

# RFID-based action tracking for measuring the impact of cultural events on tourism

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## Abstract

Organization of cultural events in a tourist destination often demands large investments. For this reason, authorities, tourism managers and operators need data to support their decisions, define their strategies and, in general terms, they are interested in measuring the economic impact of such events on tourism. In this paper, we propose a lightweight framework that can be applied to gather data on the places tourists visit during an event. The framework is based on an action tracking system that exploits RFID technologies on an existing city card circuit. The main choices necessary to design a system that allows to satisfy technical, organizational and budget constraints are described referring to its application to two important recent festivals – Trento FilmFestival and the Festival of Economics – characterized by very different content, history, and targets.

**Keywords:** Cultural events, RFID; City card, action tracking, economic impact, tourism.

## 1 Introduction

Cultural events play an important role for the offer of a tourist destination and are often planned regularly, for example, annually or biannually. This kind of events can demand large resources in terms of investments, permanent staff and office, and are frequently sponsored by public funds donations. They may also include a number of initiatives and activities of different nature, e.g., expositions, talks, film demonstrations, and others. To this end, there are many financing and planning decisions involved: on the renewal of the event, definition of the program, involvement of tourist operators and volunteers, etc. These decisions are usually based on data related to the previous editions – statistics on the number of visitors, events, website's visits, TV broadcast – and on data about the participants' preferences obtained from questionnaires (Research Resolutions & Consulting Ltd., 2005). However, for comprehensive evaluation of the economic impact of cultural events on the tourism of a destination, more specific information must be collected. In

particular, it is important to obtain actual statistics on the visits of the attendees to the places that contribute to the cultural, 'oenogastronomic' – food and wine – and commercial tourist offer of the destination.

To gather behavioral data and quantify the economic impact of a given cultural event on tourism activities within a destination, we developed an action tracking framework that includes both technical and organizational design. The framework is based on two main decisions: a) exploiting the RFID (Radio Frequency Identification) technologies; b) tracking the visits on the places in a destination using a city-card circuit. The RFID applications are based on devices that use radio signals to exchange data and they enable automatic identification (Abe et al., 2007). Thus, RFID can be utilized to register the presence of tourists by providing them with RFID tags and installing readers in the points of interest within the destination. To avoid creating an ad-hoc network of readers, we propose to use the circuit created for a city card. City cards allow tourists for a fixed price for a certain period to travel on the local public transportation, get discounts in most of the places of attraction, shops, hotels and restaurants. The use of a city card circuit permits to set up an action tracking framework with reduced complexity and economic and organizational costs.

In this paper we introduce the RFID based action tracking framework, determine the design parameters for the framework and define the technology selection criteria. We also analyze alternative technologies, as for example frameworks based on GPS (Global Positioning System) or mobile protocols, and provide rationales of the adoption of an RFID based system. The framework represents a lightweight approach because it was designed to optimize the cost-benefit ratio. To illustrate main characteristics of our system, we describe two applications to different types of cultural events: the Trento FilmFestival (<http://www.trentofestival.it> [Sept. 1, 2008]) and the Festival of Economics (<http://www.festivaleconomia.it> [Sept. 1, 2008]). The applications fall under the "RFID for Festival" project financed by the Municipality of Trento. We analyze the methodological issues on the applicability of the approach and provide some preliminary results on the data collected with the RFID based action tracking based system.

The paper is structured as follows. Section 2 provides an overview of the related work. Section 3 analyzes the problem and discusses the design of the RFID based action tracking framework. Section 4 describes the details of the application of this framework to the "RFID for Festival" project. Section 5 draws conclusions and lessons learned.

## **2 Related work**

Cultural events represent an important growth area within the tourism industry. Many cities organizing such events expressed their interest in measuring the economic impact of these events on the city. For instance, in Italy the Festival della Letteratura in Mantova (12th edition in 2008), Festival della Mente in Sarzana (5th edition in 2008), and International Film Festival in Locarno (61st edition in 2008) have been all recently analyzed to evaluate such impact (Guerzoni, 2008), (Istituto Regionale di Ricerca della Lombardia, 2006), (Istituto di Ricerche Economiche, 2005).

