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MUSEUMS IN THE DIGITAL ERA: TECHNOLOGY AND INNOVATION

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"The basis of a museum's existence and activity is its collections which must be accessible (both the real object and data on each object), exhibited and interpreted. Exhibitions are the most common means employed by museums to communicate with the public.

The new multimedia and interactive technologies represent new ways museums can improve the communication with the public, to attract remote (virtual) visitors, complement a real visit, and explore new potentials - some only possible due to recent information technology."

(A. Proença, M. Brito, T. Ramalho e H. Regalo, 1998)

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1. Introduction

Museums belong to the vast range of cultural heritage institutions. The area concerning museums is remarkably heterogeneous and complex, comprising organizations that differ according to numerous aspects, such as the type of collection, dimensions of the architectural structure, age, and type of funding. Independently of the actual differences across this kind of institutions, over the years, museums have acquired a growing significance, by spreading in all countries of the world, even the smallest ones. This makes it unquestionably clear that, throughout their long history, museums have been able to become today an extremely influential and powerful economic actor on all the international scene.

During the whole of their existence, museums have continually attempted to concentrate their efforts around their cultural offer, to extrapolate its relative value and make it accessible to the vast public. This is why, for a significantly long time, museums were associated to the concept of a mausoleum, with the sole aim of protecting antiquities and works of art from deterioration, and to preserve them from the passage of time (Witcomb, 2003). This conception certainly relies on a static and traditional way of interpreting museums, still anchored to the idea of a museum where the visitor was not placed at the center of the cultural offer.

However, the role of museums has dramatically changed. Because of the continuous developments in modern technology and to the enthusiasm deriving from the advent of the era of digitalization, the traditional bricks-and-mortar model of museums based on three-dimensional exhibits and artifacts, is currently leaving room for new technological improvements, thereby causing institutions to revolutionize their role in the society completely (Koellinger, 2008).

Nowadays, museums are serving numerous diversified purposes. Not only they are becoming a public meeting and gathering place for people around the area, but also,

they serve important research objectives, by becoming more and more accessible to a greater number of individuals in this respect.

For these reasons, museums have now actually become a dominant economic force in the global landscape. This inevitably encourages museums to pursue unique and innovative approaches that permit them to deal and interact, through appropriate means, with both the visitor and the surrounding environment while, at the same time, proceeding towards their prime mission: creating cultural value for the benefit of the population.

The ongoing urge of museums to undertake increasingly innovative activities translates into the capacity of these institutions to perform in a more tenable, engaging and interactive manner, not only with respect to their public but to all the society in its entirety (Mulgan et al., 2007). It is in this case that innovative tools, such as the new information and communication technologies (ICTs) definitely have a central role, positioning themselves as the chief determinants of this ongoing and forthcoming transformation that encompasses all cultural heritage institutions (Hempell et al., 2004).

In point of fact, the new and interactive social technologies have dramatically transformed the daily habits of all people in the society, by completely changing the way in which individuals approach reality. The success of information and communication technologies particularly relies on the capacity of these instruments to expedite and simplify our actions, modifying in this way our way of behaving and thinking (Hempell et al., 2004). In the particular case of museum institutions, ICTs effectively led people to interpret culture in an entirely original and challenging way, by enhancing the communication between the structure of the institution, the exposed artifacts, and its diversified public.

The objective of my study is to present why and how museums are attempting to innovate in the modern world. Recently, many scholars and experts of the cultural sector concentrated their efforts to deepen the analysis of museum institutions in relation to technological changes and innovations. Given the recent debates on the differences in approach of museums around the field of innovation, this study seeks to provide clarification with respect to this topic, by analyzing the reasons behind the need for museums to innovate and by exploring the innovative measures adopted by the most part of museums. By investigating technology and innovation within the area of museums, I suggest the following research question:

RQ: How did the role of museums change in the digital era?

Regarding the structure of the thesis, the work follows three principal subdivisions. The study is introduced by a presentation of the role of museums, by analyzing how these cultural institutions are changing today in response to social changes. The first chapter aims at defining the reasons behind the innovation process of museums, by looking at the developments in the society nowadays and the need for museums to expand their customer base. The second chapter defines innovation from a theoretical point of view and describes the technologies currently used by these institutions to innovate. The third section provides a deep insight into museums in Italy, through the analysis of two case studies, relative to Ara Pacis Museum and Galleria Nazionale d'Arte Moderna (GNAM) in the city of Rome. Proceeding towards the conclusion, the analysis of this study will show how these aspects concurrently will lead to a greater engagement of the visitor in an "immersive experience."

2. The changing role of museums

Not long ago, museums concentrated their activities towards the preservation and exhibition of objects essentially for the appreciation and the enjoyment of the most educated and cultured citizens. With the passage of time, this focus revealed to be extremely narrow and improper for a changing society oriented towards open-mindedness and deep social engagement (Witcomb, 2003).

For these reasons, in the digital era, we are witnessing a strong transformation concerning the role of these institutions. First and foremost, museums strive to put themselves aside from the label of a mausoleum that had been conferred upon them (Witcomb, 2003). This strong desire to take the distance from a traditional and long-established view is concretized by the willingness of museums to follow an entirely new approach, which induces these institutions to adapt to a digital approach to culture and renew their means of communicating their offer to the world (Telos, 2012).

Nowadays, more than ever, museums hold a central role in the social and cultural life of the communities in which they are located and, for this reason, they must keep up to date on the continuous changes in innovation and technology to satisfy the needs of their visitors. This has consequently permitted them to evolve from a traditional, long-established nature, to adopt a highly socially engaged function, able to educate, create a sense of belonging, recreate historical memory and convey shared values.

