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SUSTAINABLE GROWTH FOR THE PACIFIC-ASIA TOURISM INDUSTRY: ADDRESSING NATURAL DISASTERS AND BUSINESS OPPORTUNITIES WITH MOBILE ICT

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Abstract

The macroeconomic relevance of the tourism industry in the Asia-Pacific region is well recognized for years. While this industry has enjoyed a significant average growth rate over the last years, it is facing the negative impacts of potential natural disasters such as tsunamis and volcano eruptions. Besides posing a risk to the health of locals and tourists, such events can cause massive negative long-term effects on the countries' economic growth.

In this paper, we present an ICT system design on the basis of mobile communication infrastructures, which provide disaster management capabilities in order to attenuate the impact of unforeseen disasters. In addition, it provides functionalities that enable novel value-adding services. Our approach addresses both challenges and business opportunities the Asia Pacific tourism industry is facing today and aims at contributing to sustainable growth in this vital sector.

Keywords: Industry Growth, Mobile ICT, Tourism Sector, Disaster Management.

1 INTRODUCTION AND MOTIVATION

The tourist sector plays an important role in the Asia Pacific industry enjoying constantly rising average growth rates for several years. Some of the typical tourist regions depend heavily on high and increasing tourist figures. While the tourist sector has developed well in many parts of this region in recent years, significantly declining growth rates have been observed for some countries. Figure 1 illustrates these empirical findings in the Asia Pacific tourist sector showing exemplary countries with constantly rising GDP growth rates (such as China) and others for which significant declines have been observed (e.g. New Zealand). Unforeseen critical events such as natural disasters or industrial accidents (such as leaking pipelines that transport chemicals, oil or gas) can have a massive impact on tourist bookings and consequently the whole industry including service providers, vendors, hotels, airlines and so forth (Faulkner 2001). One prominent example represents the December 2004 earthquake in the Indian Ocean that triggered a tsunami killing several hundred thousand people. Besides the massive destruction of the local infrastructure, this event caused a decline of tourist bookings and subsequently a substantial negative economic impact in affected regions such as Phuket in Thailand (Ichinosawa 2006).

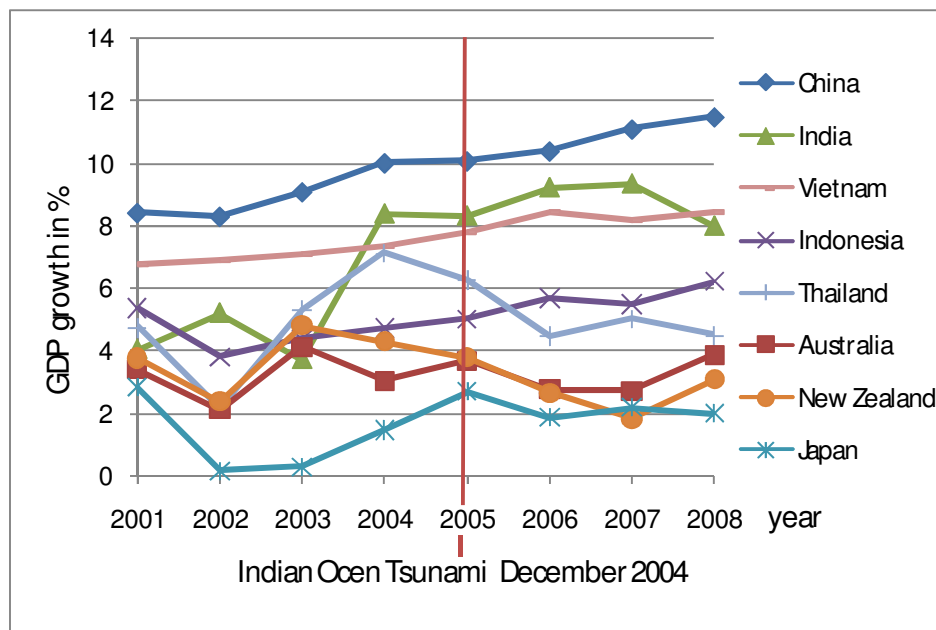


Figure 1. Gross domestic product (GDP) development (% real change p.a.) of the Pacific-Asia Tourist Sector¹

