Neurotourism:
Futuristic perspective or today's reality?

Ernestina Giudici, Angela Dettori, Federica Caboni
Department of Economic and Business Science, University of Cagliari (Italy)
Email: giudici@unica.it, angela.dettori@unica.it, federica.caboni@unica.it

Abstract

Purpose. The aim of this work is to focus on the role neuroscience is playing inside the social science field, specifically in relation to management, marketing and tourism. Turning our attention to neurotourism, the question is: Is neurotourism a futuristic perspective or a reality able to "personalize" the tourism offers and create a unique competitive advantage?

Methodology. The adopted methodology is descriptive research. According to Burns and Grove (2003: 201), descriptive research "is designed to provide a picture of a situation as it naturally happens". It may be used to justify current practice, to make judgments and also to develop theories. For the purpose of this study, descriptive research was used to understand the developments regarding nanotechnologies and, as a result, the miniaturization of several devices in the neuroscience field, that offer the possibility to have the specific and clear knowledge of the desires of consumers and tourists in real time.

Findings. The study highlights the increasing adoption of neuroscience tools due to the rapid development of nanotechnologies that miniaturize several devices relevant for the perception of emotions.

Practical implications. Implications in the social science and specifically in the tourism field are enormous and unpredictable: the possibility of having the specific and clear knowledge of the desires of consumers and tourists in real time is susceptible to the creation of applications that can create a strong competitive advantage.

Originality/value. The value is connected with the analysis of a field of study in a way that is not widely taken into consideration.

Keywords
Neurotourism, neuroscience, neuromarketing

1. Introduction

> *"According to cognitive neuroscientists, we are conscious of only about 5 per cent of our cognitive activity, so most of our decisions, actions, emotions, and behavior depend on the 95 per cent of brain activity that goes beyond our conscious awareness." (Szegedy-Maszak, M. 2005).*

A firm's competitive advantage is reached by satisfying the challenge to interact closer with customers. The previous observation is true for any field of activity, but more specifically it applies to those working in service fields, such as tourism. Increasingly, tourism firms must be able to "personalize" their offered services to satisfy most tourists' expectations to have memorable experiences. In this perspective, exponential technological development that was not conceivable only a few years ago has largely contributed to reaching the new demands of tourism firms, to know better what tourists really want, and if their decisions are really rational and what role the brain plays.

Are just the most sophisticated technology tools – particularly nanotechnologies (Mileti et al., 2016) – able to open the possibility of finding answers to questions about brain activities that researchers have been trying to answer, sometimes over the course of several centuries.

In reality, most human thinking and decision-making happen at levels of the conscious and the unconscious mind. The conscious mind represents reasoning and thinking. It is the mind which people are aware of. The unconscious mind involves all procedures that happen automatically and are not typically accessible to self-examination by reasoning processes. This unconscious mind is the programmed, subjective level of the brain and works underneath the conscious level. It is a combination of thoughts, emotions, feelings, memories, cognitive and other intellectual procedures that people are not aware of and they cannot clarify or explain (Hazeldine, 2013).

Neuroscience analyses how the brain works and how it can change. It gives crucial data on how human beings react to stimuli (Georges et al., 2013) and helps to understand our subconscious intentions.

With this work, we have the aim to contribute to a better knowledge of the role that neuroscience can play (or is playing?) in the tourism field, and investigate the emergent neurotourism field and the usefulness of innovative technological devices that can help its development. Is neurotourism the way to "personalize" tourism offers and create a unique competitive advantage? Why are tourists attracted by a particular place, or brand, or a special holiday offer? The answer lies in the brain.

To reach the above aims, it may be useful first of all to spend some lines to highlight the way the brain works and what the brain's part is in making decisions. The subsequent points are devoted to defining what neuroscience, neuromanagement, neuromarketing and neurotorusim are. Finally, some conclusions are presented.