The International Council of Museums seeks to provide a modern-day definition of museums. It defines them as "*a non-profit making, permanent institution in the service of society and of its development, and open to the public, which acquires, conserves, researches, communicates and exhibits, for purposes of study, education and enjoyment, material evidence of people and their environment"* (ICOM, 2007). The definition offered by ICOM represents a complete explanation of museums

institutions, since it defines in a broad way the activities and objectives of the institution, independently from its public or private nature.

2.1. A response to social needs

The desire of museums to renovate their tools and means of communication and to improve their relationships with the visitors must be interpreted as a reaction to the numerous advancements that have been taking place around the field of technology in the existing modern society. Since we are living in an increasingly technological and digital world, with numerous services that provide us with innovative user-experiences and greater customer involvement, museums must invent original and brand-new ways to communicate their stories and engage with their public (Bahkshi and Thorsby, 2010).
Over the last decades, fundamental changes occurred in the technological field and consequently affected our society. These transformations have significantly contributed to altering the working of museums, the way through which they provide experiences to their visitors and how their collections are exhibited.

At the moment, we are globally going through a time of technological innovation. Technology has impressively affected and influenced every aspect of our lives, by changing not only our daily routines but also the way we relate, approach to and communicate with others (G. Wayne Clough, 2012). The digital advancements have given people the opportunity to benefit from the improved facilities and services that derive from the use of these new technologies. In fact, today's digital revolution makes available many valuable tools that, in turn, provide people with compelling opportunities that are accessible to all (ARUP, 2013). Through this technological revolution, we all have the possibility to share the necessary information, to discover new things and to have access to particular facts that in the past were only reserved

for specialists. Just the sole thought of imagining the world without technology is by now impossible.

The developments in the technological area are not limited to selective areas, but they encompass disparate sectors of the society, each being characterized by a specific type of innovation. Accordingly, no institution had been exempt from the disruptions provoked by technological innovation. Digital technology is revolutionizing the society we live in: institutions should adopt the innovation, or there is a high risk for them to become marginalized (G. Wayne Clough, 2012). As a matter of fact, digital technologies are often called 'disruptive technologies', meaning that they are radically different technologies that have the effect of overturning the existing dominant products or services on the market. As described by Harvard Business School professor Clayton Christensen in his book, *The Innovator's Dilemma*, it is crucial to understand when to put into action a total conversion to a new technology, in particular, if the current technology still reveals to be hugely successful. Accordingly, this has undoubtedly challenged many institutions to reconsider how to preserve their long-established value, while at the same time keeping themselves updated with the ongoing digital developments.

Among them, the museum's sector has finally recognized the necessity to respond to the imminent social transformations. Digitization for museums becomes essential since we live in a time in which people have become accustomed to accessing infinite information by way of advanced mobiles and electronic devices. Existent visitors expect a never-ending supply of up-to-date tools and facilities.

To face the needs of the rapidly changing society, museums must be able to manage and conform to the different criterions and demands posed by societal changes, whereas working towards their primary mission (Novak et al., 2001). The capacity to meet innovative standards and reconsider their tasks and activities becomes to a greater extent a reaction to the ever-changing social needs (Telos, 2012). To attain a

good outcome towards innovation, it is necessary to get familiar with the adoption of digital technology. This digital revolution will allow the enrichment of in-person visitors' experiences, by completely immersing and involving the museum's audience, as well as giving institutions the opportunity to extend to a broader public that has not been served yet. This has consequently allocated to them the possibility to become mediators of culture, of new ideas and solid values. In this regard, one of the most recent productions of Vicente et al. contributes to define the present position of museums as promoters of *"preservation and valorisation of cultural heritage support for artistic creation, facilitating access to and involvement in culture, protecting pluralism, freedom of expression and cultural diversity"* (Vicente et al., 2012, p. 653).

The advent of digital technology created a space for both a physical view of the museum and a digital one, with one completing the other, by concurrently providing the content and the knowledge that museums bring into play (Von Hippel, 2005). Utilizing the digital access, that provides institutions with endless opportunities for public involvement, exhibitions have become surprisingly more attractive and appealing to the visitors. The experience derived from the exhibitions will go beyond the present-moment visit to the museum since it will develop and foster post-visit learning. Nina Simon, designer and author of the book "The Participatory Museum" (2010), envisions a prospect of how will museums be in the future: "*A place where each person's actions are networked with those of others into cumulative and shifting content for display, sharing, and remix. A place where people discuss the objects on display with friends and strangers, sharing diverse stories and interpretations. A place where people are invited on an ongoing basis to contribute, to collaborate, to co-create, and to co-opt the experiences and content in a designed, intentional environment. A place that gets better the more people use it.*" (Nina Simon, 2010, pp. 67-68).

As reported by Simon, nowadays, the new interaction between individuals and digital technologies pushed museum institutions to mirror the prospects of a changing world.

By revolutionizing their role in the society, museums must accept a period of transition and development in order to affirm themselves as agents of progress that lead the society to evolution and advancement. Not only they should promote their beliefs to their surrounding community, but they should connect to different communities and interact with them in order to reach a broader number of individuals, given that museums have the potential to become influential and meaningful actors within the society. Museums have the unique capacity to attract numerous visitors from all over the world and to communicate with them through a common language. Therefore, institutions must recognize their incomparable resources and abilities to become more and more responsive to the dynamic changes the society is witnessing. To this extent, museums must focus on expanding their scope, instead of restraining their efforts within their own four walls, in a way to develop and enhance their skills in the eyes of their audience.

