

Technology in tourism- From Information Communication Technologies to eTourism and Smart Tourism towards Ambient Intelligence Tourism: A perspective article

[Buhalis, D.](#) (2019), "Technology in tourism-from information communication technologies to eTourism and smart tourism towards ambient intelligence tourism: a perspective article", *Tourism Review*, Vol. 75(1). <https://doi.org/10.1108/TR-06-2019-0258>

Introduction

Technology revolutionises the tourism industry and determines the strategy and competitiveness of tourism organizations and destinations. Many had to transform their strategic management and marketing and to redesign best operational practices to gain benefits from the paradigm-shifts experienced. Technology is not simply adopted in tourism. Technology innovations have been driving developments and competitiveness in Tourism. This paper explores the transformational nature of technology for tourism.

Past perspective 75 years of developments 1946-2020

Poon (1993) predicted that "a whole system of ITs is being rapidly diffused throughout the tourism industry and no player will escape its impacts". Most of initial **proprietary information system (1960 to 1990)** investments went into airline Computer Reservations Systems (CRS) and Global Distribution Systems (GDSs) (Sheldon, 1997, Inkpen, 1998); hotel Property Management Systems (O'Connor 1995, 1999, Peacock, 1995; Collins and Cobanoglu, (2013); travel agency and tour operator systems (Inkpen, 1998) and Destination Management Systems (DMSs) (Buhalis, 1993; Sheldon, 1993; O'Connor and Rafferty, 1997; Buhalis, Leung, Law, 2011; Mistilis, Buhalis, Gretzel, 2014). Technology supported capacity management, operations efficiency and productivity; inventory control and sales; yield and revenue management; marketing research and planning; customer relationship management and personalized service (Buhalis, 2000; Buhalis, 2003; Werthner and Klein, 1999; Sigala, 2003; Buhalis and Crotts, 2013; Law, Buhalis, Cobanoglu, 2014; Benckendorff, Xiang, Sheldon, 2019).

The Internet networking **eTourism era (1990-2005)** enabled organisations to developed their **Web 1.0** presence, through web sites and ecommerce (Buhalis, 2003; Buhalis & Law, 2008; Law, Qi, & Buhalis, 2010; Qi, Law, Buhalis, 2008). Google as an engine and Yahoo as a web portal revolutionised online information search (Xiang, Woeber, Fesenmaier, 2008; Pan & Fesenmaier, 2006, Paraskevas, et al, 2011). The Internet infrastructure also enabled Application Service Providers (ASPs) to host key functions (Paraskevas, and Buhalis, 2002). The development of blogs and other social media introduced the **Web 2.0 era (2005-2015)** facilitating interaction of all users and empowering many-to-many communications (Buhalis & Law, 2008, Egger and Buhalis, 2011). Online travel communities and social networks revolutionised communication from producer-to-consumer to much more complex consumer-to-consumer, consumer-to-producer, as well as many-to-one, one-to-many, one-to-one, or many-to-many (Buhalis, 2003, Fotis, Buhalis, & Rossides, 2011; Hays, Page, Buhalis, 2013; Brás, Costa, Buhalis, 2010). Technology revolutionised the entire distribution channel by empowering direct communications and transactions between principals and consumers (disintermediation) as well as for the emergence of a plethora of new intermediaries (reintermediation) (Buhalis and Licata, 2002). Review sites, such as Tripadvisor and Yelp, enabled consumers to express online Word-of-Mouth (eWOM) influencing reputation, branding and business performance of tourism organisations (Inversini, and Buhalis, 2009; Ye, et al, 2009; Viglia, Minazzi, Buhalis, 2016).

Future perspective 75 years 2020-2095

Web 3.0 or the semantic web (2015 -) was propelled by formatting data understood by software agents to support to computer-to-computer interoperability. Linking and integrating big data, from a range of data sets, improve data management, support interoperability, stimulate creativity and innovation, and encourage collaboration in the social web (Werthner & Ricci, 2004). Smartphones and mobile devices have altered the way people communicate and interact (Kim and Law, 2015), mediating the touristic experience (Wang, Park, Fesenmaier, 2012). **Smart tourism** emerged as a result, to provide the infostructure for value cocreation (Buhalis & Amaranggana, 2015; Boes, Buhalis, Inversini, 2016; Gretzel, Sigala, Xiang, & Koo, 2015). Smartness takes advantage of interconnectivity and interoperability of integrated technologies to reengineer processes and data in order to produce innovative services, products and procedures towards maximising value for all

