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Wireless Multimedia Communications Impacts on Tourism Destination Value Chain

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Abstract: Future wireless services for tourism destinations will be implemented using several network technologies focusing on the prospective standardization and specification efforts. Current Destination Management Systems (DMS) span wide areas with heterogeneous tourism destination information resources. Recently, intelligent DMS are aware of different user context environments and satisfy the matchmaking between the mobile user requirements and destination information via various wireless services. This study discusses the evolving wireless technology and the forthcoming applications on long haul tourism destinations. It examines the implications of wireless technology on long haul destinations. Using the Porter's value chain analysis, light is shed on the future developments and potential alterations with regards to the primary and support activities within the value chain. Finally, future prospects in wireless multimedia communications such as MMS, multimedia browsing, rich call-personal real-time communication and mobile messaging are discussed.

Key words: Wireless communication, destination management systems, destination value chain

INTRODUCTION

A tourism destination is a well-defined geographical area, such as a country, an island or a town[1,2]. Destinations offer an amalgam of tourism products and services, which are consumed under the brand name of the destination, offering an integrated experience to consumers[3]. The components of a destination can be summarized as the 6As: *Attractions, Amenities, Available tourism packages*, *Ancillary services*, *Accessibility and Activities*[4]. In every destination, there is an authority that is in charge of managing these destination components that could either be public (at national, regional or local level), or a formed partnership between stakeholders and the local tourism industry[5,6]. Destination Management Organizations (DMOs) have realized the usefulness of Information and Communication Technologies (ICT) and therefore many Destination Management Systems (DMS) have been utilized. A DMS is an e-commerce system, which is used for the collection, storage, manipulation and distribution of tourism information, as well as for the transaction of reservations and other commercial activities.

Future wireless services for tourism destinations will be implemented using several network technologies focusing on the prospective standardization and specification efforts. Wireless communications broadly consist of amateur, industrial, consumer, business, military/aerospace and long-haul applications. Amateur refers to the use of the radio spectrum by amateur operators for personal voice and data transmission. Industrial uses include automotive, such as intelligent highway and vehicle navigation systems based on the Global Position System (GPS). Consumer usage includes residential cordless telephony, cellular telephony and paging. Wireless communications are used by the military and the aerospace industry for communications to vehicles, ships and planes, using satellites as well as terrestrial methods. Long-haul services are point-to-point microwave links following railroads and utilities pipelines and dot the ridgelines and high-rise buildings in urban areas. Nowadays there are many successful examples of sophisticated applications-specific wireless systems, such as those in use by car rental companies for convenient check-in on the bus from the terminal or package tracking services used by parcel delivery services. However, general-purpose wide-area wireless services have not been nearly as successful. Complex pricing, low bandwidth and poor Internet connectivity have limited their use. Wireless LANs (WLANs) are considerably slower than commonly deployed wired networking alternatives, like 10-and 100 BASE-T Ethernets. The more

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widespread adoption of standards like IEEE 802.11 and the use of etiquette rules to allow sharing of spectrum to multiple users, will help make WLANs more efficient, more interoperable and better able to coexist with other wireless users and technologies. It is noteworthy that wireless data services are still in their infancy.

In this study we discuss the evolving wireless technology and the forthcoming applications on long haul tourism destinations. The paper examines the implications of wireless technology on long haul tourism destinations. Using the Porter's value chain analysis, light will be shed on the future developments and potential alterations with regards to the primary and support activities within the destination value chain. The study is composed as follows. In the next section, we review the wireless business value chain. Afterwards, we consider the main elements of mobile commerce transactions and discuss the core elements of the tourism destination value chain, which are shaped by the wireless technologies. Finally, we future implications of the wireless technologies to the destination value chain under the prism of multimedia communications.

THE WIRELESS BUSINESS VALUE CHAIN

According to Manson[7], the big push for wireless communication currently comes from the explosion of digital handsets, low-cost Short Messaging Services (SMS), a desire for instant access to e-mail and the continuing sophistication of information data services. As the demand for these features continues to grow, the need for wireless communication will continue to expand[8]. There are the technologies used mainly for short-range communication such as Bluetooth, Infrared, 802.11 standard, Home Radio Frequency, Digital Enhanced Cordless Telecommunications and Ultra-Wide band Radio[9]. Cellular, wireless LAN, private and public radio and satellite services should be considered for long-range communication that provides the basis for extended wireless mobile computing and networking infrastructure[10]. However, it is not only the technology itself that can affect the tourism destination. Therefore, it is vital to identify the major players in the wireless business value chain. These players are the following:

