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Augmented reality in the tourism industry: A multi-stakeholder analysis of museums

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ABSTRACT

In places of tourist interest and attractions, such as museums, Augmented Reality (AR) is an emerging technology that enhances (through additional digital contents) and leverages visitor experience creating opportunities for an array of immediate and peripheral stakeholders. However, to achieve this, both researchers and managers need to better understand how to effectively co-create value through the involvement of different stakeholders and their interconnected relationships. Thus, we analysed three interrelated streams of literature (digital innovation, tourism management and stakeholder theory) and we developed a conceptual paper that sheds light on AR in museums. An in-depth analysis of the topic allowed us to develop theoretical propositions and applications on the subject, in particular from a multi-stakeholder perspective. Finally, our research proposes a preliminary conceptual model that highlights the need for the identification of the roles and interactions of museum's stakeholders towards a more digitalised museum experience through AR.

1. Introduction

Increasing digitalization makes cultural organizations pay more attention to the opportunities provided by technological innovation (Del Vecchio, Secundo, & Passiante, 2018; Karagouni, 2018; tom Dieck & Jung, 2017) particularly in an ever more complex and highly challenging tourist industry. As a matter of fact, digital innovation could facilitate business models' innovations by offering an enhancing experience to visitors in tourism (Li, 2018). In this vein, museums are strongly interested in these technological advancements, with Augmented Reality (AR) constituting one of the key emerging technologies, able to improve visitor experience through the use of multimedia contents. In particular, the pace of adoption of augmented reality (AR), which is both an emerging form of technology (Liao, 2018) and an experience (Altinpulluk, 2017), is influencing more and more the contact between the virtual and the physical world in cultural sites (tom Dieck & Jung, 2017). For this reason, many studies have been directed at AR in cultural heritage sites mainly to understand the acceptance of this technology by users (Haugstvedt & Krogstie, 2012) through the theoretical acceptance model (TAM) (Davis, 1985). In these studies, by using a mobile application with historical photograph, the main aims were to find new ways to attract and engage visitors (Tscheu & Buhalis, 2016), to recreate ancient ruins (Vlahakis et al., 2001) or to enrich the scenes of sites with a relevant cultural interest to improve visitors' experience (Vecchio et al., 2015).

According to Johnson, Witchey, Smith, Levine, and Haywood (2010), augmented reality could create "*bridges between objects, ideas, and visitors*". Thus, very recently, some researchers (Herman, 2018; Tussyadiah, Jung, & tom Dieck, M. C., 2018) started to direct their efforts towards the analyses of these "*bridges*", using a multi-stakeholder analysis to understand how AR could create value in touristic places (Thrassou, Vrontis, & Bresciani, 2014), further developing these concepts. Extant literature on digital innovation using AR technological paradigm in museums includes numerous studies on how digital devices enhance engagement with the aim of improving the visitor's experience (Szymanski et al., 2008; Waite, Kirkley, Pendleton, & Turner, 2004; Yoon, Elinich, Wang, Steinmeier, & Tucker, 2012). Notwithstanding, studies on the co-creation of values in tourism stream of research, with a particular focus on museum and using AR technologies is still missing. In fact, in order to have a full grained picture of the phenomenon, one

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key point is to understand who the stakeholders of a museum are, as well as their interrelations, and connect them to different value creation outcomes according to the peculiarities of this new technology (AR) in this particular context of analysis (museum).

This study is particularly useful in better understanding the dynamics beyond - and underlying - the usage of AR technology in museums, and the requisite interactions among all the stakeholders involved that allow the creation of different forms of values. The comprehension of these links makes this paper especially interesting and valuable, both in terms of new theory developments and of managerial implications related to the introduction of AR in a museum context.

Thus, the *primary aim* of this research is to provide a preliminary conceptual integrated framework that advances on past works on the topic, identifying how heterogeneous stakeholders may co-create value in museums through the use of AR. The research is grounded on three interconnected literature themes, relevant to the research gap: digital innovation, tourism management, and multi-stakeholder theory. *The article further develops three propositions*, which lie at the intersection of the three fragmented literature streams used, that help in understanding how the co-creation of value may take place and which typology of AR values (economic, experiential, social, epistemic, historical, cultural and educational) may be implemented in museums.

Our main *contribution to theory* is, first of all, an extension of digital innovation literature that refers to AR technological paradigm, through the particular *perspective focus* on the creation of contents by multiple stakeholders through their involvement and interrelations (Ferraris, Mazzoleni, Devalle, & Couturier, 2018; Leonidou, Christofi, Vrontis, & Thrassou, 2018). Here, the visit is enhanced by the hedonic element introduced by the adoption of such technology (Babin, Darden, & Griffin, 1994). Moreover, we add to this stream of literature through a *sub-industry focus* i.e. the museum context of analysis, arguing that AR could enhance the quality of a visit in museum, not only independently, but through the co-creation of different forms of value. Second, our paper gives a theoretical contribution to tourism research stream in terms of *interactivity* between museum organizations and visitors (Buhalis & O'Connor, 2005). As a matter of fact, museums should re-engineer the entire visit with the introduction of such technologies, managing the maintenance of this type of service e.g. by offering a high-speed free internet connection to visitors. Furthermore, the creation of contents on social networks by visitors could be managed, to improve or maintain good reputation of the museums. Thirdly, the stakeholder theory elaborated by Bunn, Savage, and Holloway (2002) has been applied in a new context of analysis (museums) with a new and emerging technological paradigm (AR), linking together the three fragmented literature themes and highlighting the imperative of taking into account the museum stakeholders in relation to AR implementation, and the manner through which they may co-create value through this emerging technology.