Consequently, this area faced a negative impact on its tourist sector developments in the year following the tsunami disaster. In January 2005, the number of international tourists declined by 85 % and so, occupancy of local hotels fell to 10 % and recovered slowly to 40% in August 2005 (VISA & PATA 2005). These developments caused massive economic impact and so, around 500 companies abandoned their business in the first six month of 2005 and, in the same period, more than 3.000 people have lost their jobs who had worked either directly in or somehow related to the tourist sector (VISA & PATA 2005).

¹ Numbers have been derived from the National Bureaus of Statistics.

In this work, we provide a possible solution how to combine infrastructural components for mass-distribution of disaster warnings and commercial secondary use. We present an information and communication technology (ICT) system design we have developed and which is based on mobile communication infrastructures. The system design addresses two different economic dimensions in order to support sustainable ICT-enabled economic growth (Ritchie 2004). On one hand, it targets the negative impact natural disasters can have on the tourist industry by notifying tourists and by providing assistance to the tourism industry in critical situations. The proposed system design supports wireless communication procedures in order to notify and warn people and to manage necessary evacuation processes. On the other hand, it provides the conceptual and technological basis for new business opportunities in the tourism industry sector and providing benefits for both tourists and companies.

2 METHODOLOGICAL FOUNDATION

This paper is based on the design science research paradigm providing a scientific framework for addressing problems fields with the design and evaluation of novel IT artifacts. In information systems (IS) research, the constructive and stimulating role of the outputs of design science research is well recognized (Orlikowski and Iacono 2001). Central research output are IT artifacts that provide a suitable solution to the problem field identified. Due to this utility-centric approach, rigorous design science research demands a novel IT artifact to be developed and a suitable evaluation of the artifact's appropriateness to contribute to the problem's solution (Nunamaker et al. 1991).

In their widely cited paper, March and Smith (1995) describe the four general types of IT artifacts which comprise constructs, models, methods, and instantiations. As most basic artifact type, constructs define a conceptual vocabulary for an addressed problem and solution domain. Using a set of constructs, models describe a relationship between these constructs such as Chens' well-known Entity-Relationship-Model for modeling basic database structures (Chen 1976). Methods describe a set of defined steps in order to provide a solution to a given task. Finally, instantiations are implementations that operationalize other artifacts including constructs, models, and methods. As system architectures, system designs or prototypical software applications these artifacts demonstrate the feasibility and applicability of models and methods developed.

The latter corresponds to the IT artifact definition of Srinivasan et al. (2005) who define an IT artifact as a "...combined hardware and software system that is designed and implemented within an organizational context and whose purpose is to collect, organize, and store data, and transform it into information needed ...".

In this paper, we present an IT artifact instantiation of a system design we have developed on the basis of mobile communication networks. Besides presenting this systems design and its functionalities, we evaluate the benefits it provides from the different perspectives of the parties operating and using the proposed system. The evaluation of developed IT artifacts is an essential part of design science research as it provides further insights into the addressed problem domain and the artifact's contribution to its solution (Markus et al. 2002).

The research outputs of design science research can stimulate IS research in diverse ways as different contributions can be made to the IS knowledge base. This includes contributions to the applicable knowledge for IS research including its foundations (such as new frameworks and instantiations) and methodologies (such as evaluation criteria) (Hevner et al. 2004).

This paper contributes to the IS knowledge base in these two different ways: First, it presents a novel system design that addresses a problem field observed in the Asia-Pacific tourism industry which aims at providing a clear contribution to its solution. Second, we present an evaluation approach being based on the IT business value – one of the major research streams in information systems research.

