closely related residential consumer species and act like producers (a phenomenon often referred to as the sharing economy). In addition, tourism suppliers and/or other business-focused species (with lines among industries becoming increasingly blurred in an open system) can connect through smart technology and create new service offerings (in medical tourism, for example) (Vargas, 2016).

If Smart Tourism requires an ecosystem approach, and this calls for complex, adaptive systems supported by intensive technological endowments which interact in multiple ways and on multiple levels to create value and foster innovation, leading, supposedly, to smarter decisions, the foundations of the complexity theory could be applied for a better understanding of this phenomenon and this approach can be presented as innovative, as no evidence has been found on the application of this theoretical framework to tourism destinations and its smartness (Vargas, 2016).

## **5. CONCEPTUALIZING THE INDUSTRIAL HERITAGE ECOSYSTEM AS A COMPLEX ADAPTIVE SYSTEM**

### **5.1. The Industrial Heritage Business Ecosystem (IHBE)**

Taking note that the process of industrialization is a complex phenomenon that combines physical and environmental, technical and economic, cultural and institutional factors, it follows that the elements characterizing the industrial heritage are multiple and especially of a different nature (e.g.: tangible and intangible assets). In fact, factories and infrastructures are closely related, and brownfield sites typologically varied in relation to sectors and temporal, spatial and organizational characters of the production.

Behind this most visible part there is another that, although not easily identifiable of great importance, is defined by the following elements: technical-productive knowledge (tacit and encoded); drawings, models, documents and archives; machinery, plant and equipment; communication and energy networks; residential, training, welfare, cultural and recreational infrastructure; territories and landscapes shaped by industrialization (Vargas, 2014).

Most historic industrial sites continue to be administered by museums, enthusiast groups, or private industrial companies themselves rather than large institutions. This nevertheless has had profound consequences for industrial heritage management, which usually receives secondary status to more established thematic research (Rautenberg, 2012).

The success of a cultural project of Industrial Heritage (IH) is intrinsically linked to the ability to generate a dense network of relationships. As stated by Iansiti and Levien (2004), each element should establish bilateral relationships with other elements. These relations represent the grade of cooperation and contribution of each element to a mutual development.

The large number and variety of the elements ask for a process of capitalization of the industrial heritage that translates in a set of practices the allocation of new meanings and cultural and economic values to the different components (Presenza & Perfetto, 2015). In other words, it would be to revive the industrial landscape (often ignored or little known sites, disused and hidden), starting mechanisms aimed to the revival of resilient places through creative and innovative uses that, preserving the memory of the places, lead to the creation and maintenance of spaces aimed at the realization of exhibitions and other tourist and cultural events (Mansfeld, 1992; Jones & Mean, 2010). This process of capitalization strongly binds to economic, social and cultural transformations of a territory, and possible reuse decisions of goods derived from industrialization imply interpretations and, above all, strategies that involve both abandoned areas and the industrial tradition (Lashua, 2013).

The recovery of IH involves choices that have a profound effect on the environment (regenerate without spoiling), the society (regenerate without distorting) and the economy (regenerate to create welfare). In this complex system of factors, it becomes necessary to better understand the characteristics and *modus operandi* of organizations devoted to the regeneration and management of IH. Therefore, before deepening the discussion about the IHBE it would be suitable to consider that a series of actions supporting the strategic intent have to be developed and shared with all the stakeholders.

All these elements together define the shape and behavior pattern: how the ecosystem “lives”. Also the time variable is important: the relationships amongst the constituent elements may change the ecosystem structure. So, understanding the ecosystem means not only drawing the shape and relationships amongst the constituent elements in a certain moment in time, but also understanding how it evolves by monitoring evolutionary trends (Battistella *et al.*, 2013). It is thus important that organizations establish monitoring processes for their ecosystem, both from a static and dynamic point of view, and they analyze

IHBEs by investigating how the relationships and the dynamics can potentially positively and/or negatively impact their businesses. Clearly, these analyses need to be supported by appropriate tools and methodologies to work on.