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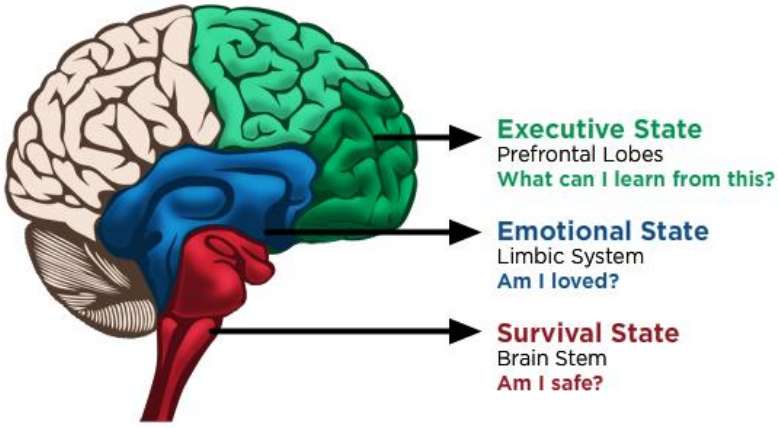
2. The brain functioning

In order to understand how the brain works, it is important to give attention to its structure. Each person has three brains, not just one. As Antonio Damasio describes in his book, *Looking for Spinoza* (2003), "The mind emerges from the cooperation of many brain regions".

Rava-Reny (2003), a mental trainer, presents how the triune brain works according to Paul MacLean's (1990) theory. MacLean shows that there is one brain divided into three sections – the Lizard brain, the Mammal brain and the Human brain – altogether they are called the trinitarian or triune brain (Figure 1). Each level of this brain has its own characteristics (Georges et al., 2013).

Figure 1 – The Trinitarian brain



Source: Image base on the MacLean contribution

The Lizard brain (or old brain) includes the brainstem and cerebellum and it represents the reptilian brain or the subcortical mind. This is the oldest part of the brain and it interfaces the brain with the spinal column. The Lizard mind or reptile cerebrum gets its name from the time 500 million years ago from the idea advanced first in the evolutionary steps of creatures on the planet. It is similar to the brain of reptiles, to which the name alludes, and it is the first brain system to be formed in human beings. In spite of the fact that our cerebrum evolved over time, its essential components are still in place and represent the smallest part of the total brain.

The primary task of the reptilian brain is to ensure the body's survival: drink, eat, sleep, defend the territory and guarantee species survival (reproduction). Different cells in the brainstem decide the general vigilance of the mind and manage essential body procedures, for example, pulse and breathing. This brain is traditionalist and has the character of imitation. It favors the sense of smell over all other senses. Its acts are instinctive and fast, properly predictable. Firstly, all engine and sensory nerves go through the brainstem to all the other parts of the body, and it assumes a key part in basic attention and consciousness.

The Mammal brain (or mid-brain) comprises the limbic system, called the mammalian brain or the emotional brain. Pleasant acts are registered to be repeated. What is unpleasant is registered to be avoided. It compares everything with actual experience. It favors hearing over all other senses. It is thought to have initially evolved in mammals, which the name alludes to. This is the place where emotion and feelings are produced and where many behaviors are directed.

It produces a genuine reaction to data coming from the environment and assumes a key part in creating and showing instinctual feelings and behaviors. It is additionally the part of the mind that produces our non-verbal communication. An extremely dynamic component of

the limbic mind is what we can call the fear system that identifies danger and instinctually creates responses and conduct that will expand our chances of survival.

The Human brain (or new brain) involves the neocortex and frontal lobes of the neocortex. Since it is in charge of complex thought, this part of the cerebrum is also called the thinking brain or the intellectual brain.

The neocortex or cortical brain analyses, anticipates and makes decisions. It favors sight over all other senses. Somehow, with no emotions, it performs like a computer. It helps reasoning and anticipates events. The neocortex is what makes people intelligent. The frontal lobes of the neocortex make the neocortex human. They enable human beings to be altruistic, to think of others, to create and to embrace the future. The neocortex and frontal lobes make human beings different from other animals.

The Human brain has the capacity to examine and translate information. This part receives and analyzes information from the senses and regulates intellectual capacities, such as thinking, speaking, learning, remembering and deciding (Hazeldine, 2013).

The greater part of choices, activities, feelings and conduct rely on 95 per cent of mind activities that happen outside the conscious awareness. In spite of the fact that we might consider human beings as clever, rational and logical thinkers and decision makers, most of the thoughts and feelings and emotions that exercise a real impact happen in the more primitive, unconscious part of the brain.

To summarize, each individual has three brains but just one is the decision-maker.

