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New technologies in tourism: From multi-disciplinary to anti-disciplinary advances and trajectories

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A B S T R A C T

Technologies transform tourism management and marketing from a static and utilitarian sense (whereby managers and tourists use technologies as tools) to a transformative conceptualization whereby tourism markets and actors both shape and are shaped by technology. This paper unravels the transformative power of technologies on: the tourism actors and resources (both the traditional but also new actors, i.e. the technology agents); the ways actors interact to (co-)create but also (co-)destruct tourism value; and the context in which tourism actors interact from a linear supply chain tourism 'industry' to a complex socio-technical smart tourism ecosystem. To study such complex phenomena and transformations, the paper emphasises that research should not only adopt a multi-disciplinary approach, but it also needs to follow an anti-disciplinary thinking whereby new knowledge and constructs do not simply fall within existing paradigms, disciplinary silos and mindsets once developed by studying the 'pure' humans and their behaviours.

1. Introduction

Research and practice in technologies and tourism have been guided and driven by the popular mantra that '*information is the lifeblood of tourism*'. Although technologies will always be important in tourism due to its nature, this position has also restrained our thinking and research about the use and role of technologies in tourism. Technologies are not only instrumental in solving the information and communication functional needs of the industry. Instead, technologies are also a transformational driver of the industry structure and operations as well as the role and functions of its stakeholders. Technological advances are causing fundamental disruptions in tourism by empowering (traditional but also new) tourism actors to form new markets, offerings, management practices and competitive strategies (Sigala, 2018). Thus, technologies are transforming tourism management and marketing from a static and utilitarian sense (whereby managers and tourists use technologies as tools) to a transformative conceptualization whereby tourism markets and actors (tourism providers, stakeholders, intermediaries and tourists) both shape and are shaped by technology.

Tourism research has started looking into these new 'roles', capabilities and changes driven by the technologies. However, to better understand, research and anticipate these fundamental changes, new (and even currently unknown) theoretical lenses, approaches, constructs and even research methods are required. Moreover, although tourism research has always been multi-disciplinary, research in tourism and technologies has not followed the same route. A 'disciplinary' myopia and business bias characterize tourism technology research that is heavily dominated by studies with a marketing and management mindset aiming to advise the industry about the best use and impact of technologies. Less research efforts are found from an anthropological, sociological, psychological, legal, political and other disciplinary approach that can explain a different part of the variance than rational/economic theories. More disciplines and approaches are required to inform and augment tourism technology research needs in order to provide a 360 degree view of the complex and multi-facet phenomena and changes driven and shaped by the technological advances.

Because of that, this paper does not do a meta-analysis of previous studies for identifying gaps and additional questions to inquire about. There are numerous meta-analysis studies (e.g. Leung, Law, Van Hoof, & Buhalis, 2013) and they are valuable for their own purposes. Instead, the paper takes a 'futuristic' and 'helicopter view' perspective by identifying and discussing how technologies have evolved to disrupt and transform tourism actors and resources (both the traditional but also new actors, i.e. the technology agents); the ways actors interact to (co-)create but also (co-)destruct tourism value; and the context in which tourism actors interact from a tourism 'industry' and linear supply and distribution chain approach to a complex socio-technical smart tourism ecosystem perspective. Suggestions on how future tourism technology research should be shaped are also provided. The paper also shows that in the age of open innovation and creativity, disciplinary silos are not appropriate to study complex phenomena.

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Thus, tourism technology research should also increase its explanatory power and contribution by going beyond the business value and mindset. To achieve that, the paper does not only show how 'other' disciplines can better inform tourism technology research, but it also challenges whether disciplinary theories and constructs once developed, tested and refined by studying the current human species and phenomena are currently appropriate and sufficient to study the behaviour of the new and emerging techno-humans or humanoid tourism actors.