3 LITERATURE REVIEW

The potentials of location-based services (LBS) have been well recognized in the academic community in recent years. However, the lack of perceived usefulness and the prices of such services, limited device functionalities' and privacy concerns (Barkhuus and Dey 2003) are some of the obstacles these services are facing. Zipf and Malaka (2001) argue that location-based services in tourism settings where localization functionality is provided on the basis of the mobile networks can contribute to increased perceived usefulness and can open up new business opportunities to service providers. These opportunities especially arise when safety services are covered by LBS. In case of disasters, citizens have to be able to form dynamic teams in emergency cases and to participate remotely without direct involvement of centralized disaster managers (Shneiderman and Preece 2007). Front-line responders that improve the effectiveness of the communication between agencies may also assist these teams. Therefore, participants may have multiple roles in such a community and such roles have to be determined and managed by an identity management system (Mont et al. 2003). Consequently, this functionality requires much personal data, which has to be protected adequately, especially when it comes to commercial services (Culnan and Armstrong 1999). Buhalis (2000) states, that the same requirements concerning training vision, rational organization and commitment hold for improving the competitiveness of firms in the tourism industry and national tourism competitiveness. Johnston et al. (Johnston et al. 2007) observed that in the tourism industry the preparedness on disasters is generally on a low level, even past the tsunami which hit Phuket in 2004. Scherner (2007) proposed a LBS infrastructure design providing the functionalities for mobile multiparty interaction in disaster management scenarios. It incorporates identity management and privacy protection measurements as well as disaster management functionalities on the basis of existing telecommunication infrastructures.

This existing literature concentrates on technical feasibility and provides insights on how to address functional and security requirements of disaster management systems being based on mobile communication infrastructures. However, there is little research with a focus on economic potentials such location-based disaster management systems can provide.

The success of disaster management systems significantly depends on well-trained users being familiar with the service functionalities provided (Turoff et al. 2004). For a closed (and infrequently used) disaster management system, limited practical experience of users can be expected. Besides sharing the costs for operating the infrastructure, the idea of providing both commercial and disaster warning services on the basis of a technically integrated platform positively affects users' experience due to a common client base. In the following, we address these opportunities for the tourism sector in the Asia-Pacific region representing a promising industry sector.

Buhalis (1998) and Buhalis and Licata (2002) analyzed how the tourism industry taps the potentials of modern communication infrastructures providing new functionalities to offer new services to their travelling customers. They analyzed that information intermediaries are a suitable infrastructure component for offering services to an installed base of travelers by providing information from various sources in a concise manner. Therefore, traditional distribution channels, like travel agencies and web interfaces, can be combined with mobile services for enabling customers to react promptly to changed settings, such as delays and spontaneous decisions, in a dynamic context. The study conducted by Lee and Miles (2007) suggests that the key factors for travelling customers' satisfaction regarding the support through mobile devices is determined by a) the degree of perception and b) by the perceived value of services provided. Satisfaction of customers is, following this argumentation, determined by using attractive (location- and profile-based) services compliant with privacy settings.

4 A NOVEL SYSTEM DESIGN

In the following, we meet the challenges described above with a communication infrastructure that shall contribute to business opportunities and early warnings in a suitable manner. Therefore, the interests of the involved parties have to be assessed and identified needs have to be considered by infrastructure enhancements. Thus, we firstly investigate and summarize the perspectives and interests of the involved parties, being crucial for the development of a suitable system design (Subsection 4.1). Given these interests, we derive requirements for a suitable system design in Subsection 4.2. Then, we present a novel system design in Subsection 4.3 addressing both economic and functional requirements. Finally, Subsection 4.4 concludes with an evaluation of the proposed system design.

4.1 Involved Parties

For the proposed system design, four main parties have been identified as main stakeholders.