The Human brain *thinks* and processes rational data; the Mammal brain *feels* and processes emotions and instinctive feelings; the Lizard brain *decides*. It takes into account the input from the other two brains, but the Lizard brain is the actual trigger of decisions.

In his book *How the Brain Works*, Leslie Hart (1975), wrote: *"Much evidence now indicates that the old brain is the main switch in determining what sensory input will go to the new brain, and what decisions will be accepted",* and Antonio Damasio (1995) wrote in his book *Descartes' Error: "Emotion, feeling, and biological regulation all play a role in human reason. The lowly orders of our organism are in the loop of higher reason".* It means that survival functions are responsible for the decision-making process.

The above-mentioned scientists have shown that people make choices in a passionate way and afterward justify them rationally. Moreover, the final conclusion is shown by the Lizard mind, that part of the brain that does not even comprehend words.

3. Neuroscience: a field of study constantly expanding

Neuroscience is a seminal discipline which specifically studies the nervous system. Applying neuroscience to cognitive science determined the birth of cognitive neuroscience. The latter studies the neural substrates of human cognition, attention, memory, emotion, language, motion and so on (Ma *et al*., 2014).

Can it be useful to observe that neuroscience is growing, in recent years, changing faster than ever before? For 100 years the development was slow, based on qualitative descriptions and invasive manipulation of a few organisms to gain some anatomical insight. As Badok and Yeo (2017) noted, "In the last 10 years neuroscience spawned quantitative datasets of unprecedent breadth (e.g. microanatomy, synaptic connections, and optogenetic brain-behavior assays) and size (e.g. cognition, brain imaging, and genetics)".

Due to the growing relevance of cognitive neuroscience due to the involvement of other research fields, interdisciplinary research has acquired a new impulse expanding the attention to new frontiers: neuroeconomics, neuromarketing, neuro-decision-making and neuromanagement.

Several of the characteristics active in neuroscience are of interest for the management field of studies and specifically for the tourism field. Among the numerous aspects, for the relevance that can be acquired in the science domain, it is useful to take into consideration the "mirror neurons", that is a kind of neurons discovered in 1996 by Rizzolatti and colleagues (Rizzolatti and Vozza, 2008; Rizzolatti and Craighero, 2004). They found – observing the behavior of macaques – that mirror neurons "became active" in the frontal lobe not only when the monkeys perform a certain task, but also when they watch someone else perform the same task. In other words, they discovered that there was synchrony between action and observation.

The discovery of mirror neurons is only one of the several new perspectives that neurosciences applied to other fields of study to determine a relevant increase of knowledge and a significant advantage in the firm's implementation. Having the tourism field in mind, mirror neurons can significantly help us to understand, for example, the group dynamics and the gregarious spirit typical of mass tourism, despite a growing individualism (Liebman Parrinello, 2012).

Nowadays a new potentiality is permeating neuroscience (and, obviously, other connected fields like neuromanagement, neuromarketing and neurotourism, to name these of interest to this work): the fulfillment of devices with the use of nanotechnologies. As better described in the next section of this study, the increasing use of nanotechnologies is opening several unexpected perspectives.

4. Neuromanagement

The purpose of neuromanagement is to explore the brain activities when human beings are engaged with managerial and economics problems. This is made possible by using some cognitive neuroscience tools: electroencephalography (EEG), electromyography (EMG), positron emission tomography (PET), functional magnetic resonance imaging (fMRI) and near infrared spectrometry (NIRS).

Neuromanagement is of interest because it allows us to focus on the deep mechanism regarding social behaviors that come directly from the brain without interference using the neuroscience tools. Emotions, attitudes and cognitive process are more objective in comparison with traditional measurement tools such as questionnaires and interviews. In fact, traditional measurement tools "may have the risk that the participants tend to hide their real thought by consciously manipulating their responses. In other words, traditional measurements based on self-report are too subjective to build high criterion validity" (Ma *et al*., 2014: 1638).

In fact, self-reporting measures, such as interviews, focus groups, or surveys, often generate misleading outcomes, conducting researchers in the wrong direction. Self-report measures are based on the concept of rational customer and conscious accessibility to their mental states. However, a huge amount of research demonstrates that human beings do not actually know the real reasons why they have certain behaviors or beliefs. Their mental procedures, including observation, assessment, and motivation, might never achieve the level of conscious awareness.