Models to measure the impact of specific activities – like cultural events – on tourism have been proposed in (Costa & Manente, 1993), (Dwyer, Forsyth & Spurr, 2004), (Manente, 1999), (Mathieson & Wall, 1982), (Mugellini, Rubegni & Khaled, 2007), (Tyrrell & Johnston, 2006). Other studies confirmed the relation between the expenses of attendees of cultural events and economic impact (Research Resolutions & Consulting Ltd., 2005). The common approach to measure the economic impact of a cultural event is based on data obtained in two main ways: (a) estimating participants of the previous editions using statistics on the number visitors, events, website's visits, TV broadcasting; (b) collecting data on the preferences or intentions of the participants obtained essentially from questionnaires (Research Resolutions & Consulting Ltd., 2005). However, obtaining behavioral data on visits of tourists in a destination would highly improve the results of economic impact models.

To this end, in this paper we propose an approach that uses RFID technologies on a city card circuit to gather actual data from a sample of attendees in order to track their actions: museums they visit, restaurants and bars they go to, and other activities.

RFID technologies have been applied in a number of different sectors, from retail to logistics (Roussos, 2006), and more recently for luggage management systems in airports (Fung L. C. et al., 2007). Other successful applications include access control, toll collection, manufacturing, animal tracking and transport. Critical points of RFID technologies have also been investigated by many authors. In particular, these points include costs related to systems that have to guarantee a high level of precision for the identification of single places (Chen et al., 2007), privacy concerns for data related to customers' behaviors (Angeles, 2007), and technical limitations of the different RFID cards and readers (Curtin, Kauffman, & Riggins, 2007), (Evjemo & Schurmann, 2007), (Finkenzeller, 2003).

Focusing on the tourism sector, the RFID applications can be illustrated in four major subgroups based on different aims of use. The first group of applications is mainly designed for human tracking and control (Zach, Gretzel, & Fesenmaier, 2008). The second group is used for tracking purposes and also to control assets and valuables rather than human beings. RFID-tagged casino chips and luggage tracking systems can be grouped in this subtopic. Contactless payment systems, including contactless billing and paying, are the third main subtopic of RFID applications in tourism. RFID-based toll collection systems and public transport cards are the major examples of this kind of applications. RFID-based information devices are the last group. Most of these systems are designed to inform the user by giving information about nearby objects. For example, the PDA or mobile-phone integrated systems are already widely used in museums to inform the users about the exhibited piece (Danks et al., 2007), (Deguchi et al., 2007), (His, 2003).

To monitor tourists' movements within a destination, other technologies have been recently applied, namely those related to Bluetooth protocol and GPS systems (e.g., Wiki City Rome project, see <http://senseable.mit.edu/wikicity/rome> [Sept. 3, 2008]). Although wireless devices could be adopted for an action tracking system, for the purpose of our project, they are too expensive, compared to the RFID technologies (the cost-benefit analysis is given in the next section). Moreover, mobile technologies also involve major privacy issues.

### 3 The RFID based action tracking framework

Gathering behavioral data to measure the impact of cultural events or other initiatives on a tourism destination is a major challenge (Roberts, 2006). Though the estimation of the number of participants of the initiatives in the program of a given cultural event and the number of tourists present in the destination during the events is relatively easy (Costa & Manente, 1993), (Manente, 1999), it is difficult to obtain actual data on tourist activities. Traditional surveys based on questionnaires are useful to get an estimation of different tourist activities in terms of intentions or preferences; however they do not represent behavioral data. Recent developments in mobile and tracking technologies can help to cope with this issue. A systematic monitoring project has to be planned taking into account requirements and characteristics of a specific destination, and cost-benefit analysis of the technologies available.

The main requirements for the monitoring of large cultural events are the following:

- define the number and the kind of places to monitor according to the tourist offer of the destination;
- identify the number and the profiles of participants to be involved starting from data of previous edition of the events;
- identify a technology taking into account economic and organizational costs.

There are two main technologies that can be considered given these requirements:

- mobile technologies that can be used for action tracking, i.e., Bluetooth and GPS devices such as cellular phones or GPS Bluetooth receivers;
- RFID technologies.

As regards cellular phones and PDAs technologies, they were suitable for our purposes; however, despite a good proliferation, they do not satisfy the initial requirements. In particular mobile devices' precision of tracking is limited to 10-20 m, while the Festivals could have several points of interest within such an area. Moreover, usability, privacy issues and costs in case of providing tourist such devices make them unaffordable for the project (Table 1). Therefore, our framework considers the RFID technologies as the most suitable for fulfilling the goal and satisfying the requirements of the project.