Structurally, the first section of the paper presents research underlying the potential of AR in museums and develops a common definition of AR's role in this sector along some of its key aspects (Capuano, Gaeta, Guarino, Miranda, & Tomasiello, 2016; Kysela & Štorková, 2015; tom Dieck, Jung, & tom Dieck, 2016). Subsequently, we develop our main propositions, explicitly in relation to AR in the museum experience. Continuing, the paper describes and prescribes how multi-stakeholder theory may be relevant in addressing this new and emerging issue, developing a third key proposition. Based on this, we propose a preliminary conceptual integrated framework to leverage stakeholders and their relationships in the implementation of AR in museums. Moreover, the framework is elaborated upon to better define and refine the means through which AR could create value through different stakeholders' perspectives. The study concludes with explicit managerial and theoretical implications, thereby defining the avenues for practical implementation and future scholarly research that will expand and test our framework.

2. Literature review – Augmented reality in museum. Definitions and main aspects

Digitalization has let no industries untouched (Bresciani, Ferraris, & Del Giudice, 2018; Bunn et al., 2002) and companies had to mobilize their effort in addressing main challenges in implementing the use of these technologies (Klein & Knight, 2005; Klein & Sorra, 1996). In this context, AR emerged as a new technology adaptable to a variety of different sectors (Chang, Chang, & Heh, 2015), from the social sciences (Hedley, Billinghurst, Postner, May, & Kato, 2002) to biomedicine (Strickland, Fairhurst, Lauder, Hewett, & Maddern, 2011).

With the arrival of Industry 4.0 and latest developments of information technology, the spread of information is changed (Damiani, Demartini, Guizzi, Revetria, & Tonelli, 2018) and digital devices and mass communication have quickly replaced traditional tourists' guides (Boucheix, Lowe, Putri, & Groff, 2013). For this reason, it was necessary to put together the classic visual and verbal methods with digital animations (Kounavis, Kasimati and Zamani, 2012). Digital innovation technologies such as augmented reality (AR) come on stage right now. Thus, AR is a visualization technology, able to introduce more information into the real world, instead of replacing it. This may be obtained by superimposing visual, auditory, tactile or even olfactory materials in real time on physical objects presented via devices (Barfield, Bressler, & Bodzin, 2013; Feiner, MacIntyre, Höllerer, & Webster, 1997).

Capuano et al. (2016) describe AR in the wide tourism sector as a technological tool able to augment user's experience using a multimedia instrument, making the visitor more conscious about the visit. The significance of customer experience is focalized as in Barber et al. (2001), where the visitors are involved in a suggestive tour, where they can make a comparison between what they have seen from the digital device and the real paining or object in the museum by focusing on skills as creativity, inspiration and knowledge (tom Dieck et al., 2016).

Scholars' interest in understanding the function on AR in tourist field is very prolific (Yung & Khoo-Lattimore, 2017). As a matter of fact, tourists are happy to be absorbed into new realities in many fields (Williams & Hobson, 1995; Yung & Khoo-Lattimore, 2017). To better understand the field of interest in this topic, we made a research on the database Google Scholar and Web Of Science using the keyword “Augmented reality” AND “tourism” has shown 190 results. Then we removed the duplicates, the ones not accessible, selected the last 5 years, receiving a result of 20 articles. Referring to the pertinent abstract and title, we have selected 15 of them, as the reader can observe in the Table 1 below:

Thus, AR technology could affect many stakeholders in different fields, giving them additional information. Referring to Freeman's (1984) framework on stakeholders' categorization into external and internal, AR could be used to spread information in particular about the museum experience, which is not so investigated in the literature, both to internal stakeholders, that need to be more involved into the visit, and to the external ones, that need to be more interested and attracted by the experience. Thus, the museums become an important tourist attraction also for national and international visitors, who have still not experienced the visit (He, Wu, & Li, 2018). According to the ICOM (International Council of Museums, 2007),[1] a museum is an institution, where the main purpose is both economic and educational (Fenu & Pittarello, 2018). In the context of museums, AR could integrate virtual with reality (Milgram & Kishino, 1994) showing its big potential and offering new ways to educate and make real objects more attractive thanks to the interaction with the real environment (Kysela & Štorková, 2015).

In this vein, AR could attract many stakeholders around a museum

[1] Data available on the following link: http://icom.museum/en/activities/standards-guidelines/museum-definition/ (2007).

Table 1
Main literature on tourism area.

Tourism areas of interest	Authors
Smart cities	• Femenia-Serra, Perles-Ribes, and Ivars-Baidal (2019) • Gretzel, Zhong, and Koo (2016)
Tourism destination	• Linaza, Gutierrez, and García (2013)
Heritage tourism	• tom Dieck, Jung, and Michopoulou (2019) • Chang, Hou, Pan, Sung, and Chang (2015) • Chung, Han, and Joun (2015) • Han, tom Dieck, and Jung (2018) • Jung, Lee, Chung, and tom Dieck, M. C. (2018) • tom Dieck and Jung (2017) • Tsai (2019) • Femenia-Serra et al. (2019) • Salerno (2019) • Bekele, Pierdicca, Frontoni, Malinverni, and Gain (2018)
Outdoor site exploration (Digital maps)	• Werner (2019) • Javornik, Kostopoulou, Rogers, and Fatah gen Schieck, A., Koutsolampros, P., Maria Moutinho, A., and Julier, S. (2019)

Source: Authors' elaboration.

experience (Ferraris, Belyaeva, & Bresciani, 2018; Leonidou et al., 2018; Shams, 2015), offering new opportunities (tom Dieck & Jung, 2017) and making the visit more hedonic (Babin et al., 1994). Table 2 presents a comprehensive summation of scholars' definitions, as identified by our theoretical research.