In reality, the main advantage of neuromanagement is "to build high criterion validity by relying on multilevel measurement to explain and predict behaviors more accurately. This advantage makes the neuroscience apply to more fields in management science" (Ma *et al*., 2014: 1638).

5. Neuromarketing and neurotourism cognitive tools

This point is devoted to highlight the shift from the conventional marketing research to the new neuromarketing field, and give particular attention to the neurotourism field. Moreover, for a more exhaustive comprehension of the conjoint analysis of neuromarketing and neurotourism, it is useful to underline that several aspects of the marketing field can be applied to the tourism field.

Before analyzing the cognitive tools useful to have better knowledge of tourism expectations, emotions, and so on, it is useful to express what neurotourism is and why it deserves to have specific attention.

Neurotourism is a discipline mixing neuroscience and tourism. Inside the management science, tourism management is a traditional discipline and the leisure activities largely contribute to the economic development. This means that it is essential to seek an effective method to enhance tourism management studies: matching neuroscience with tourism can be the breakthrough.

The answer to the possible match linking neuroscience and tourism management is in the multidisciplinary nature that the latter possesses. After all, it involves several disciplines, such as management, economics, marketing, psychology, sociology, and aesthetics. Together they constitute a strong element to combine tourism with neuroscience: in a word, neurotourism.

Tourism's interest in neuroscience is really new, despite the constant literature growth drawing attention to the field (Kandell, Schwartz and Jessell, 2000; Oliverio, 2008; Edelman, 2004). However, empirical investigations are really scarce and it is also necessary to underline that the shift from traditional studies of tourism to the awareness that it is not sufficient to study the tourist gaze but it is necessary to explore also the other senses has been slow in coming. "Dann and Jacobsen (2002), for example, not only stress the importance of the sense of smell, but also emphasize the tourist's polysensual completeness" (42).

Tourism and psychology are more related than at first glance it is possible to suppose. People's motivation for travelling, their changes of behavior during travelling, their reactions to the difficulties of travelling and holiday life (to name only a few) are all significant psychological processes.

Travellers select their vacation spots for their resources and appearance as an appropriate and adequate place for "a good vacation". This behavior is called consumer behavior (Erdogan, 1996: 74). "Consumers reach a decision with the effect of psychological factors including personality, living style, perception, motivation, learning and attitude; demographic factors including age, gender, income level, occupation, educational status and family size; and socio-cultural factors including family, advisory group, social class and culture. There are a series of sub-decisions in touristic purchasing behavior, including vacation spot, transportation, accommodation, activities, budget and reservation. An issue that needs attention first is to find answers to the questions regarding the factors affecting selection of destination spots by tourists and what affects them in their selection process" (Tosun et al., 2016: 20).

To acquire knowledge on tourist decision-making, the tools adopted in the neuroscience field can be usefully adopted for the neuromarketing and neurotourism perception of emotions. Having this clarification in mind, in the following section the most adopted technological tools will be presented taking into account that it can have relevant applications in the neurotourism field also.

In reality, the use of neuroscience techniques constitutes a big advantage for tourism in its neurotourism perspective with the possibility to build a portfolio of research procedures and techniques that are supported by more realistic assumptions that the traditional techniques cannot satisfy. In fact, neurotourism actions are based on cognitive neuroscience, that is, the investigation of brain operations (Mileti et al., 2016).

Neurotourism (and neuromarketing) research instruments and procedures are divided into two general classes: tools that measure reactions of the body to tourism, and tools that measure reactions of the brain. Each methodology can catch different kinds of signals and all of them present pros and cons as estimation technology.

The main neuromarketing (and neurotourism) measures based on body reactions involve the following phenomena:

Facial expressions. The human face records a wide assortment of emotional situations that can be read at two levels: visible changes in expressions (e.g. smile or pout) and imperceptible micro-changes (e.g. small muscle contractions). These measures have been observed to be strong indicators of positive or negative emotional reactions.

Eye tracking. This device implies the use of infrared beams to detect eye movements and pupil dilation while seeing something or someone. Eye tracking has numerous applications in neurotourism. They are both an autonomous device and a supplement to other different measurements. The speed and course of changes in eye movement give profitable markers of attention, interest and fascination. They reveal not only the direction a person's eyes take while looking at a magazine advertisement, but also how long they spent examining a particular element of it.