Public sector: The public sector owns the important role of mitigating the objectives of local service providers in the tourism industry and to safeguard the welfare of national and supra-national economies (Gruntfest and Huber 1989). Therefore, this party has the objective to provide a fruitful environment for sustainable economic growth in sectors like the tourism industry. This sector is highly interested in good reputation of travel destinations and consumers' trust in appropriate and reliable security and safety precautions. The entity *disaster manager*, as a sub-role of the public sector, provides safety services to all mobile subscribers, regardless whether they are tourists, employees of the tourism industry, or local citizens (Fritsch and Scherner 2005). Based on location data, gathered and provided by mobile networks, the disaster manager plans evacuation routes, distributes instructions and supports disaster forces in their duties. The disaster manager takes care of preparedness measurements, e.g. training of disaster scenarios. Based on regular interaction in training scenarios, disaster forces can rely on the cooperation with hotels, visitor attractions and other tourism centric facilities in the case of disasters (Faulkner 2001).

Tourism industry: The second group of stakeholders is the tourism industry consisting of different parties such as hotels, airlines, car rental agencies and other service providers, including the *employees of the tourism industry* for carrying out different supporting actions. Preventing the appearance or attenuation of the phenomena of "Reputational disaster" (Ichinosawa 2006) is of prime interest for the tourism industry. This applies to the destination itself (which is covered by the public sector) and also to hotels and visitor attractions. As analyzed by Johnston et al. (2007), single entities of the tourism industry could realize cost reduction, increase effectiveness and efficiency of tourism employee training and preparedness by outsourcing. The in-sourcing entity has to have the ability to aggregate and bundle services in a convenient manner by accessing information from detection systems, as for example seismological, oceanographic detection systems and the buoyage system in the Pacific Ocean. For enhancing the profitability of such an entity, it could furthermore provide value-added services to travelers for increasing the perceived convenience of the journey. Based on the identity management of the mobile communication industry, profile based commercials, travel assistance notifications and similar services could be provided to travelers.

Mobile network operators: The third party comprises mobile network operators offering mobile services that are based on internal customer identity management systems. Thus, the main interest of this stakeholder group is to create additional revenue by selling data and voice services to locals and foreign customers. The findings of Yu (1992) indicate that roaming fees are one of the major income sources for mobile network operators in China. Both, foreign and the domestic mobile network operators are interested in selling complementary goods to a service that is offered to customers.

Tourists: Tourists and, more general, travelers have a demand to get notified in case of emergencies, especially when they are not familiar with the destination, the language and the risks that may arise in the unknown environment. Furthermore, travelers have a demand for value-added services that support

them while traveling and help them to enjoy the trip (Ortega and Rodriguez 2007). The perceived value of services in the travelling context is influenced by many factors such as contextual, social, emotional and functional value (Pura 2005) and personalization of services is one of the possibilities to increase the value perceived.

4.2 System requirements

The literature review conducted in Section 3 and the stakeholder analysis presented in Section 4.1 provides the basis for the following requirements assessment which summarizes general requirements that need to be addressed by our system design. These general requirements which we derived from the literature review comprise (1) system effectiveness (Buhalis 1998, Johnston 2007), (2) reliability (Turoff 2006), (3) cost efficiency (Buhalis 1998) and (4) smooth service integration (Buhalis 1998, Ritchie 2004). In the following, we further explore these identified requirements:

Effectiveness: Effective early warning systems have to be based on regularly used communication infrastructures and people have to know how to react on visual and acoustic warning signals. This requirement holds for commercially successful infrastructures as well as early warning systems and it gets underlined by the demand of cost-effectiveness, which is also influenced by availability of infrastructure and a pre-installed base of potential customers. This requirement suggests that commonly used infrastructures, like those operating on the GSM specification provide a suitable basis for mobile services. GSM represents a standardized communication link between disaster management forces and victims being already used by a large installed base of more than 2 billion customers worldwide (GSM-Association 2007).