Even prior to the introduction of modern digital technology, numerous specialists and experts of the museum sector perceived the urge for museum institutions to renovate their position within the society. Among them, Stephen Weil, in his book, *Making Museums Matter*, lays the foundations for the application of digital technologies within museums. The author suggested that "*Museums matter only to the extent that they are perceived to provide communities they serve with something of value beyond their mere existence*" (S. Weil, 2002, p.41).

Weil reiterates the urgency for museums to become more significant within the present-day society, by adopting new technologies that will help institutions to engage and attract its public. As digital technology extends its field of application, it will consequently enhance the role of museums. In a society that is continually and progressively changing, museums should be breaking new ground in the technological innovation field to discover new ways in which to promote their programs and activities and become more and more oriented towards the visitor. The development of new technologies and the introduction of advanced innovations will notably

increase the potential of museums to eye-opening possibilities. In the coming years, the necessity of attracting far-reaching audiences and serving different forms of culture will increasingly lead institutions to innovate and comply with the growing visitors' needs and the changing economic world.

2.2 Customer Retention and Audience Development

We must never forget that the central role of a museum, before anything else, is to serve its public and its individual preferences and demands. Every day, museums must interact and come along with a multitude of different people, each with its own needs and motivations (Black Graham, 2005). To cope with its vast and diversified public, the first step for a museum is to analyze what lies behind the particular impulse that drives a person to visit museums. Since the market has become considerably fragmented, it is imperative for museums to be adaptable and responsive to its rapidly changing audience. To pursue this is an effective and efficient way, institutions must try to pull down the barriers they have built and begin to study the different customer segments, to promote a broad involvement and engagement of their audience (Christian Waltl, 2006). At the same time, museums should guarantee an appropriate and correct preservation and maintenance of their valuable collection, in order to pass it on adequately to the future generations. This will accordingly permit museum institutions to pursue, over a never-ending lifespan, their primary mission, that is, to provide visitors with an exclusive experience, oriented towards education and learning.

As individuals become used to innovations and new ways to communicate and interact with each other, the hard question lies on understanding how can museums prepare themselves to serve diversified sectors of the society in a way that is appealing and attractive to everyone. Present-day visitors of museums vary substantially regarding age and, consequently, their way of thinking and approaching towards an innovative mindset of the museum is totally different (Vicente et al., 2012). Therefore, museums

must be prompt and reactive in being able to serve every type of visitor, from the elder part of the population, which is still anchored to a traditional view of museums, to the growing members of the Millennial generation, characterized by a widespread use of digital technologies and the Internet, in particular social media websites. For museums to exist in this modern society, it is thus crucial to develop new ways to communicate with the present-day realities and to continuously renovate the type of the experience offered, in order to meet the endless and most assorted requirements deriving from both museums' current audience as well as new potential visitors. As a consequence, a museum must try to work out and implement strategies through a proper, initial examination of its visitors and their own familiarity with the use of technologies, in order to achieve a highly visitor-oriented mentality (Rentschler et al., 2002). Only by carefully studying each group of individuals within the society, museums will be able to learn and understand the multifaceted character of their audience.

Not very long time ago, the sole scope of museums was the one of concentrating their efforts towards an impeccable quality of the exposed objects and artifacts (Witcomb, 2003). It has been years now that museums have started taking into account a more pronounced customer-based strategy, leaving aside a plan of action exclusively based on the product, on which museums have worked for years until now. What truly matters for an institution to be successful, is not the quality of its offer, but rather, its unique capacity to attract and immerse the viewer. The process of fostering engagement between the visitor and the museum is likely to generate high customer satisfaction and increase the probabilities that the visitor will come back to enjoy the experience again. Through museums' commitment to providing their public with multiple and different experiences every time, visitors have become highly dynamic actors, involved first-hand in the creation of exhibitions and correlated museum activities and they have increased their number over the years, given that museum exhibits now require less pre-knowledge from visitors than before. With the promise of promoting, in a highly qualitative way, a vast range of original approaches to the

service of the public, museums have become influential agents within their community, by growing into remarkable gathering places and being perceived as such by all the society (Bollo, 2014).

Given the meaningful social role that has been attributed to them, museums are now recognizing the possibility to expand their horizons to a vast range of external groups of the audience that, until now, have never been visitors of the museums before. Veritably, museum institutions must take into consideration the possibility of diversifying their public, by expanding their view to reach new visitors, that are unfamiliar with the museum context. By addressing new customer categories, museums are induced to increase their social function and are challenged to adopt different techniques to serve and entertain their public (Rentschler et al., 2002). Through a multitude of efforts, institutions reach and captivate those segments of the society that currently are not in touch with museum's activities and events, and successfully transforms them into active and loyal visitors. This process is commonly referred to as 'audience development', that specifically deals with the range of learning and educational activities and programs designed to involve a new public and thereby increasing the range of audience.

Audience development is characterized by the willingness to promote advanced services to the current public, while at the same time, trying new ways to connect with potential visitors. Audience development is not meant to follow a simple and straightforward process, but rather, it requires the participation of all actors of the museum, which must work closely together, with the primary aim of pursuing the institution's general mission and goals (Anderson Hans Christian, 2005). On the one hand, audience development offers a programmed and targeted managerial process aimed at cultivating visitors' experience inside the museum, by encouraging them to make the best of their experience. On the other hand, this process intends to promote a socially engaged view of museums, by ensuring that these institutions hold a significant and meaningful role within the surrounding community.

Audience development respectively deals with improving understanding and communication between the institution and the overall society, by addressing museum activities to broader customer groups. Audience development is furtherly based on a multitude of different approaches, the most important being market research, which gives the museum the possibility to have a clear understanding of who the museum's target groups are and what are their respective characteristics and needs. By following this type of approach, the institution is capable of developing a range of activities aimed at satisfying the specific requirements of the diverse target groups (Bollo, 2014).