There are several devices with different technical specifications in the RFID market. These technical details and device alternatives makes the RFID technologies selection a multi-criteria decision making problem (Oztaysi & Mich, 2008). RFID equipments are generally manufactured for utilizing in a specified band of frequency according to their potential usage environment: low frequencies, less expensive and with low reading speed are applied to access controls or for animal identification; intermediate frequencies are used for smart cards, or for library and shop controls, high frequencies RFID, with a longer read range and higher reading speed are also more expensive and are applied for example for vehicle tracking (Roberts, 2006).

An RFID system consists of two main components; a *reader* and a *tag*, also called label or transponder. The reader queries the tag, obtains information, and then takes action based on that information. That action can be displaying a number on a hand held device, passing information on to a POS system, creating an inventory database,

or relaying it to a backend payment system with middleware software. There are two basic types of tags according to their working principle: *passive* and *active*. *Passive* RFID tags do not contain a power source; therefore, they must wait for a signal from a reader and the tag must be relatively close to the reader in order to work. Instead, *active* tags, containing a battery to power the radio circuitry, can actively transmit and receive on their own. The reader can have an integrated antenna, as in handheld units, while larger systems usually separate the antennas from the reader. Basically, the reader retrieves the information from the RFID tag. A reader may record the information internally; or, it may transmit it to another information system. Both, readers and their antenna arrays can be different sizes, from postage stamp-sized to large devices with panels that are several feet wide and high. The reader point is composed of equipment that does not necessarily need human surveillance to guarantee its correct use and functionality. The reader records the data – a card identifier (ID) and timestamp. Working in the stand-alone mode, thus, it does not need to be connected to the network. In some cases, several readers can be connected to a network, for instance, for big museums.

**Table 1.** The trade-offs in using different technologies

		<b>Precision</b>	<b>Usability</b>	<b>Privacy</b>	<b>Costs</b>
Mobile (GPS, Bluetooth)		Up to 10 m	Depends on device	Require explicit authorization	High
RFID	Active	Few meters	High (non intrusive)	Low	High
	Passive	about 10 cm	Low (intrusive)	Medium	Low

The active type has advantage of being less intrusive for its owner than the passive one, because this card does not require bringing it close to the reader and providing indications of the reading points. However, the cost of this technology is much higher and unacceptable for the purposes of our research project. For this project, we propose to use the RFID proximity cards that use passive technology. These cards are personal and anonymous thus allowing comparison of the data on tourist actions with his or her profile, obtained from a questionnaire.

Table 2 summarizes estimated costs of the RFID-based passive technology application needed for one event and shows that a framework using ten readers costs at least € 18,000. In general, we can distinguish: (a) costs of acquiring or renting of hardware and software; (b) expenses of the personnel of three roles, i.e., information technician, statistician, and marketing specialist; in addition to other eventual expenses for the control operators.

To reduce the costs, our framework foresees to exploit the presence of the city card circuit of Trento ([http://www.ap.trento.it/en/Services/Trento\\_Card/Trento\\_Card.htm](http://www.ap.trento.it/en/Services/Trento_Card/Trento_Card.htm) [Sept. 1, 2008]). This circuit uses RFID proximity cards for tourists and has an extensive network of 116 RFID readers around the city in the places of attraction, shops, hotels and restaurants. Collection of the action data can be thus realized through the readers of the circuit using the cards distributed among a sample of participants. Moreover, the circuit allows involving a larger number of the locations compared to those that could be checked in case of using another technology.

**Table 2.** Cost analysis for a framework based on an ad-hoc solution

<b>Expense Item</b>	<b>Unit Cost €</b>	<b>Total Cost €</b>
Rent of 10 reading RFID terminals	550	5,500
Proximity cards (1,000)	2.2	2,200
Offset printing in 4 colors with a personalized layout	450	450
Personal notebook with the SW for data registration and analysis	850	850
Software for RFID cards and readers	1,000	1,000
Human resources for cards distribution, communication with tourist operators, and collecting the data	-	8,000
<b>Total</b>		<b>18,000</b>

#### **4 Application of the framework in the “RFID for Festivals” project**

The “RFID for Festival” project focused on two events: the Trento FilmFestival (<http://www.trentofestival.it> [Sept. 1, 2008]) and the Festival of Economics (<http://www.festivaleconomia.it> [Sept. 1, 2008]) that represent two major cultural events of Trento. Both events, albeit having different traditions (Trento FilmFestival approached its 56th edition in spring 2008, while the Festival of Economics is only at the 3rd), get together a large number of people. Taking into account their great public success, systematic evaluation of the economic impact of the two Festivals on the city becomes highly important.