- Technology platform vendors that offer operating systems and micro browsers (e.g., Microsoft, Phone.com).
- Infrastructure and equipment vendors that offer the network infrastructure (e.g., Nokia, Ericsson, Siemens, Motorola).
- Application platform vendors who provide middleware and standards (e.g., Nokia, WAP Forum, UMTS Forum).
- Application developers who offer wireless platform applications (e.g., Yomimedia, WAPIT, Add2Phone).
- Content providers (e.g., Reuters, Yahoo).
- Content aggregators (e.g., Digitallook.com).
- Wireless portal providers for application aggregation.
- Mobile Network Operators (MNOs).
- Mobile service providers who act as an intermediary between the operator and the customer[11].

MOBILE COMMERCE TRANSACTIONS

A mobile e-commerce transaction can be defined as any type of transaction of an economic value that is conducted through a mobile terminal that uses a wireless telecommunications network for communication with the e-commerce infrastructure[11]. Usually, in an m-commerce transaction the main participants include:

- The customer who is mainly mobile. The place where a transaction is initiated may differ from the place where the service is received and the place where the payment and the transaction are completed.
- The content provider who provides specific contents to a customer through a WAP (Wireless Application Protocol) gateway which can be hosted at the MNO or through a portal that can be hosted at the operator's WAP server or anywhere else[12]. This can prove to be a business model that can be easily followed from companies like Reuters or traffic news providers or stock exchange information providers. Actually they can offer their contents by directly contacting customers or via mobile portals.
- Wireless portals offer personalized and localized services to customers to minimize the required navigation by the user. Consequently, a customer moving from Finland to Greece, when s(he) is in Greece, s(he) should be able to access a Greek portal that supports not only the local language but also his/her home language and provides local-specific information like tourist attractions, local restaurants, etc. A wireless portal is characterized by a great degree of personalization and localization. *Localization* means that a mobile portal should supply information relevant to the current (geographical) location of the user. Information requirements may include for example, restaurant bookings, hotel reservations, yellow pages and so

on. *Personalization* applies to any kind of information provided by wireless portals including location-specific information. For the provision of such personalized and localized services, user's profile, cultural interests, past behavior, situation and location should be taken into account.

- WAP Gateway providers (for m-commerce over WAP) that can be considered as an equivalent to the application service providers (ASPs) Internet business model. Revenues of this model depend on the kind of agreement the WAP Gateway provider has formed with its clients.
- Service providers provide services to customers either directly or via a mobile portal or via a WAP gateway of another company or via a mobile operator. The service they provide may depend on specific contents they have acquired from content providers.
- Mobile network operators whose role can vary from a simple mobile network provider to an intermediary, portal or trusted third party[11].

However, how DMS exploit wireless technology: Initially, we must define the DMO functionality and nature. The decision, whether the DMO will operate a DMS that will be fully transactional or just informational (non revenue generator), is of major importance. According to Buhalis and Spada[13], the first type of DMO is not easily comprehended as non-commercial and therefore the neglecting of regional development may occur due to the DMO transformation into a commercial entity. Moreover, a conflict with the local industry is more than likely, as transactional DMOs can be perceived as potential competitors[14]. A feasible solution would be to guarantee the private sector involvement. The provision of capital from the service sector for the DMS development could result in high returns of investment[15].

Still, regardless of the DMO business model, the cooperation between the destination management authorities and the major wireless business players can prove more than beneficial. Especially, for the long haul destinations the proper formation and maintenance of this relationship is critical due to the fact that, by definition, these destinations are more information intensive. If we consider the fact that the new tourist is more experienced[16], computer literate and mobile than ever[12], it is clear that the cooperation with technology platform providers is almost a necessity. Moreover, though there is a trend for short-break holidays, tourists tend to choose long haul destinations for their vacations[12]. The combination of the above mentioned factors suggest the extensive utilization of the ad hoc technologies and according to Buhalis[3] it gradually becomes evident that destinations that provide timely, appropriate and accurate information to consumers and the travel trade have better chances of being selected.

The tourism industry is heavily dominated by Small Medium Enterprises (SMEs) and a major benefit would result from networks that can be developed among clusters of firms that are more alike than others[17]. The tourism product could be enhanced by the vertical integration of networks of complementary services for example hospitality, transportation and leisure organizations. The coordination of these networks can be a key factor for the successful destination development and for customer satisfaction[3].