Interventions for the protection and regeneration of the industrial heritage should take account of many factors simultaneously: on the one hand, the historical and technical value, the social content, the recovery mode, the architectural and artistic value of an industrial good; and, on the other hand, the economic and financial management, the organization of the resources involved, the enhancement of competencies and skills, and finally, the appropriate promotion (Presenza & Perfetto, 2015). Making connections and celebrating the texture of the entire social, cultural, and natural network in this way permits the industrial landscape to incorporate multiple value systems, and recognize the dynamic blend of the old and the new. For this reason the value aspects that will be looked at in IHBE are economic value, functional value, and cultural and historical value; social value showed much overlap with both cultural and historical and functional value aspects. These aspects were found to be the most relevant for revitalizing and management of industrial heritage values, which play out in different ways at different levels of industrial heritage management. Thus, the IHBE becomes especially important to local communities who, despite their best efforts, may not be able to sustain an industrial heritage management project on a large scale. It may be easy to preserve a component of an historic system, but it is difficult and costly to manage an entire system (Quivik, 2007).

Finally, the studies on industrial heritage management have analyzed also the subject of Destination Governance (Wilkey, 2000; Smith & Couper, 2003; Xie, 2006; Landorf, 2009; Duarte-Alonso *et al.*, 2010; Alberti & Giusti, 2012; Otgaar, 2012). Moore (1996) mentions that the most used ways of governing business ecosystem relationships are community governance systems and quasi-democratic mechanisms. He mentions that the ecosystem internalizes the systems of firms and the markets that connect them under the guiding hands of community leaders. Iansiti and Levien (2004b) mention that business ecosystems are governed by shared fate, but they do not intensely discuss this guiding mechanism. In IHBE governance emerges the interest for the analysis on who are the most active stakeholders involved in the management processes and on the main methods of involvement and participation of stakeholders in decision-making processes. In particular, the collaboration between public and private sectors is the dominant theme in the analysis of the stakeholders. In this sense, there are several forms of governance and the constitution and management of ad hoc organizations. As argued also by Vos (2006) describing business ecosystem governance, the IHBE governance provides network members with an incentive and vision to strive for a common goal, giving them the freedom to reach that goal on own initiatives so that their motivation is not hampered by obstruction, while using steering mechanisms to ensure that their activities will reach this common goal, in an effort of improving the business ecosystem's capability of coping with exogenous changes and the internal pace of innovation.

## **5.2. Conceptual model: the Smart Industrial Tourism Business Ecosystem (SITBE)**

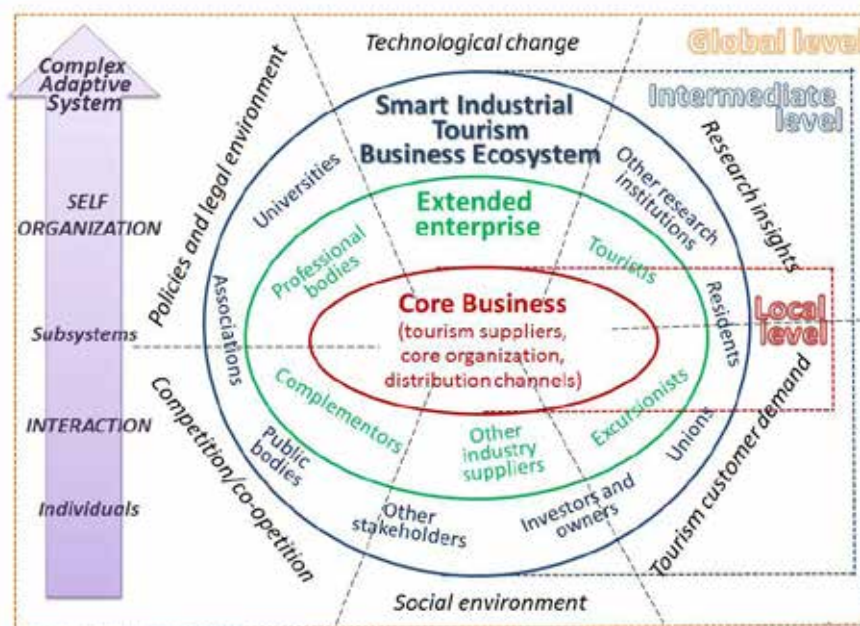
The IH, as we have seen in the previous section, is not only an urban regeneration driver but also a key resource for economic development of a destination through the development of industrial tourism. The context is characterized by numerous areas rich of IH in the territory, by an infinite number of highly specialized operators and a wide variety of agencies, associations and institutions responsible for the management of these resources. For these reasons, there are difficulties in bringing a common vision from the individual strategies of the actors.