Electro-dermal activity. Skin perspiration is measured using electrodes attached to the fingers and it can provide a very sensitive indication of subconscious responses. Signals of this tool increase with emotional stimulation of the nervous system. As people recall a particular memory, a significant spike of emotional arousal is shown. A constraint of this tool is the impossibility in identification of positive and negative emotional outcomes.

Respiration and heart rate. This system is based on measurement of beating speed of the heart and respiration speed using sensors placed on the chest or by means of a finger pulse meter. It has been found that when attention increases, the heartbeat slows down. Fast and profound breathing is connected with energy and excitement and shallow breathing can demonstrate concentration, tense anticipation, or panic and fear. This can provide a useful indication of physical excitement.

Response time. In order to understand how the brain processes are revealed in the unconscious behavior, it is necessary to analyze the rate of its reaction to word correlations or visual decisions. Reaction time measures give an easy and open approach to test the quality of notions.

Neurological tools, based on brain responses, are more complex and a more accurate tool than the body measures and these technologies need an extra effort and cost. The following are the three main neurological techniques.

Functional magnetic resonance imaging (fMRI). This method is the one most preferred by scholars since it empowers the exact imaging of activity anyplace in the cerebrum measuring the blood flow. It measures the increase in oxygen levels in the flow of blood in the brain and indicates when activity in specific parts of the brain increases. At the point when parts of the cerebrum start to be dynamic, blood flows to them. Since blood contains iron, this flow can be followed by a magnet that encompasses the head of the individual being examined. fMRI machines are very costly and now they are accessible at most hospitals, colleges, and other autonomous research centers. They're essential for testing models and theories about brain functioning. However, some neuromarketers consider fMRI, due to its cost, complexity and artificial testing environment, to be an overstatement for being used as a market research testing tool.

Electroencephalography (EEG). This is a brain-scanning technology, which uses sensors to capture the tiny electrical signals that brain activity produces. EEG measures the quality at the scalp of a few electrical fields produced by cerebrum activity and it is the most well-known technique as a result of its minimal effort and adaptable equipment prerequisites. The con-

straint of EEG is that it cannot consistently measure deep changes in brain electrical activity.
Magnetoencephalography (MEG). This method measures minute changes in magnetic fields delivered by the cerebrum. It is a multi-million-dollar piece of hardware and requires a cool temperature close to zero for it to work and it has been used as a part of scholarly research but not yet as part of a neuromarketing (or neurotourism) study.

6. Limits on the use of neuroscience tools in tourism

Until now there have been several limitations that impede a broad use of neuroscience techniques and neurological tools in neurotourism. Mileti and colleagues (2016) highlight five limitations exhibited in Table 1.

In reality, the main limits are connected with the big dimensions of some devices and also the necessity to do the experiments in an "artificial" place as a laboratory is. Moreover, the inability to provide immediate results can create some twisted interpretation.

Table 1 – Limitations and implications of techniques and neurological tools

Limitations	Implications
1) The development of high-priced and short-time neuroimaging experiments	- Limited sampling - Inadequate evaluation of neurophysiological variations
2) The development of experiments confined to artificial laboratory environments	- Experimental distortion - Incomplete comprehension of subjects' emotional states
3) The use of a single neuroimaging technology at the time: fMRI	- Incomplete map of brain functions - Overinterpretation of results
4) The use of a single nonneuroimaging device	- Scarce integration of neurological and physiological signals - Overinterpretation of results
5) Moral, social, and ethical abuses of neurosciences devices used for neurotourism	- Inadequate protection of vulnerable populations - Manipulation of consumers' minds

Source: Authors' adaptation of Mileti et al., 2016: 669.

The limitations presented above can be significantly reduced with the adoption of nanometer devices, which are now available as a result of the development of nanotechnologies. Nanotechnologies have been hailed as offering to satisfy biomedical necessities to reduce hospitalization through remote control and assistance with the use of wireless devices. The use of wireless devices offers researchers the possibility of monitoring human beings in real time when they are engaged in some consumer activity, or during holidays or when, unfortunately, they have to monitor their health.

In summary, the "technology of the small" (Courtney, 2008) is of great interest because it gives the possibility of miniaturizing complex tools into nanodevices with significant results: the miniaturization of the dimensions and the reduction of costs. The main opportunities offered by the use of nanotechnologies are showed in Table 2.