The different sectors of the tourism industry can create a powerful network and share information with other sector networks and create useful extranets. A practical approach would be that, the networks of different industry sectors are supported by short range wireless technologies and the long range ones to be deployed either to improve the communication between the different sectors' networks or by the DMOs in order to support the destination communications as a whole. The DMOs could coordinate these networks and involve the public sector. Furthermore, DMOs can create valuable networks among them locally, regionally, nationally and even internationally through wireless technology. Figure 1 shows, different types of wireless technology can support different regions and destinations.

- Satellites provide global coverage and are suitable for urban and remote areas with low traffic density and without access to terrestrial telecommunications networks[18].
- Terrestrial macro cells are typically situated in rural or suburban areas with low or medium traffic density. The cell radius has a range of several tens of kilometres. The most widespread macro cell network is Global System for Mobile Telecommunication (GSM) that has been developed to the advanced Universal Mobile Telecommunications System (UMTS) that merges several access technologies into a single service interface and provides the basis upon 3G networks operate[18].
- Micro cells are situated in urban areas with a cell radius of up to 1 km. Traffic density varies from medium to high and the mobile speed remains moderate. Micro cell networks include:

    - ❖ Fixed wireless access networks: The main standardization work takes place in the IEEE 802.16 working group and in the HIPERACCESS

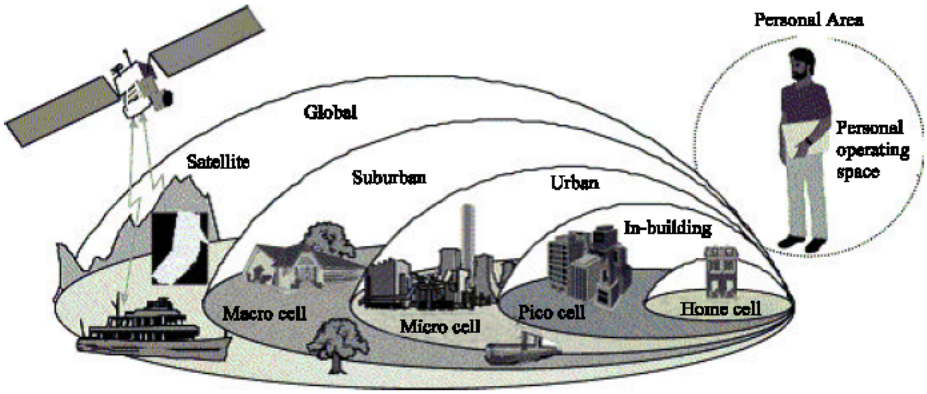

Fig. 1: Universal wireless network coverage[30].

project. Both attempt to define a fixed Broadband Wireless Access (BWA) comparable to the traditional wired access networks. HIPERACCESS supports a large variety of networks including the UMTS core network, Asynchronous Transfer Mode (ATM) and IP based networks[19].

- ❖ Digital cordless phones: Digital Enhanced Cordless Telecommunications (DECT) contains functionality for handovers, encryption of radio transmissions and authentication, which makes it a complete system platform for phone applications. However, for local data communications WLANs offers better performance[19].

- Pico cells are predominantly situated indoors with a cell radius of less than 100 m. Their characteristics include low speed terminals, medium to high traffic density and wideband or broadband services[20]. In pico cells, WLANs can be used as an extension or as an alternative to fixed LANs and an access method for UMTS based 3G services. IEEE 802.11, HIPERLAN and MMAC (Multimedia Mobile Access Communication) are used to develop high-speed wireless access[21].
- The final level of the hierarchy is personal area cells that refer to network connecting fixed, portable and moving devices operating in a Personal Operating Space (POS), where the cell radius is typically up to 10m around a person regardless if stationary or in motion[22]. A typical cell would contain a limited number of devices (e.g., less than 10) with low traffic density and wideband services (http://grouper.ieee.org/groups/802/15). It utilizes Bluetooth and IEEE 802.15 WPAN standard that target for interoperability between WPAN device and devices meeting the IEEE 802.11 standard[19]. It is worth noticing that Bluetooth aims for a global standard targeted for a low cost, small size and very low power consumption applications and is compatible with TCP/IP networking, cordless phone applications and WAP (http://www.wapforum.org/).

The core elements of the destination value chain appear in the Appendix A. Wireless technologies affect these elements. Wireless technologies regarding Personal Operating Space (POS) can be adopted and enhance the DMO's internal operations providing high speed, mobility and flexibility of operational workflow. Additionally *human resource management* (HRM) can be improved by the exploitation of wireless technologies in various ways as for example global employee databases, on-line training, real-time communication and paperless administration. They could also result in instant information exchange and communication that would lead to better management and decision-making process.