Thus, the IH can be considered as a driver for the tourist attraction, but it is also true that the availability of heritage in itself does not seem a sufficient condition to attract an adequate number of visitors to create wealth from the economic point of view. Furthermore, one must take into account a typical dualism of this sector: on the one hand the presence of IH allows the destination to be different than other territories proving to be a source of capital from which to draw income to the destination and to the various operators; on the other, the possibility of transforming the attractiveness in the economic wealth is conditioned by the size of the destinations, because institutions that manage the assets have to sustain very high costs and require a certain mass of visitors in order to contribute to cover costs of structure. The investment on the IH regards not only its physical preservation, but also its presence in the collective memory which results in costs for cataloging, digitization, promotion and communication aimed at consolidating the value of the industrial heritage to the community's eyes. The knowledge of IH, in fact, increases the attractiveness to tourists, allows adequate tourism market segmentation and enables the development of promotion and awareness campaigns on different targets, strengthens the sense of belonging and cultural roots, it stimulates the development of new knowledge and helps to increase the opportunities to valorize it.

Following our theoretical background, for an “industrial tourism destination” becomes smart and overcomes the difficulties listed above, the governance system should be perceived as a living organism and not as a mere instrument that should be made suitable for business climate adaptation. The focus of this study is on link between Complexity Theory, Business Ecosystem and Smart Tourism, considering that the evolution of the model progresses inductively beginning with a few broad assumptions and concepts. For these reasons we propose a conceptual model that arose out of a coalescence of several research activities and ideas; it starts on the adaption from Moore (1993).

To define the content of a SITBE, its structure is displayed in Figure 1. Consequently, it is necessary, for its evaluation, to identify the perimeter and constituent parts of the ecosystem; develop a representative model of it; analyze the behavior of the ecosystem in the past and in the present; and study the possible evolutionary scenarios.

Figure 1. Conceptual model of the Smart Industrial Tourism Business Ecosystem, SITBE



Source: (our elaboration)

### *5.2.1. Levels*

To understand better its development process and looking at elements that could be included, there should be a defined elements hierarchy. In the SITBE there are 3 levels: local level (core element – core organization), intermediate level (related elements inside the business ecosystem: stakeholders, markets, competition, governmental agencies), and global level (external influencing elements on the ecosystem: international competition and international markets). It is, therefore, important to acknowledge the emergence of power relationships and hierarchies as a direct consequence of the mediation of social interactions; and to devise a governance process that can maintain the dynamics of the community. It is important to assign or to establish the roles that each element performs: keystone, niche players or dominators.

### *5.2.2. Core business*

Moore (1993) describes a business ecosystem as consisting of layers, which correspond to differing levels of commitment to the business. The core business layer consists of the parties forming the heart of the business. In traditional business, this layer would be run by a single company or the supply chain would be coordinated by the focal company. Alternatively, it can also be formed by a network of several organizations, each taking care of parts of the core business.

In our case, at the basis of successful projects of IH management there is an activator (Ratclif, 2014), which can be a person, a small group of people, an organization or many organizations. It is the driving force of the entire process. It means that all the other elements have to be related to the core organization and share the same mission and vision. Thus, the presence of an activator and a cohesive group are the base for the creation of cultural projects. In turn, a cultural project should be sustainable in environmental, social and economic terms.