2. Technology evolution and advances: embedding smartness in tourism resources and tourism ecosystems

No commentary on tourism technology can exist without a short note about the evolution of technologies and the ways they impact tourism. Numerous technological advances and tools are driving tourism change including: machine learning, artificial intelligence, industrial web, big data, internet of the things, smart devices, robots, drones, sensors, beacons, virtual and augmented reality, near-field communications, ubiquitous computing and many more continuously being added in the list. A plethora of tourism technology applications can also be recorded, but the role of technology in tourism can be summarized in the following functions. Technology as a:

- way of 'individual' expression: e.g. tourism brands communicating and forming their image, tourists sharing experiences and information for self-constructing their social image and identity
- decision support tool for firms (e.g. logistics and pricing tool) and tourists (price comparison tools, meta-search engines, recommender systems)
- market intelligence source for collecting, storing, analysing, sharing, visualizing and interpreting big data (characterized by volume, variety, velocity, veracity and value)
- e-learning tool, evolving education and knowledge management from an instruction led and self-service paced learning mode to collaborative, constructivism, dialectic and nowadays open connectivism learning models (e.g. MOOCS)
- automation tool, substituting labour and 'predictable' – programmable tasks (e.g. self-driven cars), but also augmenting labour by informating and optimizing decision making processes and outputs
- game changer, enabling new business models (e.g. cyber-intermediaries, multi-sided markets, sharing economy) and new management practices (open innovation, crowdsourcing, crowdfunding, gamification)
- a transformer of tourism experiences, e.g. virtual tours, technology mediated or augmented tourism experiences
- co-creation platform (e.g. review websites, wikis based tourism guides, peer-to-peer marketplaces) empowering and providing the space, functionality and connectivity to all tourism actors to actively engage and participate in value co-creation

Overall, there are three words characterizing the features of emerging and future technologies: connectivity, data and smartness. Technology enables any device, tool, object and person to be connected and interact with other 'objects and its environment in order to 'sense' its internal and external context and take actions to adapt to the environment'. Connectivity driven by ubiquitous/pervasive computing and the Internet of the Things (an immense, distributed network that consists of interconnected and embedded systems) provides new data (e.g. actors' connections and interactions) to be collected and analysed to understand patterns and support (autonomous) decision-making by smart agents. Thus, connectivity, data and smartness are interconnected. Connectivity creates new data to be collected, whose collection and analysis can help develop the cognitive capability of a smart system that will not only be proactive and reactive but it would also be able to take autonomous pre-emptive actions. For example, imagine the case whereby the exercise monitoring device of a tourist will measure the calorie consumption and health conditions of the person, will communicate this data to the restaurant smart ordering and recommendation system to match eating with real time energy consumption and health requirements, and it will place an automated order for an Uber transport once the tourist will complete payment and the heart monitoring system has recorded indication of drunkenness. Hence, smartness (represented in smart tourism services and 'smart' technology agents) is a result of the increased connectivity and data capabilities enabled by technological advances.

In this vein, technology advances are driving the need to convert all tourism resources to smart tourism resources. Their smartness will depend on their smart connectivity and smart data components. Smart sharing bicycles will have sensors to collect internal data about the condition of the bike (e.g. flat tire, loose breaks etc.) and external data of the environment (e.g. type of surface, weather conditions, traffic, time table of firms) in order to take autonomous decisions (e.g. send a message to maintenance company, or a logistics company to re-locate the bike to a place with high bike demand) and better satisfy tourists' needs (e.g. adjust speed to the physical condition of the user, and suggest alternative routes based on traffic, opening hours or congestion of attractions visited by other tourists with similar profile and preferences to the current user). Connected smart actors create and operate within a smart socio-technical tourism ecosystem whereby they interact and exchange resources (e.g. information, computing power, skills, know how, software, cloud-based services) with the aim to achieve three major goals: optimize use of resources (e.g. space, energy, carrying capacity); enhance and enrich tourists' experiences and residents' quality of life; and empower tourism suppliers to take smart data-driven decisions. Smart tourism is not a fad; it is a reality but we have just started studying and understanding its implications (Gretzel, Sigala, Xiang, & Koo, 2015).