To estimate the economic impact of these Festivals of Trento, we needed to collect the data related to the visiting cultural, oenogastronomic – food and wine – and commercial points of the city by the participants of the Trento FilmFestival and the Festival of Economics. The locations to monitor were selected on the basis of the following criteria: (a) places of cultural interest where the Festival’s events were scheduled; (b) touristic sites important for strategies of the destination; (c) places where it is possible to use a reader in such a way that it is easily accessible by the participant and can be controlled (human control is not necessary for the work of detector, however, for security reasons, it is not recommended to install detectors in an uncontrolled environment). The data was collected from tourists that came to Trento for the Festival staying at least for one night. We counted neither same-day visitors (i.e., excursionists), nor residents.

##### **4.1 The festivals**

Trento FilmFestival is recognized as the largest international festival of films about the mountains, adventures, and exploration. Apart from the cinematographic program, it provides collateral events, such as meetings, exhibitions, performances, and “MontagnaLibri”, international book exhibition. Table 3 presents the number of visitors during the last 5 editions, while Table 4 provides additional information for year 2008.

**Table 3.** Visitors of Trento FilmFestival (2006 – 2008)

Year	Cinema	Events	Montagnalibri
2006	3,151	2,072	about 10,000
2007	3,800	3,300	about 14,000
2008	5,271	5,488	about 17,000

**Table 4.** Additional Information about Trento FilmFestival

<b>Edition 2008</b>	Over 40.000 visitors in 13 days 128 films presented 328 works from all parts of the world 32,571 website visits, 307,521 pages visited
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The Festival of Economics consisted of two main sections, meetings and discussions, together with events in the streets, initiatives for children and youth, ArtInFestival, the library of the Festival, movies and performances. Table 5 presents the summary of the main data of the first two editions and the edition of 2008 that provide an idea of the Festival's success.

**Table 5.** Data on the Festival of Economics (2006 – 2008)

	2006	2007	2008
Duration	4 days	5 days	5 days
n. of events	35	42	69
n. of international events	12	15	-
Speakers	130	252	196
Journalists registered	200	360	412
Participants	50,000	More than 60,000	More than 70,000
Website visits	1,000,000	More than 1,200,000	1,723,832

#### 4.2 The monitoring project

The action tracking framework assumes accomplishment of the following tasks: identification of locations important for measuring the presence of Festival participants, selecting the means of participant detection, realization of the measurements, and analysis of the data.

**Identification of locations to monitor.** To apply the action tracking framework we first checked that the circuit of Trento card guarantees the necessary coverage; the three criteria, specified in Section 3, have been applied to select the first list of 116 locations of readers. From this list we eliminated places of little tourist interest, as for instance, hairdressers and fur coats shops, and places located far from the city center. Moreover, we added to this list some central restaurants that are not included in the circuit then, the local Municipality administration checked the commitment of collaboration in each of the points. As the result, 48 places were fixed comprising 10 museums, 18 restaurants, 18 shops, and 2 bars. In order to make the detectors visible to the participants, proper indications were provided, more specifically, a sticker with the logos of both events and the RFID card in the middle (see Fig. 1).



**Fig. 1:** The indicative sticker for the two events and the picture of the card given to the participants

**Definition of the sample and distribution criteria.** To guarantee the representativeness of the sample, we set the maximum number of cards equal to 800 to distribute at two festivals (400 per each event) among a random sample set.

The cards had been distributed in different locations in order to intercept all the types of participants, from accredited visitors to those that participated only in the recreational types of activities. Furthermore, some hotel structures were involved in the collaboration, and, in the case of the Trento FilmFestival, the information office of the city as well. Distribution points comprised press accreditation office, conferences, meetings and evening events, information offices of the tourist boards of Trento, Monte Bondone and Lakes Valley. The distribution was realized in the first days of the events: first 3 days for the Festival of Economics and a week for the Trento FilmFestival that has a longer duration. Some difficulties were encountered in the distribution of the cards due to the presence of many excursionists and residents. However, the number of cards distributed was large enough to estimate population frequencies through sample frequencies; we have obtained a sample size so that a desirable level of precision is guaranteed (in our case, the difference between the population and sample frequencies does not exceed 5%).