Stating that AR is an emerging technology (Liao, 2018), which is able to augment more and more the experience, Altinpulluk (2017) has presented it as "*an emerging form of experience*". In this definition, the attention is focused more on the hedonic element (Babin et al., 1994), id est. the experience, than on the utilitarian one, id est. the communication tool (e.g. smartphone). This could strengthen many stakeholders' interest to utilise it in museums (Legget, 2012), where the visit is not more a didactical moment, but it could contribute to create learning experience (Olapiriyakul & Scher, 2006). Thus, the attractiveness of a museum, due to the introduction of such an innovative technology, increases, quickly capturing stakeholders' interest (Legget, 2012); including visitors, the community and external stakeholders. Moreover, in term of stakeholders' interaction and co-creation of contents, digital innovation such as AR could increment the degree of interactivity, both disseminating information about the experience on the web and building relationships between different publics and the organization (Capriotti & Moreno, 2007). It is, therefore, important to provide an unrepeatable experience to ensure that both visitors return and/or to ensure positive reviews (Chung et al., 2015) and attract new stakeholders in the experiential visit. To achieve this, costs of development and implementation of new technologies such as AR, as well as the quality of augmented and supporting services (such as the internet connection) are key elements that need to be addressed and improved on in a Museum (tom Dieck & Jung, 2018). With reference to the latter, a suitable solution could be the adoption of iOS and Android software, with which it is possible to reduce costs, giving the possibility even to small museums to design interesting augmented experiences on a modest budget (Fenu & Pittarello, 2018).

So, in this study Authors aims to investigate more museums area of interest in tourism, referring to the introduction of augmented reality into the experience and stakeholders' interactions.

3. Propositions' development

3.1. AR in museums' experience

Museums have been struggling for funds due to the reduction of government support (Del Chiappa, Andreu, Gallarza, & M., 2014). They have thus been forced to become much more market-oriented and, thus, focus more on their service experience (Del Chiappa et al., 2014; Siu, Zhang, Dong, & Kwan, 2013). In this context, customer satisfaction has become a critical factor of success for museums, which are increasingly called upon to satisfy multiple, and differing needs simultaneously (Bigné, Mattila, & Andreu, 2008; Clarke, 2013).

Customers' needs, though, are complex (Del Chiappa et al., 2014) and scholars have traditionally considered "satisfaction" as a result of comparison between subjective and objective aspects, influenced by cognitive antecedents (Oliver, 1980). In fact, in museums, emotions are strictly correlated with satisfaction, with the service itself being based upon consumers' participation and experiences (De Rojas & Camarero, 2008). Visitors' satisfaction, thus, is influenced from both the technical and tangible aspects of the museum product, and by emotional factors, social values and cognitive aspects of the whole visit experience (Caldwell, 2002; Martín-Ruiz, Castellanos-Verdugo & Oviedo-García, 2010; Rowley, 1999). In this vein, the main drivers of customer satisfaction, which could affect the museum experience, can be summarized by two dimensions: (a) the affective and emotional dimensions (such as the social context) and (b) the cognitive dimension (such as the tangible quality, general appearance, museum shop and the ambiance/environment) (Gil & Ritchie, 2009). Each of these two categories could influence the aforementioned aspect.

In this context, AR technology, embedded into products or services, could be a useful tool in enhancing the value of the customer experience, adding virtual contents to the real world. AR utilizes handheld or wearable technologies, such as smartphones, tablets, glasses and

Table 2
Definition of AR (theoretical research findings).

Author, year	Augmented reality definition
Capuano et al. (2016)	*Augmented reality "enhances cultural resources with digital contents that, on one hand, augments the user's sensory experience through the addition of multimedia objects and, on the other hand, improves the user's cognitive process by unveiling the different facets, that lie behind cultural resources"*
Barber et al. (2001)	*Augmented reality "allows visitors to see the supplementary explication above a painting through a camera lens, bringing the guide information and the artwork together within the user's range of vision. This method enables visitors to interpret the description provided by the AR guide by observing and comparing it with the original painting, while simultaneously reading the formal analysis and interpretation based on art appreciation instruction"*
tom Dieck et al. (2016)	*Augmented reality "can enhance the visitor's learning experience, with particular focus on knowledge and understanding, skills, attitudes and values, enjoyment, inspiration and creativity as well as activity, behavior and progression"*
Kysela and Štorková (2015)	Augmented reality *"offers new ways how to educate effectively and attractively (…) is a way of displaying digital content in an image of the real world and its possible interaction with the environment and the user"*
Milgram and Kishino (1994)	Augmented reality *"shows great potential as a design tool to craft innovative customer experiences across industries, by augmenting a display of real-world objects and spaces with virtual information to seamlessly integrate virtual and reality"*
He et al. (2018)	With the help of AR, *"when visitors perceive the environment that an art piece conveys to be more realistic (*i.e., *high virtual presence), the subsequent imagery process proceeds smoothly, leading to a better experience and increased willingness to pay more. However, when visitors are less able to immerse themselves into the environment (*i.e., *low virtual presence), the mental imagery process may not be successful, leading to an inferior experience and decreased willingness to pay more".*

Source: Authors' elaboration.

smartwatches to enhance and stimulate the sensorial experience of visitors by offering information that, otherwise, would have remained hidden or not understood (Tussyadiah, Wang, Jung, & tom Dieck, M. C., 2018). The main goal of augmented reality in museums is to improve users' interaction between actual reality and the augmented one, adding natural feedback to the operator with simulated cues (Milgram, Takemura, Utsumi, & Kishino, 1994; Tussyadiah, Wang, et al., 2018). These additional images expand the consumer experience, providing engaging information that is easier to memorize and which improves attention (Yeh & Wickens, 2000). Two practical and popular examples of AR application come from the general tourism industry: they are the apps *ViewRanger* (Gooding, 2016) and *AR Mountains Map*, which have introduced information on the trails and tracks while tourists are surfing on social networks, tagging their adventures (He et al., 2018). So, thanks to both additional multimedia contents (Tussyadiah, Jung, & tom Dieck, M. C., 2018) and the increasing number of smartphone owners, the availability of mobile applications for museums is nowadays improved, giving the possibility to more personalization and greater visit experience of each tourist and tailoring it to their specific needs (Chang, Chang, & Heh, 2015; Vrontis, Thrassou, & Amirkhanpour, 2017). Currently, technology devices are revolutionizing the way museums create, display and distribute content. As a matter of fact, visual contents and videos are replacing the typical explanatory panels, letting visitors to experiment more and more with a multitude of objects, such as tablets or other mobile devices during the cultural experience in a museum (Barry, Debenham, Trout, & Thomas, 2012).