3. Traditional tourism actors

3.1. Tourism suppliers

Technology is affecting all business functions and tourism sectors. However, many studies have focused on technology applications and impacts in the hospitality, airline, intermediaries – distribution, attractions and Destination Management Organization (DMOs) sectors, and less studies on sectors representing events/festivals, cruises and other transportation players. Research has examined the impact of technologies on all business operations including: supply chain, logistics, marketing, advertising, consumer behaviour, CRM, procurement, HRM-recruitment, open innovation, new service development and finance/crowdfunding. Less attention but increasing awareness is paid to technology applications and impacts on crisis management (i.e. crisis informatics), e-government, e-democracy and sustainable management.

But again, instead of trying to identify gaps in existing technology areas in tourism, one should look at the bigger picture to identify trends and research trajectories. The three technology features of connectivity, data and smartness reinforce the need to challenge and further study how firms (should) respond to their impacts. Connectivity destroys linear tourism value chains and replace them with complex tourism ecosystems that enable and support various forms of interactions and collaborations amongst a variety of actors, e.g. firm-to-firm, customer-to-firm, machine-to-customer, machine-to-machine. Peer-to-peer market places fueling the sharing economy are disrupting all traditional tourism sectors (e.g. accommodation, transportation, social dining, guiding and tour operations, intermediaries) and reinforce the rise of an asset-light/zero fixed costs economy (Airbnb the largest hotel chain owning none room, Uber the largest taxi company owning none vehicle) (Sigala, 2018). Data do not only enable firms to take data-driven decisions (by supporting evidence-based management, streamlining administrative complexities and identifying new business

opportunities), but data is also the oil of the new economy firms to build new business models by monetizing information resources (e.g. Uber collecting and selling traveling people's patterns to transportation policy makers). Smart tourism services do not only hyper-personalise and contextualise tourism experiences, but they also become the tourism experience itself (e.g. the selfie gaze tourists who travel to places not to experience them but to get and post a selfie on social media). Smart tourism agents do not only automate labour and reduce costs, but they also add a new tourism actor in value creation processes.

Within this context, we know that tourism firms need to become more agile, flexible and open, but little is still known about how tourism firms (should) develop their:

- technology governance: what guidelines and policies, privacy, security and use of data rules should be in place? How do we educate employees on the use of technologies and the consequences of "undesirable" technology and data use on staff and firms? How do we create open technology and data governance structure to collaborate and co-create with other tourism actors? For example, several airlines follow open innovation practices for increasing their creativity by sharing their API and data sources (even with hackers) or running hackathons. What rules, policies and governance structures should support such data exchanges and sharing, and how can firms optimize the impacts of open innovation?
- technology culture: some firms are encapsulated and internally focused while others adopt a more risk-taking technology use culture. What are the capabilities, benefits and costs of being a technology leader versus an imitator? How can firms not only rethink but also de-think their current business models and become disruptors? Very limited research exists on technology culture and business model redefinition and development (Foss & Saebi, 2017)
- technology structure: technology permeates all functional departments but most firms still think of technology applications in functional silos. Decentralised technology structure needs to support cross-functional thinking to enable what we call a seamless customer experiences during the whole tourism journey (before, during and after the tourism service). But still research claims that we need more research in B2B big data analytics than B2C analytics (Knuz et al., 2017). Although this is true, again, one has to think more forward; in the era of tourism ecosystems, there are no businesses or customers; every tourism stakeholder is an actor and the only thinking is actor-to-actor interactions and value creation (Storbacka, Brodie, Böhmann, Maglio, & Nenonen, 2016).
- technology capabilities: there is still limited knowledge on the organizational capabilities and transformations that firms need to develop for optimizing big data. Less is known about the skills and competencies that all staff (operational and strategic) needs to exploit and integrate big data into their daily and strategic decision making and operations; for example, how can restaurant sommeliers (or housekeepers) think big data? Do they know and have access to the right tools to identify, extract, analyse, interpret and act upon the right information (i.e. wine reviews, prices of wines online, consumers' comments on wine) to decide what types of wines to purchase when and at what price, and then, what wines to recommend to their customers for which dish and at what price?
- technology ethics: in the era of big data and technology smart agents, there is a need of new legislation but also a code of business ethics to monitor and regulate the new ecosystem. Some of the numerous key questions include: what is the legal responsibility of a robot serving and physically harming a client? How can a chat box discriminate or harass an online user and maybe vice versa? How can users 'cheat' and/or misbehave to a robot and how can such customer misbehavior be defined as robots have no values, gender, religion or values? What are the privacy rules and business ethics that should govern the use of big data and what defines the limit and the extent to which a company can use data to predict and capitalize on demand elasticities for pricing purposes?