**Table 6.** Number of cards distributed during the two Festivals

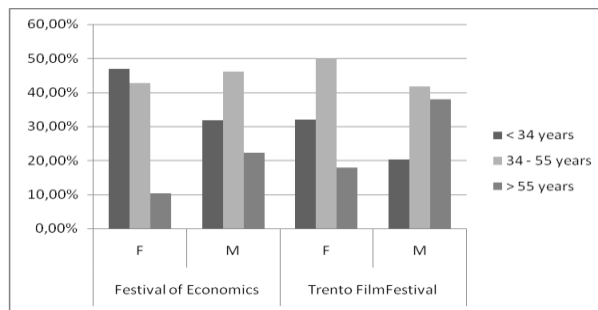
Event	Cards Distributed
Trento FilmFestival	284
The Festival of Economics	416
<b>Total number</b>	<b>700</b>

The cards distributed during the two festivals were anonymous and for individual use only; a card's ID was linked to a profile of the person. The profile was extracted from a questionnaire given to the participants at the moment of card emission. The questionnaire asks for information about the origin, age, sex, period of stay, type of lodging, the means of booking, and the loyalty to the destination (novice or frequent visitor). Along with the questionnaire, the participant was given a brochure explaining the general goal of the project, how to use the card, and listing the reading points with a map of the city. Unlike the TrentoCard, though utilizing the same circuit, the card of a participant of the project was free and did not provide any discounts. As an incentive to motivate the participants to use the card, the local tourist board provided 10 free week-ends in a hotel with half board to be extracted among the participants.

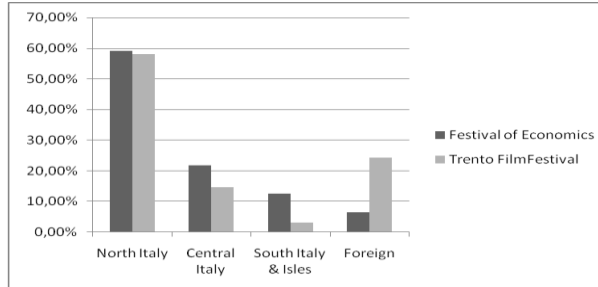


**Main results.** In this section, we provide some preliminary statistics based on the data collected with the RFID-based framework. The final results of the analysis will be published in a future work describing the assumptions, external data, and theoretical model to use data obtained with the RFID-based action tracking system for measuring economic impact of cultural events.

Fig. 1 and 2 provide statistics on the profiles of the participants of the two Festivals obtained from the questionnaire. The first diagram shows a high presence of middle-aged people in both Festivals. From Fig. 2 we can see that most of the visitors came from the nearest regions, i.e., the North of Italy. Interestingly, Trento FilmFestival attracted a larger fraction of foreign visitors than from the Center or South of Italy, while the Festival of Economics demonstrated a smaller fraction of foreign visitors.



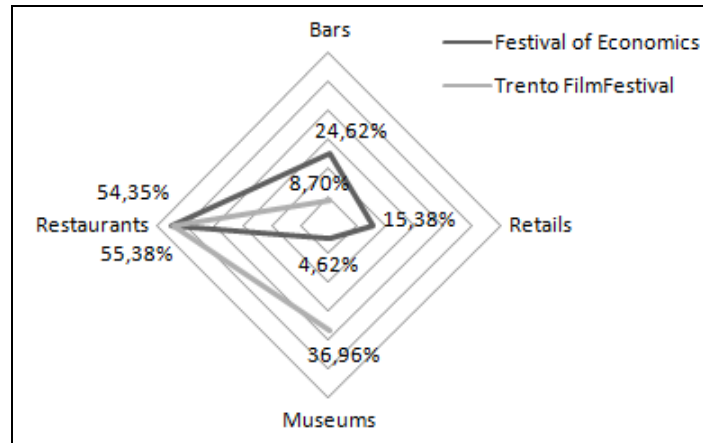
**Fig. 1.** Visitors profiles for two Festivals



**Fig. 2.** Origin of visitors for the two Festivals

Fig. 3 provides an insight on the places visited by the festivals' participants. During the Festival of Economics the catering structures of Trento benefited the most, given that more than 55% of the participants had also visited restaurants and almost 25% visited bars. In contrast, a greater number of the FilmFestival participants visited local museums (about 37%).