This follows from the fact that the demand of present-day visitors is not related to the mass market demand anymore, but rather it deals with a unique custom-built, personalized and mutually beneficial approach for both the visitor and the institution (Cunningham, 2002). This is particularly evident in the study of museums, where there is a fruitful cooperation between the institution's structure and its public, in order to attain a customized and tailor-made solution. The transformation of strategy, from product-based to audience-led, along with a cooperative and participative approach, had undoubtedly led museums to attract and immerse the visitor to a greater degree (Black Graham, 2005). As a result, by establishing a forceful contact between the public and programmed activities, the visitor had finally become the main character of the museum experience. In this way, museums have the opportunity to increasingly become open and accessible structures, addressed towards a broader group of the society, with the intention to establish themselves as renowned public areas, where beneficial collaborations can occur.

Nowadays, the desire of museums to reach out to a new public and to become more approachable for visitors, materializes in the adoption of innovative tools that guide the public in a highly engaging path and are able to establish a successful communication between people coming at the museum and the objects displayed (Molteni and Ordenini, 2003). By allocating various degrees of communication and

personalization, these technological tools develop completely new and attractive ways of involvement and participation for the users (San Martin, 2012). The most interesting part of digital devices lies in their ability to allow museum's content to be co-created by each visitor (Miles and Green, 2008). Accordingly, the public has now truly the opportunity to become the principal actor within the museum and is encouraged to enrich museum's point of view, by bringing external knowledge and expertise inside. In this way, everyone can propose fresh innovations to the institution by creating new contents and suggesting original ideas.

Nowadays, cultural consumers have transformed themselves in prosumers, that is consumers that directly participate in the productive process (Medak, 2008). The user serves as a central element for this new cultural system, to which he takes part in the creation and sharing of contents. As a consequence, the system is deeply user-centered: the user generates itself online contents, defined user-generated contents (UGC), in order to actively interact with the new mass technologies (Xiao, 2011). This change of perspective contributes significantly to the decentralization and democratization of information, following the openness model, where expert authorities are no longer the only ones who can access and manage data and contents of the institution. Specifically, the original top-down informative system, based on the one-to-many model for transmission of information, has been largely substituted by the bottom-up model, where the many-to-many system allows a total openness with respect to the contents provided by the users (Solima, 2008).

This is shown by the American economist, Eric von Hippel, who firmly indicates that innovation today has truly become democratized. "*When I say that innovation is being democratized, I mean that users of products and services—both firms and individual consumers—are increasingly able to innovate for themselves. User-centered innovation processes offer significant advantages over the manufacturer-centric innovation development systems that have been the mainstay of commerce for hundreds of years. Users that innovate can develop exactly what they want, rather than relying on*

manufacturers to act as their (often very imperfect) agents." (Eric von Hippel, Democratizing Innovation, 2005).

3. How museums innovate

With reference to the cultural field, innovation assumes a fundamental role, not only because it aims at creating value in notably new and differentiated forms, but also because it promotes an important social reaction, which goes beyond the fulfilment of visitors' needs and extends to all the community in a broader sense (Camarero and Garrido, 2010).

Particularly in the museum sector, the areas primarily interested to a renovation process are the place where the visit occurs and the manner in which the visit is carried out (Tidd et al., 2009). In the first case, the introduction of new technologies offers the possibility to enrich the museum's spaces with interactive, personalized tools, such as audio guides, multimedia supports, and interactive instruments. In the second case, instead, the access to a museum's website allows institutions to increase, in a substantial way, the interaction time with the public, thereby improving the actual visit and strengthening the ex-post experience. For this reason, *"innovation in the creative industries goes beyond the physical and aesthetical attributes, but it also affects the environment, customer relationships, market, distribution, and organizations' internal operations"* (Potts, 2009b, pp. 663-673).

3.1 Defining Innovation

"Innovation is a very complex process found in form of products, services or processes, that affects technological, organizational, managerial, market, and user behavior dimensions" (Miles and Green, 2008, pp. 451). "*It refers, in most cases, to the ability of*

an organization to adapt to changes of the environment at the same time as producing itself changes that affects the environment, in a simultaneous endless loop" (Peacock, 2008, pp. 335).

Innovation in museum organizations is shaped by the continuous and rapidly changing requests of everyday visitors (Mulgan et al., 2007). In order to sustain their competitive level, institutions today cannot avoid the presence of new technologies and it is vital for them to understand this transformation as well as to realize their innovative potential. For this reason, a museum must not only concentrate its efforts on renovating its services and processes but also aim at increasing the value perceived by the customer, in a way to keep the public interested and excited, and it does this on the basis of the evaluations and reactions of customers to the overall museum's experience (Patil & Athawale, 2014).

The reasons behind the urge towards innovation reside in the need for cultural heritage institutions to maintain or grow their position within the market (Bakhshi & Throsb, 2012). As a consequence, the introduction of successful innovations allows institutions to sustain their competitive advantage with respect to their competitors. This occurs, in particular, because innovations are oriented towards the improvement of the institution's efficacy and efficiency. Through innovation, therefore, museums explore new possibilities, with the competitive advantage of "first player" since the innovative institution can respond first to the oncoming needs of a segment of the audience that had not been served yet until the market opens up to competition (Andreasen and Kotler, 2002).

"Nowadays, in the digital era, innovation strongly depicts technological development. In the creative industries, this observation is also true because the facility to create, produce, reproduce, store, diffuse, and share digital content through social technologies and the Web 2.0" (Bahkshi and Throsby, 2010). The application of technological innovation that resides within museums is observed both at a

managerial and customer service level (Pascual, 2012). The former relies on the use of tools that enhance the organization of museum's patrimony and numerous data. Instead, the latter involves all the technological devices settled inside the museum designed to improve and facilitate visitor's experience. This description of technological innovation is reinforced by Camarero and Garrido, that delineate technological innovation as "*the adoption of new technologies employed to products, services, or the production process for such products and services*" (Camarero and Garrido, 2011, p. 39).