3.2. Tourists: from prosumers to micro-entrepreneurs and techno-humans

Tourism technology research has for years examined the impact of technologies on the way tourists purchase, select, evaluate, pay, share, evaluate and experience their tourism experiences. Technologies have a major impact on consumer behaviour, decision making processes, the design and consumption of tourism experiences. Nevertheless, the major technology disruption has been the technology empowerment of tourists to be transformed from passive consumers to active co-creators (prosumers) of their tourism experiences. Numerous studies (Sigala & Gretzel, 2018; Stephen & Lamberton, 2016) show how tourists become co-designers, co-marketers, co-advertisers, co-promoters, co-distributors of tourism experiences through user-generated-content, customer review platforms, blogs, wikis, participation in innovation contests and toolkits, crowdsourcing practices. Crowdfunding platforms now also enable tourists to even co-fund and support the implementation of tourism experiences such as events, concerts, tours, volunteer tourism projects. Research is also emerging for studying the impact of technologies on the prosocial behaviour of tourists for co-creating social value, e.g. online volunteering, activism or civic crowdsourcing.

Moreover, technologies have not only changed the way tourists identify, select, pay and experience tourism, but they have also changed the reasons and motivations for traveling by creating a new tourism market. The newly established (but less) studied market segment of selfie-gaze tourists who travel not because they wish to experience the place and be immersed into it; instead, they travel because their peers have done and shared it on social media, and they also wish to take a selfie and post it on social media. Traveling has always been seen and used as an act of self-promotion and identity development, however, social media advances have further escalated and digitised this social practice. For these tourists, the quality of the tourism experience itself does not determine their satisfaction. They do not even experience and/or are aware of their surrounding environment, as they only see it through their cameras and their moods depend on the discussions taking place around their content shared on social media. When the motivation to travel to a place is for taking and posting a selfie, then social media metrics (such as number of likes and comments) rather than quality of experiences influence tourists' satisfaction.

During the last decade, peer-to-peer platforms and the sharing economy have enabled tourists and any person to become a tourism supplier, such as in the cases of micro-hoteliers, micro-restaurateurs, or micro-guides. Although research has mainly focused on the impact of sharing economy on destination, traditional players and the tourism experience itself, less or no focus has been paid yet on the impact of sharing economy on fuelling micro-entrepreneurship and the profile, motivation, motives and skills of these micro-entrepreneurs. This is critically important because, although the sharing economy does provide a second income and employment to people, it simultaneously creates a new tourism workforce of freelancers – contractors, who may have increased flexibility in terms of controlling work conditions (when, for whom, for how long and for how much to work), but they have fewer working rights of security, stability, predictability of income and pension. There are already signs that the sharing economy is dominated by a platform capitalism (e.g. Deliveroo, Uber) creating a new form of labour slavery that works through, and not for, the sharing platforms.