Reliability: Despite effectiveness, reliability of underlying networks is an important success criterion. For this paper, the availability facet of reliability will not be considered since it is out of the scope of this paper to provide solutions for all possible events which might destroy communication infrastructures. However, the literature review shows that up-to-date systems have to be regularly maintained. This requirement is tied to regular usage (Kron and Thumerer 2002) of the system by the involved parties. Furthermore, potentially affected people have to be involved in preparedness measures. Otherwise, alerting systems that are not regularly used for other purposes often become outdated, unmaintained and do not get adapted to changing requirements (Gruntfest and Huber 1989).

Cost efficiency: The system shall offer interfaces to existing legacy systems providing the opportunity to include available information from sources of the stakeholders of the tourism sector and the public sector. Furthermore, it should provide functionalities to direct messages in a cost-efficient manner. Major revisions on mobile communication infrastructures and on mobile devices of customers will thus violate this requirement. Secondary use of early warning systems in terms of offering value-adding services shall be supported.

Smooth service integration and device interoperability: End-users should be able to use their already existing equipment without being forced to invest in additional equipment. High prices for new equipment tend to result in reduced acceptance by end-users (Chen et al. 2002) and therefore the interoperability with already existing mobile telecommunication devices must be considered.

4.3 System design and functionalities

Our system design is based on the work of Fritsch and Scherner (2005), who describe early warning functionalities of a mobile disaster management system. To open up the system design to commercial service providers, we have defined sub-roles of the public sector and the tourism industry having access to underlying communication infrastructures. Thereby, each sub-role entity provides specific services the stakeholder is specialized in. Consequently the *disaster manager* provides all disaster management-related services to tourists and ensures efficient notifications, which is henceforth classified as *service category 1*. Furthermore, this sub-role provides services to the tourism sector and

its employees (*service category 2*) in order to provide guidance to the employees of the tourism sector. A newly introduced sub-role of the tourism industry provides service aggregation on behalf of the tourism industry in order to provide novel commercial services to tourists (*service category 3*). This sub-role has been described in the literature as an *information intermediary* (Bhargava and Choudhary 2004) since it provides an n-m link between different entities of tourists and the tourism industry.

The presented system design allows sub-roles of the public sector (disaster manager) and the tourism sector (information intermediary) to gain access to their customers via an integrated communication infrastructure and therefore meet the requirements effectiveness, reliability and cost efficiency. The disaster management system is not any longer a stand-alone system which has to be maintained separately since it serves now a regular secondary use. Furthermore, the stakeholders get used to the system in day-by-day scenarios and gain experiences how to react to different messages.

Figure 2 illustrates how the different parties interact within our system design and which services are provided by and to whom.