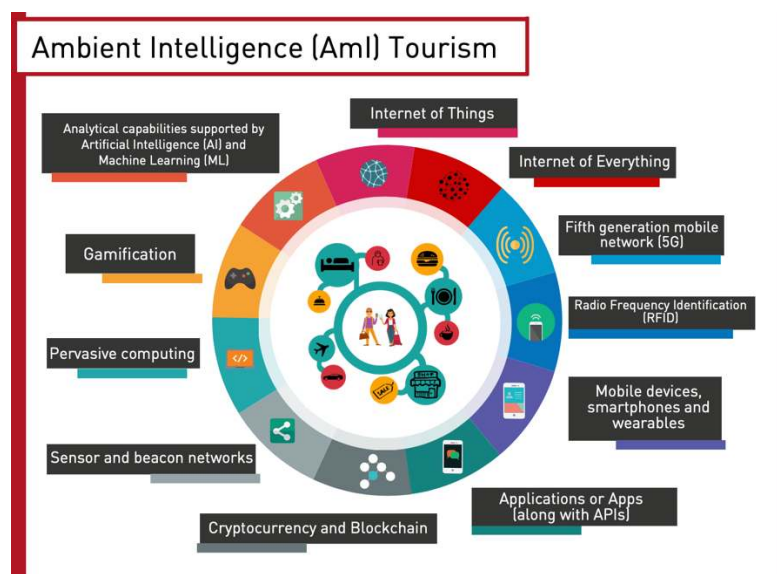
stakeholders. All suppliers and intermediaries, the public sector, as well as consumers are networked, dynamically co-producing value for everybody interconnected in the ecosystem. Smartness increase inclusiveness and accessibility for travellers, by supporting tourists with mobility, visual, auditory, and cognitive impairments to remove physical and service barriers (Buhalis, and Michopoulou, 2013). Gamification also contributes rewarding interactions and higher level of satisfaction and engagement (Xu, Buhalis, Weber, 2017; Xu, Tian, Buhalis, Weber, Zhang, 2016). Interoperability and ubiquitous computing ensure that everybody is interconnected and processes are integrated towards generating value, through dynamic co-creation, sustainable resources and dynamic personalisation and adaptation to context.

Ambient Intelligence (Aml) Tourism (2020-future) as illustrated in Figure 1 is driven by a range of disruptive technologies: the Internet of Things, the Internet of Everything, fifth generation mobile network (5G); Radio Frequency Identification (RFID); mobile devices, wearable smartphones and wearables; 3D printing, apps along with APIs, Cryptocurrency and Blockchain, sensor and beacon networks, pervasive computing, gamification as well as enhanced analytical capabilities supported by Artificial Intelligence (AI) and machine learning (ML) (Buhalis, Harwood, Bogicevic, Viglia, Beldona, Hofacker, 2019; Tussyadiah, Jung, and tom Dieck, 2018). Aml brings intelligence to tourism ecosystems and makes those environments sensitive, flexible and adaptive to the needs of stakeholders. Synthesizing innovations, these technologies support autonomous devices, robots, as well as virtual and augmented reality (Yovcheva, Buhalis, Gatzidis, 2013). Self-driving autonomous vehicles, cars and drones as well as servicing robots will have major implications for the tourism ecosystem (Tussyadiah, Zach, Wang, 2017; Ivanov and Webster, 2019). Increasingly smartness and Aml support real-time service empowering the co-creation of value for all stakeholders across multiple platforms. Interactions take place in real-time, at the exact moment when consumers are willing to engage with brands. “Nowness” reflects the agility of brand performance towards real-time, co-creation, data-driven, consumer-centric and experience enhancement. This reengineering enables shaping products, actions, processes and services in real-time, by engaging different stakeholders simultaneously to optimise the collective performance and competitiveness and generate agile solutions and value for all involved in the ecosystem (Buhalis and Sinarta, 2019).

Conclusions

Technology innovations bring the entire range of stakeholders together in tourism service ecosystems. Leadership is the most significant driver for technology adoption in tourism (Spencer, Buhalis, Moital, 2012). Technology-empowered tourism experiences increasingly support travellers to co-create value throughout all stages of travel (Neuhofer, Buhalis, Ladkin, 2014; Fotis Buhalis, Rossides, 2011). Inevitably smart environments transform industry structures, processes and practices, having disruptive impacts for service innovation, strategy, management, marketing and competitiveness of everybody involved.