Technological innovation results in two forms, respectively technological product innovation and technological process innovation. Both are incorporated in the content and in the services realized by the museum and they allow the introduction on the market of a technologically new offer or that is substantially improved in terms of performance.

On the one hand, technological product innovation, which can be illustrated by the application of ICTs, depicts the creation of a new technological product or service, as well as the technological improvement of existing ones. "*It involves taking the initiative to make incremental or even dramatic improvements to the existing product portfolios, replacing some of the current products with new ones, or developing new-to-the-world products for the benefit of existing or new customers*" (Rainey, 2005).
On the other hand, technological process innovation deals with the execution of a new or improved way to create products or deliver services. "*Process innovation is the implementation of new or significantly improved production or delivery methods. This includes significant changes in techniques, equipment and/or software"* (Oslo Manual, 2005).

Within this discussion, it is likewise noteworthy to distinguish between evolutionary innovation and revolutionary innovation. Evolutionary innovation, alternatively called incremental, continuous or dynamic innovation, is "*the refinement, improvement, and*

exploitation of existing innovations" (Narayanan & O'Connor, 2010). It is defined as "*a series of small improvements to an existing product or product line that usually helps maintain or improve its competitive position over time*" (Business Dictionary). The aforementioned improvements of innovations are designed to improve the products and services, by enhancing their various attributes progressively and continuously. Additionally, evolutionary innovation does not provoke significant changes, but it creates limited and narrow improvements instead. Diversely, revolutionary innovation, also known as radical innovation, is characterized as an "*innovation with features offering dramatic improvements in performance or cost, which result in a transformation of existing markets or creation of new ones*" (Narayanan & O'Connor, 2010). In this matter, a revolutionary innovation is characterized by an absolute novelty that determines a breakup with respect to existing products or services, while offering new products or innovative methods to do things. They open new fields of research and determine the necessity to redefine the economic activities that they involve.

However, the museum context is largely characterized by evolutionary innovations. These are visible in the numerous museum's services, such as the installation of exhibitions or the various programs and activities promoted by museum's staff (Carmen & Jose, 2008). Alternatively, incremental innovations can be seen in the developments in the technologies used by visitors inside the museum, through the displays and tablets offered by the institution, but also through the online website that permits the user to come across the content of the museum through innovative ways.

For years, the notion of innovation has been primarily examined in the business field and has been a crucial subject in the literature of business studies. Indeed, innovation is an essential aspect of the success of a business, due to the continuous need to develop and create advanced products or services and the urge to come up with new ideas in the market. A primary source of information attempts to define innovation in a general way, as "*the development of new customer's value through solutions that*

meet new needs, inarticulate needs, or old customers and markets" (Patil & Athawale, 2014). Additionally, the NYC Economic Development Corporation provides a highly accurate definition of innovation, by stating that innovation is "T*he design, invention, development, and/or implementation of new or altered products, services, processes, systems, organizational structures, or business models for the purpose of creating new value for customers and financial returns for the firm*" (Strauss, 2013). Finally, the Conference Board of Canada describes innovation as "*the process through which economic and social value is extracted from knowledge through the generation, development, and implementation of ideas to produce new or improved strategies, capabilities, products, services, or processes*" (The Conference Board of Canada, 2014).

The aforementioned interpretations aimed at explaining the concept of innovation are all characterized by a particular core element: innovation retains an economic and business character. As a matter of fact, innovation is highly business oriented, since it regularly deals with factors connected to economic issues and, in many markets, is commonly associated with the desire of attaining profitable outcomes. Undoubtedly, museums reside within the area of creative industries, where innovation plays a truly important role in addressing all cultural institutions towards the attainment of their economic goals (Koellinger, 2008). However, this is not the only reason behind the ongoing innovation of museum institutions. As a matter of fact, the museums' world must confront itself with an increasing number of competitors, coming not only from the cultural heritage sector but mainly from the entertainment field (Muller et al., 2008). Nowadays, individuals are served with a huge variety of activities from which to choose in their leisure time and this definitely constitutes a challenge for museums to attract new types of public. The advent of innovation granted institutions with the opportunity to effectively compete with the numerous competitors, in order to maintain a constant level of sustainability in their daily operations. *"Sustainability is important to grant museums with the possibility to perform more independently, improving design and access to their exhibitions and its content"* (Camarero and Garrido, 2011, p.56).

Innovation can be applied in various frameworks and at different levels. At this moment, most museums all over the world attempted to conform to various tools necessary for museum's innovation, by adopting tablets or displays, for example. These technological tools are no longer innovative to the museum world, but they just meet basic expectations for cultural institutions (Camarero and Garrido, 2011). Therefore, a product or service that is considered innovative in one area, may have already been adopted by other countries and therefore not deemed as innovative by everyone. For this reason, it is of extreme relevance to identify innovations within each specific museum, since "*innovation does not actually have to be entirely new to the world; it has to be new to that organization"* (Richard Evans, 2014). In particular, it is important to observe each innovation about the museum's mission. As reported by the director of Digital and Emerging Media Department at Cooper Hewitt, Smithsonian Design Museum, Sebastian Chan: *"It [innovation] becomes the ability to find new ways of fulfilling that mission, and increasing its reach, scope, and scale. Or doing it more effectively to reach out to our targeted communities. I think the precursor to that is having a clarity around what you are there for. Having an app, [for example] is not the innovation; the innovation, perhaps, is that the app has enabled the mission to be delivered better, more efficiently, and reach other audiences. The app itself is not innovation"* (Chan, 2014).