Thus, the interest expressed in this technology by users has generated an increase in sharing reviews and comments about the experience (Szymanski et al., 2008). Additionally, sharing content can also communicate emotions, which are immediately transferred from one individual to another. In this vein, new technologies, such as AR, may increase a large-scale emotional synchrony, enhancing social relationships and creating pleasurable feelings in others (Coviello et al., 2014). Continuing on the affective (emotional) aspect of the experience, previous researches can be classified according to three main approaches to measuring emotions: (a) Mehrabian and Russell (1974) state that emotions exist in bipolar categories along with three constitutive dimensions: pleasure–displeasure; arousal–non-arousal; and dominance–submissiveness; (b) Izard (1977) states emotions as existing in terms of ten basic emotions: interest, joy, anger, contempt, disgust, shame, guilt, sadness, fear and surprise; and (c) the last approach affirms positive and negative emotions as both being useful in understanding customer reactions and behaviour (Babin and Attaway, 2000; Bagozzi & Moore, 1994).

Finally, AR is useful in preserving or reviving external heritage sites and re-living historic life (Kourouthanassis, Boletsis, Bardaki, & Chasanidou, 2015) and in protecting creative works such as paintings, books and sculpture (Chung et al., 2015; Sotiriadis, 2017), assuming an historical and educational value. With all these apps the tourist can observe more aspects of the same work, on site, with the addition of multimedia elements, rather than computerized images of smaller dimensions with more limited frames (Sadeh, 2003). In line with these arguments, we reach the following proposition.

P1. *The greater is AR technology embeddedness into museum services, the higher are the experiential, epistemic, historical and educational values, along with customer satisfaction.*

Using AR technologies embedded into historical sites their value can be preserved (Chung et al., 2015), and costs of use and implementation can be reduced (economic value), as in the case of the exhibition "Terracotta Warriors of the First Emperor" at the Franklin Institute of Philadelphia, which digitally displays warriors and their weapons (Hurdle, 2017). The more used AR technology is the QR-Code, due to its potential of being automatically available to all the latest models of smartphones (Lalicic & Weismayer, 2016). AR's high diffusion and simplicity as a mobile channel represent its bigger potential (Amirkhanpour, Vrontis, & Thrassou, 2014). As a matter of fact, the tourist can customize AR information with personal preferences, age, level of knowledge and profession, comparing real with the various multimedia formats offered by the augmented reality app i.e. videos, sounds, 3D images (Tussyadiah, Wang, et al., 2018). Another potential of this technology, referring to creation of POIs (point of information), is the creation of virtual tags to remember to visit some spaces in a city or in a museum, sharing this experience on social networks (Kounavis et al., 2012), assuming a particular importance in terms of social value. In fact, many AR apps are integrated with the most popular social networks, giving the possibility of updating status in real time, to use tags, to share photos and opinions, to exchange tips with other tourists, and of enjoying a much larger network than the limited one offered by a museum's basic level of interaction; creating in a sense a sort of community on the Web (Kounavis et al., 2012). This system, therefore, builds a stronger sense of confidence and awareness to the tourist, allowing him/her to live a greater experience, interacting with other users who post virtual contents, albeit exposing him/her to the risk of the halo effect (Kounavis et al., 2012). This combination of factors allows interested parties to create a new and deeper experience in using this service by adding dynamic elements to reality (Hollerer & Feiner, 2004). Thus, AR reshapes the design of museum exhibits and environments to influence users' resource allocation (Yeh & Wickens, 2000). Visitors ultimately become much more involved and have the opportunity to improve their learning (and entertainment) experience through AR, versus traditional tools (e.g. audio guides). In this way, even a person with limited knowledge can get the most useful and important information for him/her, eliminating subjectively boring information (tom Dieck et al., 2016). Moreover, for assessing customer perception of AR museum service quality, the SERVQUAL model by Parasuraman, Zeithaml, and Berry (1988) reveals that customers analyze ten dimensions to assess the fit of a service: tangibles, reliability, responsiveness, communication, credibility, security, competence, courtesy, understanding/knowing the customer and access.

Thus, consequent to and in line with the above, we suggest the following proposition.

P2. *The greater the AR implementation is in the museum, in terms of economic and social values, the higher is the perceived quality of contents and the visitors' museum experience.*

Having discussed how AR could be integrated in tourism and museum experience, the next section describes the stakeholders involved in this process and, most importantly, how these stakeholders may co-create value in the museum through AR service implementation.

3.2. Multi-stakeholder analysis for value creation through AR in museums

Resources to create knowledge in possession of a firm or an organization are limited (Kazadi, Lievens, & Mahr, 2016). So, many different organizations have opened-up their innovation processes to involve external actors in the co-creation of value (Bresciani & Ferraris, 2016; Thrassou, Vrontis, & Bresciani, 2018; Santoro, Ferraris, & Winteler, 2019). Many researchers, therefore, support that technological innovations do not concern a specific group of people within the organization, but a large pool of internal and external stakeholders (Ferraris, Belyaeva, & Bresciani, 2018; Leonidou et al., 2018; Shams, 2015). As a matter of fact, to expand their knowledge during the innovation process, organizations and firms co-create value with external stakeholders (Hoyer, Chandy, Dorotic, Krafft, & Singh, 2010; Kazadi et al., 2016; Mahr, Lievens, & Blazevic, 2014). Museums have therefore begun to focus on the opportunities offered by this new and innovative technologies, as for example augmented reality (tom Dieck & Jung, 2017) through value co-creation avenues, revolving around the experience offered (Festa, Vrontis, Thrassou, & Ciasullo, 2015); for instance, making the visit assume hedonistic aspects for visitors, who can