Thus, even from the preliminary figures we can draw some conclusions on the differences in the tourist fruition of the two Festivals on the destination. Further analysis will be realized to identify the reasons of diversity of tourists' actions and eventually derive recommendations for the next Festivals' editions. In particular, we expect to find out how the operators that so far benefited the least can increase their profits.



**Fig. 3.** Action track data of visitors for the two Festivals

## 5 Conclusions

The action tracking framework proposed in this paper allowed to efficiently resolve the cost-benefit trade-off related to collecting data on large cultural events. In fact, compared to the other solutions that were technically possible, the proposed solution guarantees the collection of behavioral data with relatively small costs.

The contributions and lessons learned in the two projects described in this paper can be summarized in the following points:

- RFID technologies allow to address the trade-off costs vs. precision of the data only if all the actors involved are committed to cooperate; in particular, (a) tourist operators, as owner of the restaurants, shops and museum ticket boxes, must promote the initiative at an adequate level, exposing the sticker and readers in such a way as to facilitate the card utilization even in rush hours; (b) technical partners have to support the data collection process starting from the very early phases, when off-line readers have to be checked, on-line data have to be stored in a database so that it is then possible to recognize visit to the location from those due to the normal use of the city card; (c) the local office of tourism promotion in charge for the city card circuit has to commit the chosen members to participate in the monitoring initiative and to sponsor it.
- Our solution of using a specific card on the basis of the city card circuit allows to overcome the limitations of the original Trento card: the cost of the real card, the predefined validity time, fixed number of monitoring points in the circuit and difficulty of extracting data of participants to the events. Moreover if participants were given the full city card, which provides discounted entrance in most of the cultural places and shops – data could be affected by opportunistic behaviors. Though introduction of specific cards raises costs, it allowed monitoring locations not included in the city card.
- The most critical phase of the entire monitoring process is the distribution of the cards. The solution identified in this paper was to engage tourists mainly at the

reception of the hotels and during inaugurations. However, as the number of cards distributed in this way was lower than expected, distribution points comprised also press accreditation office, conferences, meetings and evening events, information offices of the local tourist board.

Finally, as for the application of the proposed framework in a new destination, it is recommended to fulfill a test that monitors a minor event to verify possible critical points and situations. Such issues are important to anticipate because each city has its specific cultural, oenogastronomic – food and wine – and commercial offer, and each cultural event has a different target. In our project, we used as an applicability test the Trento FilmFestival.

Results obtained from the statistical analysis confirmed that the global design of the framework was adequate to accomplish the final goal: collection of behavioral data on the places visited by tourists during the Festivals. These data represent a new input towards the application of effective models for measuring the impact of cultural events on the tourism and better focusing future decisions for the Festivals' funding and organization.

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## References

- Abe, A., Maita, N., Ooshida, Y., & Kano, T. (2007). Design Approach for Providing Tourism Information by Linking RFID and GIS Proposal for a System Based on the Universal. In G. Magyar, & G. Knapp, *Advances in Information Systems Development*, 247-258. Springer US.
- Angeles, R. (2007). An empirical study of the anticipated consumer response to RFID product item tagging. *Industrial Management & Data Systems*, 107 (4), 461-483.
- Chen, P., Chen, W., Wu, C., Tseng, Y.-C., & Huang, C.-F. (2007, April). A Group Tour Guide System with RFIDs and Wireless Sensor Networks. *Proc. of 6th Int. Symposium on Information Processing in Sensor Networks, PSN 2007*, 561-562.
- Costa, P., & Manente, M. (1993). *The Economic Impact of Tourism in Italy: A Multiregional - Multisectoral Analysis for 1988*. Venezia: Ciset.
- Curtin, J., Kauffman, R., & Riggins, F. (2007). Making the 'MOST' out of RFID technology: A research agenda for the study of the adoption, usage and impact of RFID. *Information Technology and Management*, 8 (2), 87-110.
- Danks, M., Goodchild, M., Rodriguez-Echavarria, K., Arnold, D., & Griffiths, R. (2007). Interactive Storytelling and Gaming Environments for Museums: The Interactive Storytelling Exhibition Project. *Edutainment*, 104-115.
- Deguchi, A., Mizoguchi, H., Inagaki, S., & Kusunoki, F. (2007) A Next-Generation Audio-Guide System for Museums "SoundSpot": An Experimental Study. *Proc. of KES 2007, LNCS, 4694*, 753-760.
- Dwyer, L., Forsyth, P., & Spurr, R. (2004). Evaluating tourism's economic effects: new and old approaches. *Tourism Management*, 3 (25), 307-317.