As a matter of fact, the definition of the mission represents a fundamentally important aspect: it identifies the objectives and goals that the museum intends to achieve in the long run, by defining, in this way, the direction towards which the museum expects to proceed and the area in which to operate. Therefore, the starting point for the development of a museum resides in its mission, thereby requiring the museum to define, in a strict and clear way, its purpose and the social and cultural environment where to operate, in order to delineate the institution's reason for being.

3.2 Information and Communication Technologies (ICTs)

"Some of the drivers which commonly induce the development and implementation of innovations are the new information and communication technologies (ICT), new distribution systems (channels and delivery mechanisms), alterations in the driving regulatory environment (policies, globalization, IP issues), and the influence of consumers (which have become more selective, segmented, and active)" (Miles and Green, 2008, pp. 434).

These new information and communication technologies applied to the field of museums are under the duty to replace and improve the traditional means used by these cultural institutions to give the public a detailed understanding of the artworks (Solano, 2012). The solution that, until some years ago, had been adopted to guide people around the museum was mainly represented by panels for formal descriptive information, usually located aside of the work of art, or at the entrance of the museum. This means of communicating information generally interfered with the lecture of the artwork, by asking the viewer to continuously shift its attention from the reading of the written text to the observance of the piece of art.

Today, this difficulty has been readily overcome by way of the information and communication technologies. The introduction of these new technologies in the museum sector has been a long and heterogeneous innovation process. The users acquired technology through "learning by doing", which enabled the introduction of ICTs in disparate areas of the cultural institutions, mostly in the processes of communication and dissemination of information (Pilat, 2004). *"ICTs facilitate the communication process with their public and improve their experience by providing information, online presence, displays, and screens, up to better services such as new forms of ticket sales*" (Camarero and Garrido, 2011, p.42). They comprise numerous tools at the disposal of museums to orient and guide the public. Some of these tools

are already well-known and widely used inside museums, while others have found some adversities in affirming themselves in the museums' world.

The new technologies within museums enjoy a noteworthy importance both for the end user, that fulfills his needs through the museum experience, and for the museum itself, that can implement its service by encouraging a better valorization of its patrimony (Srinivasan et al., 2009). Most importantly, ICTs represent a beneficial instrument addressed towards museums' development, focused on promoting a dynamic interaction with its users, reaching a new target audience and becoming a tool of integration to the visitor's experience (Camarero and Garrido (2011). Likewise, the new technologies allow the institution to be closer to its customer: by enabling the personalization of the visit on the basis of individual needs and by promoting a direct involvement of the visitor through the use of interactive installations.
The aforementioned characteristics deriving from the application of ICTs in museums furtherly contribute to the formulation of the notion of "edutainment", a recent term which encompasses both the meaning of "education" and of "entertainment". It aims at defining a particular situation that promotes a feeling of amusement and pleasure in the visitor while offering grounds for learning and knowledge (Jegers & Wilberg, 2005).

It is possible to distinguish among three different areas in which the application of new technologies has revealed to be extremely important: technologies for the promotion of culture, technologies for the enjoyment on site and technologies for managerial and organizational activities.

3.2.1 Technologies for the promotion of culture

The first category refers to those technological instruments adopted by the museum in order to increase the visitor's engagement both prior to and after the experience inside the museum, strictly through the use of museum's website, social media and

other social networks. *"ICTs has changed the way in which people access information and communicate, allowing multi-directional stimulus through the massive use of technologies like the Internet and other digital technologies"* (San Martin, 2012).

Since its inception, the Internet has revolutionized the way through which people communicate, interact with each other and access the mass media. In the cultural field, the Internet had been a significant means of cultural communication and it is more and more frequently used as a tool for the promotion of the cultural and artistic patrimony (Solano, 2012). First and foremost, the Web permits the immediate and unlimited procurement of information regarding the objects and artifacts exposed in the museums' collections. Furthermore, the Internet employs pictures, instead of texts, as central means of its communication, and this characteristic is fundamental for the comprehension of an artwork, that derives primarily from a visual valuation. But one of the main characteristics of the Web lies in its capacity of reaching millions of people of all ages, from the youngest to the eldest groups of the population. This feature allows the museum to interact and discover its customer groups and its relative needs and preferences, in order to create a personalized and customized experience for all types of visitors.

In particular, the museum's website serves as a means to break down the geographical boundaries and permits to come in contact with artworks preserved in places distant from the one of the Web user, as well as to be always informed about the exhibitions and activities organized by the museum every day (Monaci, 2005). Today, by reason of the new media, the broadcast of information is not only more efficient and accelerated but also more targeted and personalized (Rio Castro, 2012). The user can use the museum's website to carry out, in a straightforward and immediate way, the booking and purchase of cultural services (entry tickets, guided tours, reservations), as well as have access to all the information connected to the cultural offer (opening and closing times, dates and prices).

To communicate with the users efficiently, the museum's website must be organized properly, since it reflects the first impression of the institution for people who have never been there (Soon Amit, 2011). It must represent the museum's identity, by highlighting its mission and strategy. The idea of a website should not be meant as simple informative brochures, limited to provide basic information on the museum and services. On the contrary, a museum's website should provide information about the activities organized by the institution, by updating them continuously in a way to make information evolve through time. It should furtherly give notice of the online networks on which the museum is registered, in order to additionally disseminate cultural contents and information. Moreover, the website must include a section where users can book tickets and guided tours prior to the visit, and offer the possibility to purchase on-line material of the museum and the bookshop (Monaci, 2005). It should be appropriate for museum's website to give the user the possibility to personalize his approach to the website, by making available the text in multiple languages and being ready to satisfy the needs of diversified user targets.