share contents on the websites. In order to better understand the array of individuals related to a Museum, we decided to apply the stakeholder theory adapted for the specificities of Museum experience. Referring to the latter, the identified stakeholders are the owners, local and central governments, benefactors, employees, visitors or customers, the general public, associations of friends, sponsors, and suppliers of services and goods used by the museum. Mainstream studies on stakeholder approach (Brooks, 2007; Hughes & Luksetich, 2008; tom Dieck & Jung, 2017) highlighted a set of factors, such as tax regulations, household income levels and personal interests (Brooks, 2007; Hughes & Luksetich, 2008; Smith, 2007) for museums, which could further be determinants for strategies choices; and allow museums to understand who their stakeholders truly are or can be (tom Dieck & Jung, 2017).

Kazadi et al. (2016) used Pretty's (1995) study to describe how firms involve multiple stakeholders in their decision making-processes, whereby two schools of thought are described: (a) using stakeholders' integration to drive the market and (b) seeing their integration as a fundamental right in term of network. Indeed, these actors enter into a trust-based relationship with firms and organizations, driving and increasing both the market and revenues (Ramaswamy & Gouillart, 2010). So, stakeholders could be considered as *resource-integrators* that co-create the ecosystem value (Merz, He, & Vargo, 2009) using the network and the aforementioned trust-based relationship.

In this vein, Pera, Occhiocupo, and Clarke (2016) developed a multi-stakeholder co-creation process model, where stakeholders collectively generate more value than the sum of the value created by each actor (Gyrd-Jones and Kornum, 2013). In this model, motives (i.e. reputation motives, experimentation and relationship motives) and resource integration (i.e. communication, open platform and implementation and support encounters) engage stakeholders in the co-creation of value for an organization. These two elements represent the core of the value co-creation process. Then, three individual characteristics influence in a dual flow resource integration: (a) *creativity*, the ability to find original solutions in a task, (b) *negotiation*, a process between two or more actors to make them a decision about an issue with initial discrepancies, and (c) *flexibility*, the openness to the possibility to understand there will be different way to achieve a task (Pera et al., 2016).

Referring to museums, Legget (2012) has rather naturally concluded that the more complex the museum is, the more its range of stakeholders and users is diversified. However, due to this strong heterogeneity of stakeholders and in light of these two frameworks, the larger museums have been able to implement new technologies as mobile augmented reality to test opportunities to engage visitors, implementing creativity of the service offered and visitors' flexibility to experience a visit. Conversely, due to their limited financial resources, smaller museums should carefully examine potential benefits before investing resources in AR, (Cadima Ribeiro & Freitas Santos, 2008; tom Dieck & Jung, 2017). The attractive nature of these cultural organizations easily captures stakeholders' interest (Legget, 2012). So, museums should look at the dynamics of stakeholders' influence, which could create many potential investment opportunities (tom Dieck & Jung, 2017).

Based on this field research, Bunn et al. (2002) developed a five-step process to better understand who the stakeholders are of a specific organization. The first step is to identify key sectors and relevant stakeholders, to create a very broad division of museum stakeholders between internal and regional governments, investors, mass media, economic growth organizations, museum institutes (such as museum authorities), staff, members of the board of directors, volunteers, and community (McLean, 1997). The second step refers to the description of the main characteristics of each stakeholder group, integrating this phase with Pera et al.'s (2016) framework to better design each stakeholder. Thus, a classification of stakeholders in three different clusters is done: (a) *Visitors*, here the aim is to monitor, to understand and to improve all aspects of visitor experience in museums to increase the competitive advantage of the organization (Gilmore & Rentschler, 2002; Halcro, 2008; McLean, 1997); (b) *Government agencies*, which include central government, local authority, Ministry, and other organizations charged with all museum-related issues (Gilmore & Rentschler, 2002; Halcro, 2008; McLean, 1997), and (c) *Community*, which assumes importance thanks to the physical collections referring to the history of a place and for this reason for the all community. (Halcro, 2008; Yeh & Lin, 2005). The third step focuses on the classification of stakeholders based on their backgrounds and their attributes, dividing them into internal i.e. employees, managers, owners, and external i.e. suppliers, companies, government, creditors, shareholders, benefactors (Freeman, 1984). The visitors' category was deliberately excluded from this division, because they are recognized as an important and individual class of its own. The fourth step examines the dynamic relationships between the parties involved, where stakeholders' collaboration is essential to improve the tourist experience (Kourtit, Macharis, & Nijkamp, 2014; McCabe, Sharples, & Foster, 2012). And the last step evaluates generic stakeholder management strategies (Bunn et al., 2002), as the involvement of museum stakeholders in developing of new exhibitions or the introduction of new technologies in a museum (Hall & Bannon, 2006), keeping in mind the influence of individual characteristics described by Pera et al.'s (2016) model abovementioned. In this vein, it could be interesting to integrate Bunn et al.'s (2002) and Pera et al.'s (2016) models with the identification of stakeholders' capabilities in co-creation of value.