The activator is usually a “cultural industry”. Throsby (2001: 112) says that this is a subject that produces or distributes goods and services that include creativity in the production and incorporate a certain degree of intellectual property and transmit a symbolic meaning. The activator displays various institutional, organizational and entrepreneurial forms.

In the case of tourism suppliers or other business-focused actors, they can connect through smart technology and create new service offerings to enrich industrial tourism experiences and to ensure the “longevity” of the SITBE. In this sense, it is also clear that the system is open to players from other industries/ecosystem being able to tap into resources or form beneficial relationships.

### *5.2.3. Extended enterprise*

The next layer, the extended enterprise, widens the view of the business supply chain to include the customers, complementors and second-layer suppliers, as well as standard-setting bodies in the particular field of tourism or related to it. For example, tourism consumers in STIHM have resources and can organize by themselves or mingle with the closely related residential consumer actors and act like producers. So, touristic and residential consumers should produce data and consume data produced by other actors or the physical environment. While other industries suppliers are important predators in the SITBE, they also feed the system with critical information and should offer opportunities for enhanced value creation.

#### 5.2.4. *Smart Tourism based on Industrial Heritage Management*

The IH has the potential to attract the interest of different players. The last layer adds trade associations, unions, universities and other research bodies, investors, and stakeholders to the business ecosystem. Even though they are perhaps not directly involved in the business operations, these parties may have a significant effect on the success of the business.

The SITBE model starts to address this issue on a regional scale by integrating private, local, regional and national stakeholders into a coalition to define their own preservation goals, themes, and practices. Incorporating value systems into landscape preservation provides a platform for preservation to truly serve the changing nature of historic industrial resources, their users, and ultimately, the public trust. The stakeholders in industrial heritage, from government bodies and historic preservation professionals to amateur archaeologists and local communities concerned about the history and quality of place, can interact with each other through sophisticated models of both collaboration and competition. It means that a SITBE comes in a broad array of shapes, sizes, and varieties; and it also captures three core characteristics that are generally present:

First, it enables and encourages the participation of a diverse range of (large and small) organizations, and often individuals, who together can create, scale, and serve markets beyond the capabilities of any single organization.

Second, participating actors interact and co-create in increasingly sophisticated ways that would historically have been hard to formally coordinate in a “top-down” manner.

Third, participants—often including customers—are bonded by some combination of shared interests, purposes and values which incite them to collectively nurture, sustain, and protect the ecosystem as a shared “commons”.

#### 5.2.5. *SITBE subsectors*

The challenge in boosting the growth of the SITBE is how to recognize who are the next actors or areas that should be contacted and involved in collaboration. To overcome this challenge, it is useful to divide the SITBE map into differing subsectors as we have done in Figure 1. The sectors are recognized as external forces that affect the success of the industrial tourism destination. These forces include competition/co-opetition, policies and the legal environment, social or technological change, research insights, and changes in customer demand. Each of the subsectors shown in Figure 1 is described below, in the form of implementation advice:

1. **Technological change:** a SITBE model should be built on a tourism system able to take advantage of smart technologies or information technologies. Decreasing information and communication costs make totally new processes and ways of working possible. In addition to proving new business possibilities, it also challenges the existence of current ones. Therefore, it should identify the potential of smart technologies and contact the suppliers.
2. **Research insights:** In addition to the business aspects, the SITBE should attract research. Reading major research articles or best practices studied on the topic of industrial Heritage Management (IHM) and contacting those researchers can help to locate suitable collaborators within the universities or other research bodies.
3. **Changes in tourism customer demand:** Consumption patterns and “fashion” are examples of changes in tourism customer demand. High adoption rates of social media could be a good example of social change that might provide new possibilities. Customer co-creation is increasingly adopted to gain knowledge on the changing demand.
4. **Competition/co-opetition:** One of the main pressures comes from competitors. In order to survive, product or service must be cheaper, better, or quicker than that

of competitors. In the SITBE the collaboration with competitors might be needed to execute the business model. Competitors, for instance, might have some specific knowledge or capabilities and it should try to turn the competitors into co-opetitors.