The development of advanced communication technology finds its main application in the use of social networks, which definitely revolutionized the field of information and communication for their effective and ground-breaking nature. Social networks contributed to the creation of a vast global community and to the transformation of the Web into an informative and communicative platform with a strong economic character based on the socio-economic model of word of mouth 2.0 (Trebastoni, 2012).

Social media networks, such as Facebook, Twitter or Instagram, are online platforms that serve essentially the function of providing a new space to promote and disseminate information in reference, for instance, to events and activities organized by the museum, that, thanks to the global spread of the Internet, can reach millions of people from every part of the world at the push of a button (Potts et al., 2008). By opening a public profile on these social networks, museums obtain an extraordinary

visibility at no cost, by proposing their activities to a public, mostly young people, that in most cases, would not have visited the institution. In turn, users of the social media can share museums' pictures and posts with their friends, families, and strangers from every part of the world, contributing to increasing the popularity of the museums (San Martin, 2012).

In addition, it has been in particular the use of *tagging* that revolutionized the visibility of a museum institution to the eyes of the external world. Tagging refers to the technique of assigning a keyword (i.e. tag) to a document or file (text, image, or video) on the Internet through which it can be cataloged and easily accessed. By promoting the direct participation of users, this technique brings about further innovative ways of bottom-up organization. In fact, tags fully embody the notion of user-generated content, derived from the need to classify and organize information, due to the rapid spread of new contents on the Web (Huvila-Johannesson, 2011).

The widespread use of social networks and tagging offered museums the possibility to foster one of the most innovative museum-user forms of communication, that is the feedback mechanism, through which the museum encourages its visitors to express their opinions and feelings after their visit to the museum (Kvan-Affleck, 2007). By means of the feedback mechanism, which is based on a participatory and experiential approach, institutions strengthen their relationship with everyday visitors, raising in them an emotional involvement after the museum experience. In particular, nowadays, it has become crucial for all cultural institutions to promote the production of cultural contents post-visit, especially by means of the current social network platforms and geo-social tagging. Moreover, the real-time share of information has a strong communicative potential, facilitating new forms of digital interaction between visitors and institutions (Ciappei-Surchi, 2010).

In this way, museums are able to appear to millions of individuals all around the globe and communicate with their public and the broad external environment. Users of

these social platforms can additionally choose to express their preferences by creating their own customized experience to the museum, through posts and comments, and share each moment of their visit (Celaya, 2012). The connection with the main social networks furtherly promotes the communication among different users, thereby stimulating the exchange of opinions, in order to deeply involve the public and reach new target segments. Therefore, with the use of online social platforms, museums can enhance and disseminate their cultural patrimony in a modern and up-to-date manner, in a way to make new generations understand the cultural value of museums.

The aforementioned tools demonstrate that nowadays the application of the "Web 2.0" can no longer be ignored or avoided. It represents a particularly efficient means for museums that intend to reach vast segments of the public, by using an informal communication, suitable for a straightforward interaction, mostly with young people. Therefore, the on-site experience should be accompanied by a successful online experience, always conform to a visitor-centered strategy, able to inform and educate users at the same time.

3.2.2 Technologies for the enjoyment on-site

The second category of technologies refers to the tools, implemented by the museum institution on site, both at an informative and expositive level, to improve the installation of the exhibition and the exposal of works of art. This area is above all the most relevant in which technologies enjoy a notably impressive and ample application.

This type of technologies allows the institution to be closer to its visitors, by personalizing the visit to the museum and making it more interactive (Solano, 2012). Additionally, technologies for the enjoyment on-site create services able to transform the site into a place of edutainment, rather than education only. Likewise, they favor

the enhancement and diffusion of the artworks in a modern way, permitting to younger generations to access and understand the value of the cultural offer.

This category of ICTs guides the visitors towards two different experiential levels. On the one hand, information and communication technologies enrich the visitors' experience, by providing the user with supplementary contents both prior to, during and after the visit to the museum. On the other hand, the ICTs can represent the artwork itself, in a completely virtual and revolutionary way. From these features, it is, therefore, possible to distinguish between technologies for the enjoyment on-site and technologies for the enjoyment off-site. In the following discussion, only the first typology of technological devices will be analyzed, since the technologies that provide an experience off-site are the same ones used for the promotion, that has been already mentioned in the first category.

At the informative level, the new technologies for the enjoyment on site provide the public with detailed additional information about the ongoing exhibitions, the description of the content and the story of the museum, in a way to contextualize the museum's content and increment visitor's learning (Known et al., 2003). To this extent, institutions have adopted audio guides and smart guides, that is, wireless and mobile devices that to enable the visitor to walk through the spaces while being assisted by a vocal tool (Sayre and Wetterlund, 2008). The descriptions and information deriving from audio guides can be selected from the user or activated automatically in the vicinity of an artwork. *"Electronic museum guides have evolved from inflexible and isolating single user tools into adaptive presentation devices that can take into account social aspects of the visit as well as the visitor's personal preferences and physical path"* (Ciolfi et al., 2008, p.354).

In recent times, following the general tendency of powerfully customizable technologies, new devices have been developed, specifically PDAs (Personal Digital Assistants) that offer an interactive audio-visual tour. In other words, PDAs are

portable computers that combine the potentials of an audio-guide with the ones of a computer (Sayre and Wetterlund, 2008). Visitors, through the use of PDAs, can listen to voices and sounds, read textual information and visualize pictures and videos. These technologies furtherly allow the user to save important contents and advise him on the best paths to follow inside the museum. These actions ultimately allow the person to have a personalized path inside the museum.