Kazadi et al. (2016) design a conceptual framework, where stakeholders create knowledge during two phases of the project: (a) before its start and (b) during its start. The ability of a firm or an organization to attract the appropriate stakeholders for co-creating activities is located in the pre-project. Here, network and individual skills are the base of stakeholder capabilities and the organization should clearly map them. Then, the in-project stakeholder co-creation capabilities relate to the ability to create knowledge from different types of collaborations (Kazadi et al., 2016). We argued that only after this last phase it is possible to understand the significance of value co-creation of a museum, owing to the different stakeholders involved, as well as their reciprocal relationships (tom Dieck & Jung, 2017). Furthermore, it is noted that the use of a stakeholder approach to the implementation of innovative technologies helps to overcome learning barriers (McCabe et al., 2012). This was confirmed by an earlier study that described how the initial participation of key stakeholders could reduce the risk of developing inappropriate technologies, minimize costs and increase efficiency (Douthwaite, Keatinge, & Park, 2001). In the museum industry, the participation of tourists in the co-creation of the visit experience is essential to ensuring a strong focus on creative museum experiences through technology (tom Dieck & Jung, 2017). McCabe et al. (2012) refer to common stakeholders' vision as the perceived value, which could incorporate important aspects to decide or not to implement a strategy in small museum's point of view.

Furthermore, the role of employees in the co-creation of value is particularly important. As a matter of fact, organizations depend more and more on their human resources (Schein, 1977). Thus, employees participate as organizational members of the Museums, acquiring tasks, role knowledge and behaviours to interact with other stakeholders (Yi & Gong, 2013). In this vein, many scholars conducted research on the importance of the employees' creativity to the survival and competitiveness of organizations and companies (George & Zhou, 2002; Malik et al., 2019; Oldham & Cummings, 1996; Zhou, 1998), showing a positive relationship between creativity and performance (Gilson, 2008; Gong, Huang, & Farh, 2009). Museums ought, further, to deal with different challenges, not creating value through stakeholders only in the museum, but also in social, technological, economic and political environments (Carroll & Buchholtz, 2003). Moreover, there is still no common definition of stakeholder theory (tom Dieck & Jung, 2017), even if in tourism research and, in particular museums, stakeholders are divided into two different classifications, which could influence

museum decisions: (a) *internal stakeholders*, as owners and employees and (b) *external ones*, i.e. government, grant givers, visitors, general public, donors, friend associations, sponsors and providers of services and goods (Lindqvist, 2012). More specifically Hyde, Ryan, and Woodside (2012) found the following stakeholders of a museum: museum workforce, board, local media, school users, donors, special interest groups, local authority and other museums. Using the above and Lindqvist division, we can sum up Hyde, Ryan and Woodside's work as followed: a) *Internal stakeholders* (Museum Workforce and Board); b) *External stakeholders* (Local media, School users, Donors, Special interest group, Local Authority, Other Museums).

But how can stakeholders substantially co-create value in a museum context? The concept of value creation by stakeholders has been expanded and companies are more interested in having responsibilities that communicate and practically show deep concern for the community and the environment (Clulow, 2005; Ferraris, Belyaeva, & Bresciani, 2018; Leonidou et al., 2018). So, the above-described stakeholder theory can be used through three phases, originally developed by Gupta (1995), which could be useful for identifying how the values are originated. Specifically, to:

a. Identify and specify the stakeholders and their interests, origin and characteristics.
b. Identify and describe the relationships between stakeholders and the museum, and between stakeholders, including power relations.
c. Incorporate the concepts of action and time, build stakeholders and subsequent stakeholder maps.

Thus, we propose the following:

P3. *The greater the importance given to stakeholders' identification and individual characteristics is, the higher is the opportunity to facilitate value co-creation through AR in the museum.*

3.3. Leveraging stakeholders and their relationships towards AR implementation in Museums

The three streams of research on which this paper is grounded are usually individually dealt with in academic literature (Barfield et al., 2013; Capuano et al., 2016; Freeman, 1984; He et al., 2018; tom Dieck et al., 2016), but none of these studies has taken all three into consideration, let alone their interrelations in the specific research field of AR in museums. Fig. 1, thus, schematically and simply presents our specific conceptualisation of a preliminary framework, where intersections between the three main research topics are outlined, along with the three afore-stated propositions; placing particular attention on value co-creation through digital tools in museums, which, essentially, constitutes the intersection of the three.

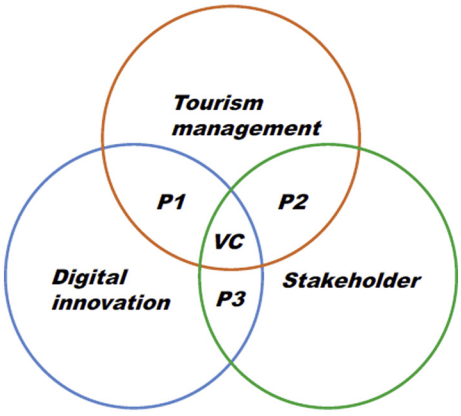

Fig. 1. A preliminary theoretical framework for value co-creation using AR in museums.
Source: Authors' elaboration.

The first intersection refers to *P1*, which the research has proposed above that "*The greater is AR technology embeddedness into museum services, the higher are the experiential, epistemic, historical and educational values, along with customer satisfaction.*".

Literature on Augmented Reality in museums has shown how AR technology could create value to the customer experience, adding contents to the real world (Barfield et al., 2013; Capuano et al., 2016; Feiner et al., 1997), using handheld and wearable devices to create additional contents of different nature (as videos, images and audios) during the real visit (Tussyadiah, Wang, et al., 2018). Thus, value is created by mapping and involving the stakeholders around a museum (Szymanski et al., 2008; Yoon et al., 2012) by using AR in the creation of augmented contents and improved experiences (Kounavis et al., 2012; Sadeh, 2003), as referred in *P2* and *P3*.

As a matter of fact, through deeper understanding of who the stakeholders are and which are their main interrelations, tourism organizations could analyze their preferences better (Barry et al., 2012), and offer additional services, based on the nature of stakeholders (Nicoli & Papadopoulou, 2017). Adding to that, the power of innovation given by technology tempts museum to focus on new opportunities offered as AR (tom Dieck & Jung, 2017).