Figure 1 Ambient Intelligence Tourism



Acknowledgement

The anonymous refereeing process for this paper was handled by Associate Editor Professor Cihan Cobanoglu

References

- Benckendorff, P., Xiang, Z., Sheldon, P.J. (2019), *Tourism Information Technology*, 3rd Edition. CABI
- Boes, K., Buhalis, D., Inversini, A., (2016), Smart tourism destinations: ecosystems for tourism destination competitiveness, *International Journal of Tourism Cities*, Vol.2(2), pp.108–124
- Brás, JM; Costa, C., and Buhalis, D., (2010), Networks analysis and wine routes: the case of the Bairrada wine route, *The Services Industries Journal*, Vol.30(10), pp.1–21.
- Buhalis, D., (1993), Regional Integrated Computer Information Reservation Management Systems (RICIRMS) as a strategic tool for the small and medium tourism enterprises, *Tourism Management*, Vol.14(5), pp.366-378.
- Buhalis, D., (2000), Information Technology in Tourism: Past, Present and Future, *Tourism Recreation Research*, Vol.25(1), p.41-58.
- Buhalis, D., and Amaranggana, A. (2015). Smart tourism destinations enhancing tourism experience through personalisation of services. In *Information and communication technologies in tourism 2015*, Springer, Cham, pp. 377-389.
- Buhalis, D., and Crotts, J. (2013) *Global alliances in tourism and hospitality management*. Routledge.
- Buhalis, D., Harwood, T., Bogicevic, V., Viglia, G., Beldona, S., Hofacker, C., (2019), Technological disruptions in Services: lessons from Tourism and Hospitality, *Journal of Service Management*, <https://dx.doi.org/10.1108/JOSM-12-2018-0398>
- Buhalis, D., and Law, R. (2008). Progress in information technology and tourism management: 20 years on and 10 years after the Internet—The state of eTourism research. *Tourism management*, Vol.29(4), pp.609-623.
- Buhalis, D., Leung, D., and Law, R. (2011). eTourism: critical information and communication technologies for tourism destinations. Wang, Y., Pizam, A., (eds). *Destination marketing and management: Theories and applications*, CABI, pp.205-224.
- Buhalis, D., and Licata, M. C. (2002). The future eTourism intermediaries. *Tourism management*, 23(3), pp.207-220.
- Buhalis, D and Michopoulou, E., (2013), Information Provision for Challenging markets: The Case of the Accessibility Requiring Market in the Context of Tourism, *Information & Management*, Vol.50(5), pp.229–239
- Buhalis, D., and Sinarta, Y., (2019), Real-time co-creation and nowness service: lessons from tourism and hospitality, *Journal of Travel and Tourism Marketing*, Vol.36(5), pp.563-582.
- Collins, G. R., & Cobanoglu, C. (2013). *Hospitality information technology: Learning how to use it*. Kendall/Hunt Publishing Co..
- Egger, R., and Buhalis, D. (Eds.). (2011). *Etourism case studies*. Routledge.
- Fotis, J., Buhalis, D., & Rossides, N. (2011). Social media impact on holiday travel planning: The case of the Russian and the FSU markets. *International Journal of Online Marketing (IJOM)*, Vol.1(4),pp.1-19.
- Gretzel, U., Sigala, M., Xiang, Z., & Koo, C. (2015). Smart tourism: foundations and developments. *Electronic Markets*, Vol.25(3), pp.179-188.
- Hays, S., Page, S. J., & Buhalis, D. (2013). Social media as a destination marketing tool: its use by national tourism organisations. *Current issues in Tourism*, Vol.16(3), pp.211-239.
- Inkpen, G., (1998). *Information Technology for Travel and Tourism*. 2nd ed. Addison Wesley Longman, London.
- Inversini, A., & Buhalis, D. (2009). Information convergence in the long tail: The case of tourism destination information. *Information and Communication technologies in tourism 2009*, pp.381-392.
- Ivanov S., and Webster, C., (2019), *Robots, Artificial Intelligence and Service Automation in Travel, Tourism and Hospitality*, Emerald
- Kim, H. H., & Law, R. (2015). Smartphones in tourism and hospitality marketing: A literature review. *Journal of Travel & Tourism Marketing*, Vol.32(6), pp.692-711.
- Law, R., Qi, S., & Buhalis, D. (2010). Progress in tourism management: A review of website evaluation in tourism research. *Tourism management*, Vol.31(3), pp.297-313.
- Law, R., Buhalis, D., & Cobanoglu, C. (2014). Progress on information and communication technologies in hospitality and tourism. *International Journal of Contemporary Hospitality Management*, 26(5), 727-750.
- Mistilis, N., and Buhalis, D., Gretzel, U., (2014), eDestination Marketing of the future: the perspective of an Australian Tourism Stakeholder Network, *Journal Travel Research*, Vol.53(6), pp.1-13.