Table 2 – Opportunities and implications of nanotechnologies tools

Opportunities	Implications
1) The employment of nanotechnologies to measure emotional states in real time	- Continuous and real-time monitoring of subjects' emotional states and purchasing experiences - Eliminating generalizations of limited laboratory studies - Increased reliability and validity of findings
2) The use of unobtrusive and portable nanotechnologies devices	- Eliminating perception of intrusiveness and distortions of conventional laboratory devices - Monitoring different neurophysiological signals in a natural, continuous and comfortable way
3) The application of multifunctional nanotechnology devices	- Co-measuring of different neurological and physiological signals - Increased reliability and validity of findings
4) The combination of laboratory experiments and testing of daily life through miniaturized nanotechnology devices	- Co-measuring of different neurological, biological and physiological signals - Increased reliability and validity of findings
5) The balance of nanotechnology techniques applied in the neurotourism field with moral, social and ethical requirements	- Defense of consumers' privacy and autonomy - Protection of vulnerable population groups - Comprehension of compulsive behaviors and pathologies and consumer buying habits

Source: Authors' adaptation of Mileti et al., 2016: 669.

Also, if the use of nanotechnologies constitutes a great opportunity in the comprehension of the behavior of consumers and tourists, a debate is started about the invasive applications and ethical consequences (Roskies, 2002). The ethical problem is not new in marketing studies, but now the miniaturization of devices poses new problems.

A neurotourism application, described in the following lines, has been made with the acceptance of the people involved in the experiment regarding a really special target: families, that is, parents and children.

The experiment was made by two Australian neuroscientists Peter Simpson-Young from the University of Sidney and Associate Professor Joel Pearson from the University of New South Wales (2017).

They tested a wireless device that measures the electrical activity of the brain through electrodes located on the scalp. Developed by the Australian firm Emotiv, the EEG (electroencephalography) headset measures levels of electrical activity in the brain, indicating stress, excitement, interest, relaxation and happiness.

They tested the headsets on five Australian families in the account from the Singapore Tourism Board. Speaking on the experiment, Prof. Pearson said that the EEG had great potential as a destination marketing tool because it offered a more honest appraisal than traditional research methods. Moreover, the "real time" nature of the EEG data was also of appeal, Prof. Pearson said (2017).

In summary, the neurotourism advantage is to have the possibility to perceive, using the EEG tool, the tourists' emotional state in real time without any bias. In this way, the manager can understand if the tourists' experience is positive, if the products are attractive, and so on, allow a quick change, if necessary, to meet the tourists' emotions and appreciation. In fact, the main contribution is to highlight tourists' neural mechanism when they are travelling.

4. Conclusion

In this work we took into consideration, on one hand, the staggering increase of research in the field of neuroscience and, on the other hand, the application of neuroscience discoveries to numerous other fields such as economics, management, marketing and tourism.

Moreover, unexpected developments have clearly emerged regarding nanotechnologies and, as a result, the miniaturization of several devices in the neuroscience field. These new technologies are capable of affecting fields such as management, marketing and neurotourism.

This means that – to find an answer to the question put in the title of our study – neurotourim is not a futuristic perspective, but it is a reality. The tourism field is beoming, and will continue to become more and more in the near future, neurotourism, and the use of wireless devices to know tourists' preferences in a short time will be the normal state.

Moreover, the research question "Is neurotourism the way to 'personalize' tourism offers and create a unique competitive advantage?" can also have a positive answer because the unique desires of each tourist can be satisfied with the knowledge in real time.

The field of study taken into consideration in this work is continuously in progress and it will be really interesting to continue to analyze developments, not only from an academic point of view but also in the implementation in the field of.

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Biographical sketch

Ernestina Giudici, Full professor, Department of Economic and Business Science, University of Cagliari (Italy). Research interest: Communication, Organization theory new perspectives, Didactic methods in the third millennium, Experiential and neuro marketing.
Angela Dettori, Research fellow, Department of Economic and Business Science, University of Cagliari (Italy). Research interest: sustainable businesses, sustainable tourism and sustainable education.
Federica Caboni, Research fellow, Department of Economic and Business Science, University of Cagliari (Italy). Research interest: Place management, Town Centre management, retailing and new technologies.