As aforementioned, literature provides many different methods to identify the stakeholders, where we underlined, as the most important for this study, the five steps by Bunn et al. (2002) and the three phases planned by Gupta (1995), with the analysis clearly focusing on the co-creation of value and the differentiation between internal and external stakeholders also proposed by Hyde et al. (2012). Given this, our research has focused on the intersection between the three main topics analysed to understand if, in this intersection, stakeholders could co-create value (VC) using augmented reality during a visit in a museum.

But, before analysing the ways in which stakeholders use AR in a museum, we need to more specifically define its functions. To make up this technology,[2] users could use (a) *market based devices* where a camera and some type of visual marker, such as a QR-code, are used to augment contents, (b) *marketless AR,* where GPS, digital compass, velocity meter, or accelerometer are embedded in the device to provide data based on your location, (c) *projection based AR*, where artificial light could be projected onto surfaces to give additional information or instructions in a factory, and then (d) *superimposition-based augmented reality*, where the real view of an object is partially or fully replaced with a virtual one, as a virtual sofa in a room. This systematization allows a clearer understanding of the potential of this technology in terms of its application to and by different stakeholders. As a matter of fact, those working for a museum could use AR and add many different values; as analysed in tom Dieck and Jung (2017) where they referred to heritage tourism context, stimulating the co-creation of value from external stakeholders, id est. local media, school users, donors, special interest group, local authority and other museums and internal one, id est. museum workforce and board (Lindqvist, 2012 p.8).

These could co-exist in different value categorizations:

(a.) *economic value of AR*, created for the museum through the adoption of AR, by attracting new target markets and increasing sales, owing to the augmented curiosity of this technological visit by visitors. Also, they contribute to the creation of economic value through greater engagement in the museum activities which also lets the organization gather data about personal needs and preferences (Barry et al., 2012; Chang, Chang, & Heh, 2015). This data could be used in a second phase to reorganize the visit according to the visitors' preferences;

[2] Data available on: https://www.realitytechnologies.com/augmented-reality/ (Retrieved on 2nd January 2019).

(b.) *experiential value of AR*, id est. *"the customers' perceptions of products or services through direct use or indirect observation"* (Yuan & Wu, 2008, p. 391) where the museum tries to enhance emotional attachment, creating more interactive and exciting experiences to enrich memories of the visitor;

(c.) *social value of AR*, id est. *"customers' and businesses' public recognition"* given by products and services to make a good impression to others (Gordon, Butler, Magee, Waitt, & Cooper, 2015), where the museum offers activities in which gamification is a key point. Within it, the visitor shares online (e.g. social media) contents about personal experience in the museum, increasing the interest into the museum visit by his/her followers;

(d.) *epistemic value of AR*, id est. "*the consumers' curiosity about new products and their willingness to experience something new*" (Jiang & Kim, 2015), where external stakeholders are involved in new engagement, increasing their attention when using different kind of tools to visit the museum and for this reason their curiosity of trying new technologies enhances;

(e.) *historical and cultural value of AR*, where internal stakeholders could add more contents to the exhibition of history, telling more details than before and thus stimulate interest in exploring the history of the museum. Here, external stakeholders are interested in discovering new concepts thanks to augmented elements, creating a virtual experience of this knowledge process.

(f.) *educational value of AR*. On one hand, AR could be interpreted as a creation of value in the 'external' perspective, whereby people could learn about and visit the museum at a time of their preference, focusing their attention wherever and whenever they want. In this manner, it is easy to memorize information, and make the visit more enjoyable and interactive (tom Dieck & Jung, 2017). On the other hand, *educational value* could be co-created by internal stakeholders saving contents and data to conduct a deeper analysis of preferences and needs (Barry et al., 2012; Chang, Chang, & Heh, 2015) and to give less experienced staff the possibility to learn faster and more about the museum (tom Dieck & Jung, 2017).

Table 3 summarizes how co-creation of value could be possible in the different typologies of values, as discussed above.

4. Conclusions

4.1. Discussion of results and theoretical contributions

AR and its application in museums could bring many significant advantages to all internal and external stakeholders, but it should be used in correspondingly different manners in a museum. The preliminary conceptual model proposed, along with our propositions, shows how stakeholders could co-create value using AR technology with the aim to deliver a better museum experience. This contributes to the co-creation of different forms of value and it is in line with the framework developed by Shams (2016), which highlighted that the cause and consequence of stakeholders' collaboration in a network could better design and deliver value according to all the key stakeholders, preserving competitive advantages. This research, thus, provides a better understanding of the interaction between the three domains on this topic, where digitalization is more and more important in the co-creation of value around a product or a service (Ferraris, Mazzoleni, et al., 2018; Godes & Mayzlin, 2004; Maxham III & Netemeyer, 2002).

Our conceptual discussion of the framework examines how augmented reality could co-create value in the museum context, for each of the stakeholders interested in. This represents the main theoretical contribution of the present study, which could be tested and implemented in different museums. Specifically, we ground on and conceptually discuss in relation to different streams of research: *(a) digital innovation and AR paradigm,* where the digitalization process increase the visit in a museum, making a more hedonistic experience (Babin et al., 1994; Ferraris, Belyaeva, & Bresciani, 2018; Leonidou et al., 2018); *(b) AR in museums,* where the introduction of this technology into products or services become a useful tool to increase customer experience through digital tools (Tussyadiah, Wang, et al., 2018) and *(c) Stakeholder theory in a new context dealing with an emerging technology,* where the introduction of AR technology is able to create value not only into the museum itself, but also in social, technological, economic and political environments (Carroll & Buchholtz, 2003) thanks to the possibility to share contents.