5. Social change: Changes in work practices, processes, culture, and social mood in general might have an effect on the SITBE. Changes in attitudes on environmental issues, technology adoption, social/political life can affect the business. Collaboration with various kinds of associations and societies helps to keep track of social change.
6. Policies and legal environment: Legal issues are something that you must always take into consideration. Many times, it pays to find out the legal restrictions at the beginning to take them into account when building the SITBE.

#### *5.2.6. Self-organization and interaction*

The core Complexity Theory concepts extracted from this model were above all self-organization and interaction as shown in Figure 1. The phenomenon of self-organization is central for the understanding of the behavior of complex systems, in our case of a SITBE. Self-organization means that there is no 'external controller' and that the SITBE organizes from within itself in response to its external environment. However, a SITBE is an open system and therefore the observer defines the boundaries of any system. It is nested in larger systems in which they interact and respond to the influence of the behavior of either the larger or smaller system. In this sense the characteristics are:

- Open systems fluctuating.
- No centralized control.
- It evolves in a self-organizing interaction of co-operation and competition between actors connected within the system.
- It adapts to influences within and beyond its boundary.

#### *5.2.7. Interaction*

Interaction (feedback) in a SITBE is the bidirectional transfer of information from one decision making agent (individual human) to another. This information can be enhanced, suppressed or altered leading to an impact of this effect overall on the system. These interactions will be non-linear (asymmetric) and paradoxically, large changes can have a small effect, whereas small changes can have a large effect. However, greater interaction creates greater system complexity. The transformative process of human communication and relations underlies social interactions and organization of social systems. In this sense the characteristics are:

- Interaction, feedback, continual transformation.
- Interaction results in emergent structures that have causal influence on the individuals.
- Interaction through communication in a continual evolution.

## **6. CONCLUSIONS AND FUTURE OF RESEARCH**

The SITBE proposed in our work (which could be used for any tourist ecosystem, not necessarily for one related to industrial tourism, and named as Smart Tourism Business Ecosystem) represent a key element to characterize the aims of the development of industrial tourism in destinations where this heritage is located. There is a growing number of industrial areas where tourism is promoted as a helpful tool for regional restructuring and economic development. In this context, the development of smart industrial heritage tourism can be understood not only as one of the pillars of alternative economic and social development to



replace the deactivated industry, but also as an active agent in the process of defining the diverse collective identities.

This paper is an initial attempt to identify the implication that this new phenomena can have on a smarter tourism development. New steps will have to be covered through new research. In particular, much more emphasis will be put on the challenges that this topic has in relation to a more competitive and sustainable destination governance. In particular, the analysis of actors, inter-actions, coproduction and management of the business ecosystem's resources will represent, perhaps, the main direction of future studies. For this reason the next step could be to use this conceptual model for a case study in a specific destination.

Several implications arise from this study. Theoretical ones are related to the concept of Business Ecosystem. Results have revealed the adequacy of this approach to the analysis of IHM considered as a complex adaptive system. In particular, it gives useful lens to observe and understand the complex mix of actors and activities that compose a project of IHM.

Practical implications are related both to managerial and political issues. About managerial implications, we suggest a new approach to the management of IH resources that comprises first of all new organizational forms (in terms of innovative forms of organization, production methodologies and working practices based on refined forms of self-disciplinary managerial power, control and surveillance) that do not easily fit with the traditional business models but in a smart initiative. The main important political implications are related to implementation of IHM projects. The management of IH, as the management of cultural heritage in general, requires a new approach that involves factors such as creativity, flexibility, networking, dynamism, promotion, ICTs, etc., that are difficult to reconcile with a traditional approach made by high bureaucratization, static conservation and unilateral management. All of that requires a farsighted policy that is able to support, organize, coordinate the industrial/cultural resources and link them with the other resources in the territory.

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