Moreover, the utilisation of the above mentioned technologies is merely a matter of the geographical position of the destination. Long haul destinations are considered those that are for example more than a 4 h flight away from the visitor's origin, but this does not describe the destination itself. Up till now, there can be no rule that can apply to all destinations considering the preferable type of wireless technology deployment.

Wireless applications take advantage of mobile communications to offer to consumers, businesses and destinations additional numerous benefits as opposed to traditional e-commerce applications. Wireless technology can increase location-awareness. In mobile computing, knowledge of the physical location of a user at any particular moment is central to offering relevant

Appendix A: *Destination Value Chain*

Firm infrastructure:
- Economic of scale and scope.
- Centralized data warehouse.
- Multi-channels (online and offline).
- Wireless networking.

Human Resource Management:
- Global employee database.
- On-line training.
- Global real-time communication.
- Paperless administration.
- Wireless Internet-based sharing and dissemination information.

Technology development:
- Collaborative service/product design.
- Virtual cooperation with multiple value-system participants.
- Knowledge directories accessible from all stakeholders.
- Innovation initiative-R and D to on-line sales and service information.
- Wireless CRM.

Procurement:
- m-procurement.
- Internet-enabled demand forecasting.
- Global tailed made purchase.
- Inventory and forecasting systems with suppliers.
- Automated invoice system.
- Direct and indirect procurement via marketplaces.
- Exchanges.
- Auctions and buyer-seller matching.
- Wireless inventory control.

Marketing and sales:
- Multi-channel distribution strategy.
- Real-time information access and availability.
- Tailored
- m-marketing via customer profiling.
- Push advertising and promotions.

Inbound Logistics:
- Automatic warehouse (just in time inventory
- Real-time staff scheduling.
- Dissemination.

Operations:
- High speed, mobility and flexibility of operational workflow.
- Integrated instance information exchange and communication
- Better management decision-making.
- Tailored made product/services,
- Real-time customers feedback

Outbound Logistics:
- Instant service/ product delivery.
- Real-time transaction (mCommerce/ m-payment)

Aftersales-services:
- m-CRM
- Real-time sales statistics.
- m-services community

services. The location of a mobile device is available to the MNO, but it can also be found using sensor devices or technologies such as the *global positioning system* (GPS)[23]. There are many examples of location-based e-commerce applications including geographically targeted advertising. For instance, everyone near a restaurant gets free (electronic) coupons as a special offer for the dish of the day, or receives a SMS from a hotel regarding current discounts. Push marketing strategies and tailored mobile marketing via customer profiling can be implemented. Extra-personalized requests such as traffic control reports or 3D maps can increase customer satisfaction. However, there are limitations with regards to advertisement, as there are issues of privacy and low customer tolerance. What is more, technical issues such as limited screen space might influence the effectiveness of advertisement. Still, moderate solutions such as free access to some services in exchange for ads, or more radical such as pay for no advertising, may appear.

Wireless communications have to take into account the different conditions of usage. The mobile user may be engaged into another activity, like traveling, meeting people, etc., rather than sitting in front of a desktop terminal. This means that the traveler can be on the move and therefore be provided with information before the arrival on the destination, whilst there and after the departure. *Inbound Logistics* are improved as automatic warehouse (just in time inventory) and real-time staff scheduling are possible. Procurement is also enhanced directly and indirectly via marketplaces, exchanges, auctions and buyer-seller matching. Furthermore, internet-enabled demand forecasting as well as common inventory and forecasting systems with suppliers may take place. Finally, these functions would result in better Customer Relationship Management (CRM) that would add value to the customer and would provide the opportunity to charge premium prices or even attract other partners. Wireless e-commerce applications should be adapted to the environment of the customers. *Adaptability* is possible along various dimensions including:

- The type of the device in use,
- The currently available communication bandwidth as well as
- Location and
- time. Collaboration with wireless service providers and virtual co-operation with multiple value-system participants could result in technology development and innovative service/product design (e.g., *m-wallets* viz. software that would exist in cell phones and handle monetary transactions[24]). DMOs could get share of the transactional fees but it must be admitted that it is highly unlikely as there are also mobile operators and mobile portals, banks, credit card companies and content providers that are involved in the e-payment procedure.