Thus, we firstly extended the theory of augmented reality of Capuano et al. (2016) Barfield et al. (2013), Kounavis, Kasimati and Zamani (2012) and Feiner et al. (1997) referring to AR technology as a technology able to add contents to the real world, arguing its potential in co-creating value with stakeholders, thanks to the creation of augmented contents. Secondly, we proposed an extension of the concept within the tourism literature (Barry et al., 2012; Buhalis & O'Connor, 2005; Clarke, 2013; He et al., 2018; Tussyadiah, Wang, et al., 2018), where the experience become more interesting for visitors with the introduction of AR technologies during the visit. Thirdly, stakeholder theory (e.g. Bunn et al., 2002; Hyde et al., 2012; Kazadi et al., 2016; Lindqvist, 2012; Pera et al., 2016) design a new context of analysis, where the fragmented literature about the connection between the three topics are mixed together.

4.2. Managerial implications and final remarks

Our findings present many *managerial implications* that are related to the introduction of this new technology in the visitor' experience.

Table 3
Co-creation of values by stakeholders in museums.

Values	Tools
Economic value of AR	- Adoption of AR to attract new target markets and increasing sales - Creation of economic value increasing its engagement in museum activities - Gather data about personal needs and preferences
Experiential value of AR	- Enhancing emotional attachment, creating more interactive and exciting experiences to enrich memories of the visitor
Social value of AR	- Recognition given by products and services to make a good impression to others. - Sharing contents on social media about the personal experience in the museum
Epistemic value of AR	- Involving external stakeholders in new engagement, increasing their attention when using different kind of tools to visit the museum and for this reason their curiosity of trying new technologies enhances
Historical and cultural value of AR	- Give the possibility to internal stakeholders to add more contents to the exhibition of history. - Letting external stakeholders discover new concepts thanks to augmented elements, creating a virtual experience of this knowledge process.
Educational value of AR	- Letting people learn and visit the museum in the time they prefer, focusing their attention whenever they want. - Saving contents and data to make deeper analysis of consumers' preferences and needs and giving less experienced staff the possibility to learn faster about the museum

Source: Authors' personal elaboration.

Firstly, the introduction of technologies during the visit enhance visitor satisfaction and engagement. In fact, the augmented visit complements the curiosity of people in the museum experience, augmenting visitors' satisfaction. And, if users are satisfied, they will generate and increase their comments about the experience on social networks (Szymanski et al., 2008; Kounavis et al., 2012). The intensification of interest could further create engagement, and so the sharing of information and different kind of personal data with the organization. In this case, organizations have to collect this new knowledge about customers, analyze and use it in order to re-organize and adapt the cultural visit, improving the overall experience. Otherwise, museum managers difficultly know if visitors are indeed interested or not in the services offered, and to what degree and how they would like to participate or be engaged with the improvement of the museum (Lindqvist, 2012).

Furthermore, revenues increase with the adoption of AR, due to the creation of a more attractive experience. As a matter of fact, making the experience more attractive, visitors are more encouraged to go to the museum moreover to try the new technology (Legget, 2012). Here, the importance of sharing the experience assume a relevant role in term of promotion of the experience, able to reach a rich number of people (Szymanski et al., 2008; Kounavis et al., 2012).

Museums, in fact, are advised to base their activities on very diversified income to survive (Camarero & Garrido, 2009; Johnson & Barry, 1998), which includes revenue from ticket sales and public or private contributions (Fedeli & Michele, 2006; Toepler & Dewees, 2005). From this study we can also derive some disadvantages created by technology. For instance, scarce and fragmented connectivity in rural areas museum could limit AR experience, suggesting these organizations should use other technology to face this problem. The same is true for those locations with largely older visitors, which are not able to or comfortable using innovative technologies, preferring a traditional experience of a visit to a museum. Additionally, some employees could feel replaced, with the introduction of AR during the visit experience provoking internal resistance to implementing this kind of technology.

In terms of future avenues for research, we believe that the novel approach herein described presents significant results for further study. To start with, it would be interesting to empirically analyze the co-creation of value by stakeholders using augmented reality in different and/or specialized contexts, such art galleries; typically (in the Italian context), the “Modern Art Gallery” (GAM) in Turin, the “Uffizi” of Florence and the “Vatican Museum” of Rome, with their cross-comparison potentially offering a more complete and reliable understanding of visitors' reactions to augmented (reality) contents. Moreover, scholars could adapt the model presented in this study, adapting in all the fields of tourism interest suggested in Table 1, trying to verify the coherence of our work in all the area related to the tourism. Naturally, it would firstly be more useful to conduct some tests in order to validate and refine the presently developed framework, which, in parallel, constitutes the main limitation of this study: “*model some aspect of the empirical world*” (Dubin, 1976).

As stated by Wright and McMahan (1992), nonetheless, a good theory could make interesting predictions and previsions thanks to a set of values for each variable used in the model as the present research has successfully done. So, the next step for scholars would be to test this model in a small museum, where the complexity of this organization is lower than the larger ones, as is the diversification of its stakeholders (Legget, 2012). The analysis could then be expanded by further research, in different directions; for instance, by making some international comparisons between different cases.

Moreover, as a potential expansion of this study, a co-citation analysis could be conducted (Appio, Cesaroni, & Di Minin, 2014; Appio, Martini, Massa, & Testa, 2016; Ardito, Scuotto, Del Giudice, & Messeni Petruzzelli, 2018; Fahimnia, Sarkis, & Davarzani, 2015) as well as in depth systematic literature review (e.g. Dezi, Battisti, Ferraris, & Papa, 2018), integrating this framework with conventional framework of stakeholder theory.

Concluding, we would like to put forward the findings' confidence in the ability and potentialities of an approach that balances the use of AR with the value from and value to the specific ‘fingerprint’ of stakeholders of each and every individual museum. This unique combination of internal and external stakeholders ultimately shapes the needs and wants and benefits pertaining, not simply to the exhibits, but to the museum as an organizational entity; and the use of AR to capture, enhance, and even create value by and for all stakeholders cannot be blind to the individuality of the shareholders' collective profile.

Declaration of Competing Interest

None.

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