Traditional tourism firms are already responding and exploiting this new labour market of flexible freelancers. For example, instead of going through a normal hiring process, Zappos asked candidates to join a social network called Zappos Insiders where people had to network with current employees and demonstrate their passion for the company in the expectation that the company will call them should the need arise. The unwanted evolution is the normalisation of this type of micro-entrepreneurship and freelance labour market to the extent that

instead of becoming a temporary solution to under or un-unemployment, it becomes a permanent and mainstream labour type. As traditional theories of entrepreneurship, labour economics and industrial relations are also challenged by these technology disruptions, research is urgently required to guide policy making and regulation by studying these new forms of labour and structure of labour markets as well as the new working conditions, quality of life and career opportunities of these micro-entrepreneurs.

The ubiquity of technologies has given rise to a culture where people increasingly rely on technologies to maintain their social structure, complete work, study, and guide many other behaviours enacted in day-to-day life. As a person becomes more attached to IT emotionally and psychologically, technology gains more influence and control, eventually becoming part of the person's identity, and a new form of techno-human identity. Research has already found the display of a technology identity that occurs when a person views the technology use as integral to sense of self, because he/she experiences feelings of connectedness, emotional attachment, enthusiasm, and reliance on technology. Tourism technology research however has not yet looked into the emergence of this new type of techno-human tourists. Very little is currently known about the new features, capabilities and behaviours afforded by these new 'tourists' that are physically and socially empowered, cognitively augmented and psychologically affected by technologies. Numerous questions need answers, but traditional theories (e.g. cognitive constraints, social comparisons, social exchange theory) developed by studying 'normal' humans should not be simply 'plugged and played' to understand the behaviours of technology affected humans. For examples:

- How do tourists behave, think and take decisions, when mental resources and cognitive power are freed as google has become their knowledge storage and search mechanism?
- In technology communication settings that do not allow traditional nonverbal cues, people encode relational messages through text, metacommunicative cues (e.g., emoticons), and paralanguage (e.g., intentional misspelling, punctuation, capitalization). How do these communication mechanisms influence online service quality, expectations and standards, firm-customer-employee relations?
- People anthropomorphise technologies and develop parasocial direct and reciprocal interactions on social media by engaging with brands, celebrities and technology agents as if they were human beings. What is the impact of the people's increasingly technology addiction or attachment on their communication, socialisation, relation (dis)engagement or disaffection behaviours? What is the impact of the latter on brand management and image making processes, customer relation management practices and the building of online tourism communities?
- Technology attachment has been found to lead to new forms of technostress and anxiety affecting life satisfaction, well-being, workplace productivity, social and work relations. How do such concepts influence the tourism experiences and behaviour of the techno-human tourists and tourism labour force?

4. New tourism actors: technology agents

Adding technology agents as tourism actors is imperative, because of the fast-paced development and adoption of technologies (e.g. anthropomorphic robots, chat boxes, smart automated online assistants, artificial intelligence) in service delivery and value creation processes (e.g. hotel concierge, airport welcome staff, museum guides restaurant waters, online service support) (Van Doorn et al., 2017). Technology agents can now provide 'near-human' experiences and they are going to transform and disrupt:

- Workplace productivity, augmentation and substitution of labour (e.g. staff decision making, capabilities and roles). Will technology agents replace staff? Research in artificial intelligence shows that complex reasoning, which requires precision and regularity, is hard for humans but easy for machines, while tasks that require generationalisation, perception, creativity and interacting with real world (i.e. low-level sensory motor skills) are relatively easy for humans but computationally expensive. In this vein, any task that can be described by an algorithm or is repetitive, then, will be outsourced to technology, while skills like pattern recognition, recombinant innovation, multi-sensory communication, and developing creative solutions to previously unimagined problems would be the traits and skills for which human labour will still be demanded. How do we develop these skills in our future tourism workforce?
- The design, operations and competitiveness of business models, collaboration networks and tourism ecosystems
- Service delivery methods, e.g. drones used for food delivering
- Tourism experiences, e.g. self-driven cars will allow tourists to 'enjoy' landscapes more.