- Evjemo, B., Akselsen, S., & Schurmann, A. (2007). User Acceptance of Digital Tourist Guides Lessons Learnt from Two Field Studies. *Proc. of HCI, Part I, HCII 2007, LNCS, 4550*, 746-755.
- Finkenzeller, K. (2003). *RFID Handbook : Fundamentals and Applications in Contactless Smart Cards and Identification*. John Wiley & Sons.
- Fung L. C., Chan, K. H., Lam W. K., Leung S. W., Wong Y. F., Wu Paul W. K, and Tang C. K.(2007). Electromagnetic Assessment on Human Safety of RFID System at Hong Kong International Airport. *Microwave and Optical Technology Letters*, 49 (4), 924-927
- Guerzoni, G. (2008). *Effetto festival. L'impatto economico dei festival di approfondimento culturale*. La Spezia: Fondazione Carispe.
- Hall, T., & Bannon, L. (2006). Designing ubiquitous computing to enhance children's learning in museums. *Journal of Computer Assisted Learning*, 22, 231-243.
- Hsi, S. (2003). A study of user experiences mediated by nomadic web content in a museum. *Journal of Computer Assisted Learning*, 19, 308-319.
- Istituto di Ricerche Economiche. (2005). *Impatti economici e potenziali strategici del Festival internazionale del film Locarno*. Bellinzona: Università della Svizzera Italiana.
- Istituto Regionale di Ricerca della Lombardia. (2006). *Metodologie di valutazione di impatto degli interventi culturali*. Milano: Regione Lombardia.
- Manente, M. (1999). Regional and inter-regional economic impacts of tourism consumption: methodology and the case of Italy. *Tourism economics*, 5 (4), 425-436.
- Mathieson, A., & Wall, G. (1982). *Tourism: Economic, Physical and Social Impacts*. Prentice Hall.
- Mugellini, E., Rubegni, E., & Khaled, O. A. (2007). Tangible Interaction based on Personal Objects for Collecting and Sharing Travel Experiences. *Proc. of HCII 2007, LNCS* (pp. 873-882).
- Oztaysi, B., & Mich, L. (2008). Technology selection for radio frequency identification (RFID) based actions-tracking system using fuzzy analytic hierarchy process. In: D. Ruan, J. Montero, J. Lu, L. Martínez, P. D'Hondt and E.E. Kerre (eds.), *Computational Intelligence in Decision and Control, vol.1, Proc. of the 8th Int. FLINS Conference* (pp. 1057-1062).
- Research Resolutions & Consulting Ltd. (2005, August 01). *Guidelines for Measuring Tourism Economic Impact At Gated Events and Festivals*. Retrieved August 26, 2008, from Alliance for Arts and Culture: <http://www.allianceforarts.com/advocacy/EconImpactGatedEvents.pdf>
- Research Resolutions & Consulting Ltd.(2005). *Guidelines for Measuring Tourism Economic Impact At Gated Events and Festivals*.
- Roberts, C. (2006). Radio Frequency Identification (RFID). *Computers & Security*, 25 (1), 18-26.
- Roussos, G. (2006). Enabling RFID in Retail. *Computer*, 39 (3), 25-30.
- Smith, J.R., Fishkin, K.P., Jiang, B., Mamishev, A., Philipose, M., Rea, A.D., Roy, S., & Sundara-Rajan, K. (2005). RFID-Based Techniques For Human-Activity Detection. *Communications of the Acm*, 48 (9).
- Tyrrell, T., & Johnston, R. (2006). The Economic Impacts of Tourism: A Special Issue. *Journal of Travel Research*, 45 (1), 3-7.
- Zach, F., Gretzel, U., & Fesenmaier, D. R. (2008). Tourist Activated Networks: Implications for Dynamic Packaging Systems in Tourism. *Information and Communication Technologies in Tourism 2008* (pp. 198-208). Wien: Springer.