- Neuhofer, B., Buhalis, D., Ladkin, A., (2014), A typology of technology enhanced experiences, *International Journal of Tourism Research*, Vol.16(4) pp.340–350.
- O'Connor, P. (1995), *Using Computers in Hospitality*. London, Cassell.
- O'Connor, P. (1999). *Tourism and Hospitality Electronic Distribution and Information Technology*. Oxford, CAB International.
- O'Connor, P. and Rafferty., J., (1997). Gulliver: Distributing Irish Tourism Electronically. *Electronic Markets* 7(2):40-45
- Pan, B., & Fesenmaier, D. R. (2006). Online information search: vacation planning process. *Annals of Tourism Research*, 33(3), 809-832.
- Paraskevas, A., and Buhalis, D., (2002), Information Communication Technologies decision-making: The ASP Outsourcing Model from the Small Hotel Owner/Manager Perspective, *The Cornell Hotel Restaurant Administration Quarterly*, Vol.43(2), pp.27-39.
- Paraskevas., A., Katsogridakis, I., Law, R., and Buhalis, D., (2011), Search Engine Marketing: Transforming Search Engines to Hotel Distribution Channels, *The Cornell Hotel Restaurant Administration Quarterly*, Vol.52(2), pp.200-208.
- Peacock, M. (1995). *Information Technology in Hospitality*. London, Cassell.
- Poon, A. (1993). *Tourism, Technology and Competitive Strategies*. Oxford, CAB International.
- Qi, S., Law, R. and Buhalis, D., (2008), Usability of Chinese Destination Management Organization Websites, *Journal of Travel & Tourism Marketing*, Vol.25(2), pp.182-198.
- Sheldon, P. (1993). Destination information systems. *Annals of Tourism Research* 20(4):633-649.
- Sheldon, P. (1997). *Information Technologies for Tourism*. Oxford, CAB.
- Sigala, M. (2003). The information and communication technologies productivity impact on the UK hotel sector. *International journal of operations & production management*, 23(10), 1224-1245.
- Spencer, A., Buhalis, D., Moital, D., (2012), A hierarchical model of technology adoption for small owner-managed travel firms: An organizational decision-making and leadership perspective, *Tourism Management*, Vol.33(5), pp.1195-1208.
- Tussyadiah, I. P., Jung, T. H., and tom Dieck, M. C. (2018), "Embodiment of wearable augmented reality technology in tourism experiences", *Journal of Travel Research*, Vol.57(5), pp. 597-611.
- Tussyadiah, I. P., Zach, F. J., & Wang, J. (2017). Attitudes toward autonomous on demand mobility system: The case of self-driving taxi. In *Information and Communication Technologies in Tourism 2017*, Springer, Cham., pp. 755-766.
- Viglia, G., Minazzi, R., Buhalis, D., (2016), The influence of e-word-of-mouth on hotel occupancy rate, *International Journal of Contemporary Hospitality Management*, Vol.28(9), pp.2035 – 2051
- Wang, D., Park, S., & Fesenmaier, D. R. (2012). The role of smartphones in mediating the touristic experience. *Journal of Travel Research*, Vol.51(4), pp.371-387.
- Werthner, H., & Klein, S. (1999). *Information technology and tourism: a challenging relationship*. Springer-Verlag Wien.
- Werthner, H., & Ricci, F. (2004). E-commerce and tourism. *Communications of the ACM*, Vol.47(12), pp.101-105.
- Xiang, Z., Woeber, K., & Fesenmaier, D. R. (2008). Representation of the online tourism domain in search engines. *Journal of Travel Research*, Vol.47(2), pp.137-150.
- Xu, F., Buhalis, D., Weber, J., (2017), Serious Games and the Gamification of Tourism, *Tourism Management* Vol.60, pp.244-256
- Xu, F., Tian, F., Buhalis, D., Weber, J., Zhang, H., 2016, Tourists as mobile gamers – Gamification for Tourism Marketing, *Journal of Travel and Tourism Marketing*, Vol.33(8), pp.1124 -1142.
- Ye, Q., Law, R., & Gu, B. (2009). The impact of online user reviews on hotel room sales. *International Journal of Hospitality Management*, Vol.28(1), pp.180-182.
- Yovcheva, Z., Buhalis, D., & Gatzidis, C. (2013). Engineering augmented tourism experiences. In *Information and communication technologies in tourism 2013*, Springer, Berlin, Heidelberg, pp. 24-35.