Ubiquitous wireless communications enhance electronic commerce by making electronic commerce services and applications available anywhere and at anytime[25]. Through hand-held devices such as mobile phones, users can be reached at anytime, independent of their location. Mobile computing makes possible that

users are immediately notified about particular events. It also enables the delivery of time-sensitive information whose value depends on its timely use. Destinations *outbound logistics* performance needs to be mentioned at this point as instant service/product delivery is critical and can be improved through wireless technology.

At the present the information, the available services and applications in the Internet are enormous and wireless technologies can increase personalization of content. Therefore, it is important that the user receives information that is of relevance. Furthermore, *customization* is a key-issue in using mobile devices because of the limitations of the user interface in terms of size, resolution and surfability. Studies have shown that every additional click reduces the transaction probability by 50%[26]. Consequently, wireless commerce applications must be personalized enough to represent information in compact and attractive forms and to optimize the interaction path, enabling the user to reach the desired services with as few clicks as possible. This way the destination obtains new powerful multi-channel distribution opportunities and the marketing operations are improved, as real time information about the location is available to the target audience at any time.

FUTURE IMPLICATIONS

In the near future, refined metadata models will be proposed encoding semantic tourism destination information in wireless schema-based networks. For example, Kanellopoulos and Panagopoulos[27] proposed a metadata model encoding semantic tourism destination information in an RDF-based P2P network architecture. Their model combines ontological structures with information for tourism destinations and peers.

Another important factor under consideration is *broadcasting*. Some wireless infrastructures (e.g., cellular architectures and satellite networks) support broadcasting (i.e., simultaneous delivery) of data to all mobile users inside a specific geographical region. Broadcasting offers an efficient means to distribute information to a large consumer population[11]. This mode of operation can be used to deliver information of common interest to many users such as weather information or for advertising. For this reason, the traveler experience is enhanced due to the fact that s(he) can indulge in one-to-one marketing services and most importantly the information is accurate, instant and relevant to his/her preferences, while the destination can benefit from the broad MNO's customer bases.

Users, such as mobile travelers, are rapidly discovering that access is the killer application. However, compelling applications for wireless data have yet to be found. Mobile video conferencing might be the next killer application, though needed bandwidth is high. There are a number of wireless LAN products on the market, most operating in the unlicensed industrial-science-measurement (ISM) band. IEEE standard 802.11 offers a standardized specification for a wide range of WLAN technologies that will enhance interoperability for the future. The Europeans have been working on the HiperLAN specification, supporting data rates up to 20 Mbps over short distances. The U.S. Federal Communications Commission (FCC) has opened up the 59-to-64-GHz band for unlicensed WLAN development. Dispatch operators, such as taxicabs and delivery services use private/special mode radio systems. Wide-area packet radio services (mobile data) used primarily for e-mail access to mobile users.

Mobile database systems and broadcasting: Mobile travelers will use their information appliances to obtain information, the latest news, or directions to a restaurant[28]. Frequently, requested information could be filtered from broadcast information channels, so called push communications. Broadcasting involves careful scheduling, balancing bandwidth against worst-case latency. If many travelers (subscribers) are interested in the latest happenings, these should be scheduled frequently. If a substantially smaller traveler community is interested in basketball scores, we would expect this to scheduled for broadcast at a much lower frequency, utilizing less bandwidth but also introducing increased latencies to obtain up-to-date information. With mobility, location becomes an important attribute in database queries. A traveler is interested not only in the number of taxis within 1 mile of 37th Street, but also the number of taxis within a 1 mile of where they are standing now.

Mobile services can depend on the node's location. These include resource discovery mechanisms that make it possible to find local services (viz. the destination management system services) or the nearest printer or file server. Follow me services are also possible. Phone calls could be routed to the nearest phone, based on the traveler's current point of attachment. Some services may migrate as the traveler moves, for example, a special format translating proxy may follow the traveler into the roamed in sub-network, to reduce the latency to perform its translation. This raises issues of *privacy* and *traveler tracking*. While tracking traveler location may be desirable from a resource allocation viewpoint (e.g., spectrum can sometimes be borrowed from adjacent cells that are not as heavily loaded), it is possible to have too much information about the location of travelers. It is obligatory to treat travelers in an anonymous fashion for anything but the internal processing demands of the network.

Privacy and security are important aspects in mobile computing. Mobile nodes and users must be authenticated to obtain services. Encryption protects users from eavesdropping. Mobile users and their equipment are authenticated, authorized to perform certain functions and allocated resources. This is obtained via their registration to the local system. It is important that the registration process not to be overheard and replayed by intruders. From another perspective in small devices, video and image capture is becoming ubiquitous, while highly integrated Charge Coupled Devices (CCD) cameras have been declining in price and are being integrated into PDAs (Personal Digital Assistants).