Past studies have shown that human inefficiency and unpredictability had been reported as major reasons that direct people to utilize self-service and technology supported services. The more reliable the technology and technology agents become, the more they will be used by tourists. Therefore, potential future studies can question: how technology provided and supported service is going to be evaluated; and how trust, empathy, warmth/caring, interaction and communication between tourists and technology agents are going to be established, defined, evaluated or even be important and relevant to tourism experiences. What will define and characterize service quality and tourism experiences in technology agents-to -tourists or other technology agents' interactions? Obviously, existing paradigms and theories on traditional service management would need to be disrupted and a new thinking and perspectives would need to be developed to answer such questions.

5. Value formation processes: value co-creation vs co-destruction

Research has taken an implicit assumption that whenever actors interact, value is co-created. But value co-creation should not be taken for granted, as outcomes of co-creation processes can also have a negative valence. Value is also a subjective concept that is phenomenologically interpreted and assessed by each actor, i.e. a value co-creation process for one actor may be a value co-destruction process for another actor. For example, tourists writing fake positive reviews on Tripadvisor destroy value for other tourists (unreliable advice), but they create value for themselves (getting freebies from hotels for promoting them), and for hotels (enhancing hotel image). Research has started showing that co-creation processes can intentionally or accidently result in the simultaneous co-creation and co-destruction of value for various actors and so, it is better to use the term value formation processes (Sigala, 2017). The features of online environments (i.e. anonymity, lack of legislation/penalties and policing) do not only reinforces actors to engage more in mis-behaviours, but they also create new forms of value co-destruction processes. For example: do people misbehave when they give false private information online and/or when they check-in in a location on Facebook where they have never been; who can ever monitor and penalize/deter such mis-behaviour; and how does it co-destruct value (e.g. unreliable online data of consumer behavior can lead to wrong predictions and inappropriate personalization services). Research needs to identify, define and operationalise these technology related mis-behaviours in terms of their occurrence, motivations, co-destruction/creation value impacts, regulation, monitoring, controlling and deterrence mechanisms. In addition, emerging research on cyber-bulling, cyber-attacks, dark web, cyber-crime, but also people's self-destruction processes (such as technology addiction and obsession) needs to be further understood and studied within a tourism

context and from both a tourist's and tourism workforce perspective, as very few studies exist about the mis-use of technology by staff and the staff's mis-behaviour in online environments. Theories and constructs from disciplines such as criminology and victimology may be adapted to study the behaviours, impacts and motives of actors participating in value formation processes. However, technology agents do not possess intent and agency as human beings do. Instead, they are 'programmed' to behave in specific ways. Thus, can technology agents mis-behave and if they do, when, how and why they mis-behave? Traditional theories are limited in explaining the engagement motivations and practices of technology agents, but mathematical sciences and algorithmic theories can provide a better explanatory power of the latter. Thus, when studying new territories, one has to be open to any theoretical lense and thinking.

Overall, there is a call for a renewed value-related terminology and research in various forms of actors (mis)-engagement and of value formation processes that make them more encompassing, less biased and closer to real business life.

6. Conclusions

Technology advances have disrupted every tourism actor. Disruptions occur when newer companies offer cheaper alternatives sold by established players and also, when existing markets are defined and the economic landscape reconfigured. This paper has added new types of disruptions: when new actors are added (technology agents); when the functions and features of actors are changed (techno-humans and functional modification of human actors); and when value co-creation (for one actor) is the result of value co-destruction (for another actor) and vice versa. Exploring and understanding these new territories and disruptions require not only new thinking and lenses, but also de-thinking of the current mindsets that are confined within well-bordered disciplines. Research has to adopt a multi-disciplinary approach to study the complex phenomena, but it also needs to follow an anti-disciplinary thinking whereby new knowledge and constructs do not simply fall within the existing paradigms and mindsets that were once developed by studying the 'pure' humans and their behaviours.

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