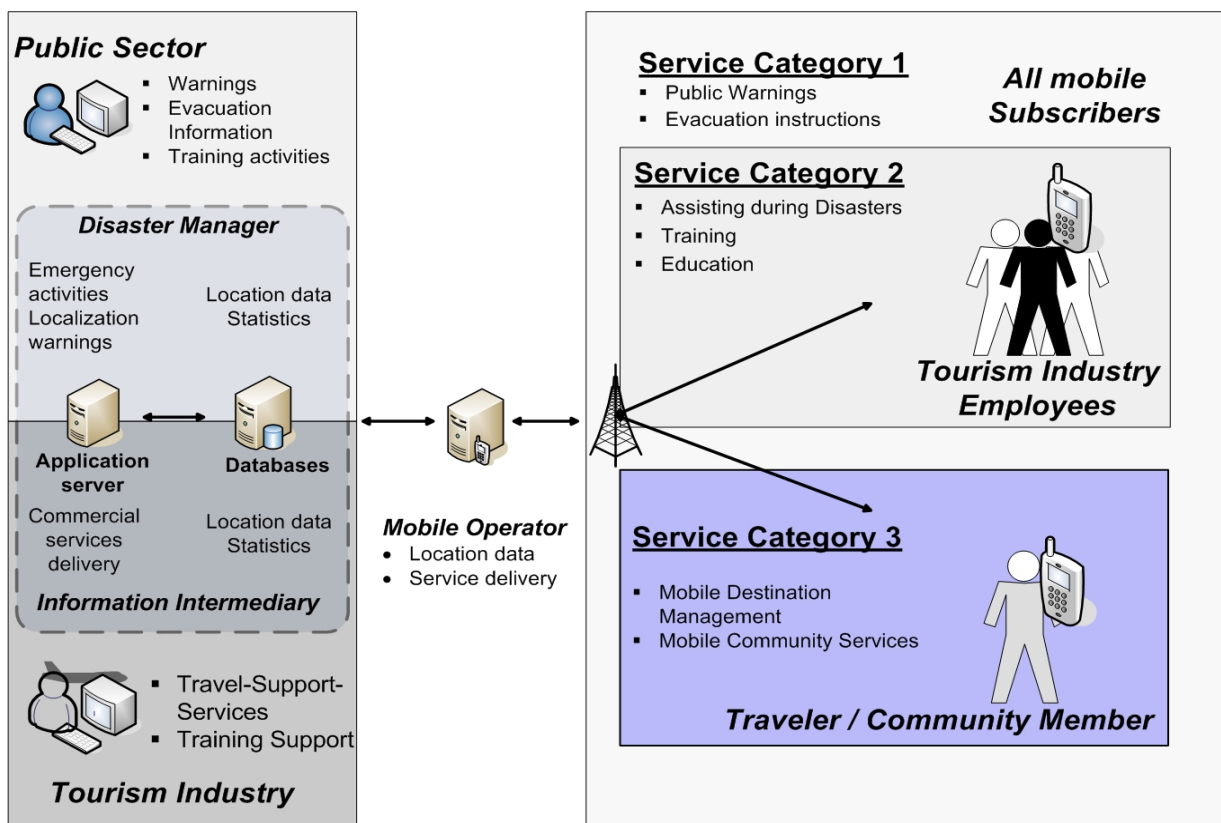


Figure 2: Proposed system design

The left part of the architecture concept illustrated in figure 2 can be implemented on the basis of a Value-adding network (VAN) offering automated data transformation between different formats and providing guaranteed network bandwidth. The Mobile Operator and the entities depicted on the right-hand side are operating on common mobile communication technologies, such as GSM networks.

The designed architecture provides functionalities for implementing three different service categories which are targeted to (1) the general public, (2) specialized employees of the tourism sector and (3) tourists. These three fundamental service categories are further described in the following:

Service Category 1: Publicly available services

Disaster warnings have to be sent to *all* reachable recipients, thus matching mechanisms do not apply. Consequently, the first service category provides a standalone benefit; independent of a matching service (i.e. there is no matching between service characteristics and user preferences). However, delivery of messages with different languages could be addressed by using different cell broadcast channels the mobile device is listening to (Aloudat et al. 2007):

- Disaster warnings (Fritsch and Scherner 2005)
- Evacuation instructions

The corresponding revenue model is based on the assumption that messages of general interest generate higher revenues throughout the countrywide tourism industry. The perceived value of the service can represent a competitive advantage of the destination (Lee et al. 2006) before booking trips. The positive experiences gained during the trip can be turned into positive evaluation provided to travel portals and therefore increase the awareness of such services by prospective customers. A similar approach without producing revenue has been initiated by the Dutch government for Civil defense purses (Cisco Systems 2008).