QoS and WLANs: In fiber optics links, error rates are extremely low, link bandwidths are very easy to predict and quality of service (QoS) guarantees are largely determined by how queues are managed within the switches or routers. Since link quality varies on small time scales, improving a wireless link through error coding or higher transmit power is difficult. In general, it is difficult in a WLAN to achieve guarantees between sender and receivers. QoS can be achieved for wireless users through packet scheduling at the base station. This is a natural place for centralizing admission and bandwidth allocation decisions for a wireless cell. Packets within the cell must pass through the base station and the base station decides whether to accept a new connection. These can be scheduled to give precedence to high-priority traffic or to achieve minimum delays[29] .

Wireless meets multimedia: Recently, mobile terminals are one of the key platforms for multimedia communication and content consumption. *Multimedia Messaging Service* (MMS) is a technical solution that is enabling practical implementation of efficient multimedia communication already in current mobile networks. Multimedia message are slide show type of presentations that contain text, images and audio streams. To describe the layout and synchronization between different elements, a subset of *Synchronous Multimedia Integration Language* (SMIL 2.0) is used. MMS is non-real-time communication and is based on store-and-forward type of information delivery. The main parts of the MMS system are the MMS client and the MMS multimedia messaging service (MMSC). The third generation mobile networks (3G) are a combination of the global communication standards and technologies. Unified development is ensured by standardization in 3GPP (Third Generation Partnership Project) and 3GPP2 that are joint projects of leading regional standardization organizations (www.3gpp.org).

In the future, most of the mobile data solutions will be based on mobile infrastructures that are fully using packet oriented IP (Internet Protocol). The current IPv4 is not sufficient for fulfilling the need for increased addressing space. Therefore, it is vital for future development to ensure smooth transition to a new version of Internet Protocol (IPv6) in 3G networks[30]. In addition, protocols such as Session Initiation Protocol (SIP) are important when realizing mobile multimedia applications. SIP is text-based client-server protocol, designed to establish modify and terminate multimedia sessions or calls.

As the number of multimedia enabled wireless devices increases, these are becoming important platforms for consumption and creation of various multimedia content. The access to information via a mobile phone is not limited to a certain place or time (e.g., multimedia presentations can be ordered and viewed whenever the user wants to do so). There are going to be three different basic models for interaction using a mobile device.

Multimedia browsing: It is downloading content per request and displaying it. This can be implemented in a rather straightforward manner on top of existing protocols such as WAP. The problem is that multimedia content contains so much data that it is not feasible to store it in the terminal before playing it. Displaying the content while still transmitting (i.e., media streaming) is already a well-established application over fixed IP-networks[31]. To confirm interoperability between various terminals, standardization efforts are made. For example, the *3G Packet-switched Streaming Service* (PSS) is a standardization effort that defines common optimized protocols and codecs. Technical issues such as bit rates; displays resolutions, available colors and audio capabilities are taken into account in the optimization and creation of the content. However, the actual content of the presentation is very important.

Rich call-personal real-time communication: Traditional voice calls will be extended to include transfer of multimedia elements. If the mobile terminal is equipped with a camera, it is very natural to send images that show something from the location of the caller. One-way video applications in which the user is only receiving or sending real-time video streams from the terminal will raise the concept *See What I See*. This concept offers the caller the possibility to share his/her experience immediately.

Mobile messaging: The success of mobile messaging is owed to the store-forward type of message delivery. The message receiver does not need to retrieve the message (as in the e-mail case) but the message is pushed to the

terminal and the receiver gets indications of the arrival of the message when it is ready to be shown. In the future, a wireless terminal is going to be an important platform for multimedia. Mobile phones with integral camera and MMS are the key elements of the transition from traditional voice-and text-based communication to the era of multimedia communication

CONCLUSION

Wireless technologies affect crucial elements of the destination value chain such as wireless inventory control, mobile CRM, mobile-marketing via customer profile, real-time sales statistics, etc. Wireless technologies can prove extremely beneficial especially for long haul tourism destinations. The right deployment of wireless is a complex issue that must be thoroughly examined beforehand. However, there is a significant added value to the destination value chain that has not only technical and operational aspects but social as well[32]. Virtual communities promote the destinations and enrich the traveler experience[33]. Finally, according to Kanellou[34] the response of destinations has to focus on the enrichment of content of tourist services in combination with strategies of differentiation and customization.

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