Service Category 2: Auxiliary disaster support services

These services are targeted to the tourism sector and its employees for assisting tourists while disasters and supporting organizations in training and educating personal for being prepared in the case of disasters. The entity *disaster manager* is in a good position to consult the tourism sector and its single entities in terms of check-lists, readiness checks and regular training of employees. Exemplary services are (Turoff et al. 2006):

- Point-to-point interaction, for contacting certain employees and to assign roles to them during crisis
- Training and consulting by using scenarios for improving effectiveness and preparedness

The underlying matching mechanism is role-based and can be used for assigning roles to specialized employees of the tourism industry (e.g. assigning and changing roles within evacuations). A close interaction between the tourism industry and the public sectors is required so each employee is well prepared for any disaster that might occur. The network-based identity management system thereby provides a link to the recipient. This communication service is mapped to *service category 2* in Figure However, identifying and contacting first-line responders and coordinating their actions needs to be combined with regular training activities. Similar activities are anyhow part of each disaster management system as well as intra-organizational precautions for emergency cases, such as regular evacuation activities in hotels and holiday resorts.

Service Category 3: Tourism support services

The third category of services comprises point-to-point services which can be customized to user-profiles provided by the mobile operator who acts as an identity provider in this scenario. Customers can freely decide which kind of services should be provided by whom and at which point-in-time, respectively which event shall trigger notifications. Tourism support services for example comprise:

- Personalized messages and information packages for tourists provided by tourism industry, containing e.g. changed travel schedules, confirmed bookings etc., complementary goods and services requested on demand, such as information about museums, tourism attractions and restaurants (Buhalis 2000)
- Localized tourism information, such as entire transportation system information, comprising routes, terminals and vehicles (Buhalis 1998)
- Customer-to-customer interaction (Wu 2007), such as community services, dynamic travel groups and similar applications like static friend finder applications (Scherner 2007)

This service category applies to personalized travel-support services that the tourism industry may offer to customers. Thereby, the information intermediary act on behalf of the tourism industry providing services on behalf of travel organizers, booking portals and travel guides by aggregating information. The services can be offered to tourists as pre-configured information sets either on demand or as part of the travel package for a journey booked.

4.4 System Evaluation

There exist different approaches to assess the value provided by information technology (IT business value). Following the analysis of Hitt and Brynjolfsson (1996), we qualitatively evaluate the benefits of the proposed system design from different perspectives (i.e. for the different involved parties) and on the basis of different approaches and theoretical foundations.

Various industrial sectors can benefit from increased business profitability and consequently, the evaluation will apply a corresponding theoretical foundation (Subsection 4.4.1). The industrial sector is enabled to achieve cost reduction and realize multiplier effects.

For the public sector, a positive impact on the domestic economy can be assessed and will be evaluated on the basis of the theory of productivity (Subsection 4.4.2). However, quantitative analyses of changing productivity measures for single industries are subject to future research.

Finally, tourists can directly benefit from novel services being provided on the basis of our system design. A corresponding evaluation therefore provides insight into the consumers' value provided (Subsection 4.4.3).

4.4.1 *Benefits to the Industry Sector*

From the perspective of the theory of competitive strategy (Porter 1979), the existence of the proposed system infrastructure can provide a competitive advantage compared to other tourist destinations and it can positively contribute to the profitability of different industrial sectors involved.

Tourism Industry: The presented architecture design supports several business objectives of the tourism industry and matches with strategic marketing objectives of destinations (Buhalis 2000). Using the expertise of disaster managers in order to educate and train tourism employees allows a smooth integration of first disaster-respond-activities in a cost-efficient manner. These activities of training and education could therefore be outsourced to the specialized part of the public sector. On the other hand, the system design allows meeting customers' needs by providing commercial travel-assisting information services. These can contribute to increased profitability of local enterprises and to the realization of multiplier effects (Buhalis 2000) by boosting the awareness of services offered.

Mobile network operators: Our system design enables mobile operators to increase the amount of data services sold to their customers by providing the infrastructure for the communication between the disaster manager, the tourism industry and tourists. Additionally, the design is lowering the barrier to entry for LBS providers by providing access to a large installed base of mobile subscribers through an information intermediary. This again leads to increased chargeable data traffic on mobile networks.

4.4.2 *Benefits to the Public Sector*

The analysis of the business opportunities provided evidence that the proposed system design positively influences the production functions of various sectors of the domestic economy. Signalling preparedness to prospective customers (i.e. tourists) has a positive impact on the destination's image and can therefore positively influence the productivity of the domestic economy. A positive image can contribute to a positive reputation in the long-term and therefore increase the popularity of the destination. Via the sub-role of disaster managers, the public sector has an instrument at hand for optimizing the training and preparedness of disaster forces as well as the overall coordination of safety

services. One contribution of the proposed system is that the pool of disaster forces has been enlarged to specialists of the tourism industry.

4.4.3 Benefits to Tourists

The assurance that someone takes care for the health and needs of travelers increases the total perceived value of the trip. Hitt and Brynjolfsson (1996) argue by applying the simple hypothesis: “The consumer surplus created by IT is positive and growing over time” that investments in IT results in additional positive consumer surplus per invested unit. Linking IT systems and creating timely and accurate notifications to consumers creates new value to customers since this positively contributes to perceived utility and perceived risks. The complex process of observing early warning indications, travel schedule deviations and useful commercials is hidden to end users and managed by the underlying notification system. The system design provides functionalities for the delight of travelers by maximizing their satisfaction through offering personalized services based on their preferences. By offering consumers a simple method for deciding which kind of service they like, the perceived level of relaxing and satisfaction increases. Furthermore, from the tourists’ perspective, a corresponding system would create the good feeling that someone is taking care for every ones well-being.

5 SUMMARY AND CONCLUSION

In this paper, we address both challenges and opportunities the Asia-Pacific tourism industry is facing today. This sector is one of the growth industries in this region since several years, but however, in particular natural disasters such as volcano eruptions, earthquakes and tsunamis have had massive negative impact in the past. In order to address this challenge, we present a mobile ICT system design we have developed. This system design addresses these challenges and provides the basis for new business opportunities in order to leverage sustainable growth of the of the Asian-Pacific tourism industry.

Our analyses provided evidence that combining the demand of modern disaster management systems with the interests of the tourism industry could produce benefits to all parties involved. The proposed system design allows prompt delivery of disaster notifications to domestic people as well as to tourists in an understandable manner and covers therewith the demand of reliable mass-distribution of early warnings. Furthermore, it offers the opportunity to enlarge the number of first-line responders by employees of the tourism industry for coordinated evacuations and enables bilateral communications between centralized coordinators and first-line responders. Additionally, by introducing an information intermediary as a sub-role of the tourism sector, we have shown that commercial and safety services could be provided on the same infrastructural basis. It therefore contributes to achieve business opportunities by the stakeholders of the system.

Finally, we qualitatively evaluate our system design on the basis of well-established IT business value evaluation approaches. The proposed system design enables the public sector and the tourism industry to coordinate preparedness measurements in order to achieve efficient workflows. Furthermore, the designed system can be used to create a positive image for tourists planning to visit the destination via the positive feedback of those tourists who already visited the same area. Tourists have the assurance that disaster messages or messages related to their trip scheduling will be delivered promptly in order to give them the opportunity to react in time. Additionally, mobile network operators can create additional sources of revenue by selling additional data traffic on their networks. By applying the changes to the existing mobile communication infrastructure, the involved entities have the opportunity to create a win-win situation without major investments.

Some further service adjustments are needed, for example the information intermediary may also provide message filtering for security or convenience reasons, e.g. for preventing that messages with lower priority will be delivered in resting periods. However, no major revisions to underlying ICT

infrastructures are needed. Companies can seize new business opportunities and the public sector is enabled to attenuate the impact of unforeseen disasters. The presented mobile ICT system design can therefore contribute to resilient organizations and sustainable growth in the Asian Pacific tourism industry.

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