Similarly, information in museums can be provided through multimedia kiosks and tablets, located in precise areas of the museum where people can acquire knowledge while enjoying the artworks (Monaco, 2008). During the enjoyment of the museum's experience, the technological devices guide the visitor towards different levels of experience, by enriching the overall visit through supplementary contents. This type of digital support additionally allows the user, not only to access more information about museum's collection but also to produce personal contents. The user can select the language to use and the timing and accuracy of the consultation, thereby revealing to be extremely pliable and manageable tools.
As an alternative, in the last years, museums have started promoting the policy of "Bring Your Own Device" (BYOD). In other words, it invites visitors to use their mobile phones or tablets inside the museum to benefit from a number of museum's services, as quick response codes (QR) or applications that provide further information to the visit in a dynamic and interactive way and connects directly the user to the museum's website (Solano, 2012).

In fact, in recent years, the rapid spread of iPods, iPhones, and iPads definitely substituted the use of traditional audio guides, based on a pre-recorded vocal information. This change has revolutionized the mobile cultural communication completely. For instance, the iPod has evolved throughout the years, starting as a portable media player and becoming one of the main devices for the fruition of mobile culture. Due to its increasing multimedia functions, it found maximum application within museums institutions to visit the cultural site.

Also, the iPhone and iPad have evolved over the years since their original version. These devices are both controlled by the user through a multi-touch screen with a virtual keyboard and a motion sensor. They are largely adopted in museums, in that they offer the possibility to access a virtual tour of the museum from Internet websites. The evolution of these portable devices, and in particular of smartphones, permitted to create personalized and customized virtual tours of the institution that largely fostered the communication and valorization of patrimony.
The use of these mobile portable devices constitutes a watershed in the communication in general, and, specifically in the cultural one:

"[...] changes the occasional nature of the museum visit and transforms the museum information and knowledge into a portable commodity, available at any time and space. [...] mobile media can be used not only to bring museums into the everyday but also to create a gateway for the everyday knowledge to enter museums". (Arvanitis 2005, p. 251)

All the aforementioned portable devices have rapidly transformed themselves in the technologies most used inside museums for cultural communication. These devices, due to their improved tasks of multimedia and connectivity, guide the visitor through the cultural area without any geographical boundary or scheduled path. In this way, visitors become wireless visitors.

On the other hand, there are expositive technologies that, instead, are actually integrated as part of the overall exhibition, differently from informative technologies that just provide support to the museum's exhibition. They offer the opportunity to enhance the educational and communicative character of the museum's content while promoting interaction between the museum and its audience. Yet, they are divided into two categories, according to the experience derived from it: immersive and non-immersive (San Martin, 2012). The new immersive expositive technologies allow users to experience new visit paths within the museum's spaces, by truly experiencing at

first hand the cultural offer. In fact, mainly thanks to the new immersive technologies, such as augmented reality, 3D, and holography visitors feel as being transported in another context, surrounded by dynamic images, illuminations, and sounds.

According to the 1994 definition of a group of scholars of the Industrial Engineering Department of the University of Toronto "*AR can be regarded in terms of a continuum relating purely virtual environments to purely real environments"* (Milgram *et al.,* 1994, p. 282).

Augmented reality is a digital technology characterized by the overlapping of physical real elements and computer-generated images able to 'augment' reality, that is, capable to provide an enhanced version of reality by way of specific vision devices, from monitors, glasses and virtual binoculars, to the most recent personal devices such as PDAs and smartphones. Differently from virtual reality, in which the viewer is completely transferred into a new virtual location, augmented reality exploits the environment in which the person is located and manipulates it by superimposing virtual images. *"Its objective is to improve people's interaction with the real world by providing them with information that can- not be perceived directly by their senses"* (Pujol 2004, p. 3). In this way, the viewer participates in an immersive experience both at a real and virtual level, through the addition of computer graphics, illustrations, and sounds. However, museums have firmly adopted also non-immersive expositive technologies, for example, multi-touch screens and interactive devices, that similarly promote an interplay with the user through visual activities, without bringing the viewer into a new reality (Michael et al., 2010).

Today, museums often adopt multimedia laboratories, that are actual spaces inside the institution, equipped with portable computers or art-projection video systems. The objective of these laboratories is to educate and provide additional information to the visitor by placing him at the center of an immersive experience, both at the physical and mental level. The more innovative expositive technologies involve installations in which there is an incremented interaction between the visitor and the surrounding

space. The main character is the individual that experiences all the five senses by interacting with pictures in movement, different sounds, lighting effects, and objects (Monaco, 2008).

3.2.3. Technologies for managerial and organizational activities

One of the first applications of ICTs in museums was carried out on technologies for managerial and organizational activities. Recording, storing and preserving information has always been a crucial issue for cultural institutions. Therefore, the urge to promote more efficiency, quality and speed of information resulted in the adoption of new technological devices that improved the online consultation of the institution's archives.

"One of the reasons why storage has become so central an issue is because the scope of digital cultural heritage has continued to expand. In the 1970s, initial efforts were on remote access to references to cultural objects largely through library and museum catalogs. During the 1980s and 1990s, the quest expanded to include images of those contents, i.e. digital versions of paintings, full texts of manuscripts and books, monuments, sites and in some cases even whole cities. Even so, the emphasis remained focused on tangible heritage. During the 1990s, the efforts of Unesco drew attention to the importance of intangible heritage in the form of oral traditions, language, music, dance, and customs" (Veltman, 2005, p. 7).

More precisely, this last category of information and communication technologies is related to the technologies for regulatory issues and management, which are divided into two different typologies, according to the function they serve. These new technologies offer museums and other institutions to carry out their internal operating activities in a more efficient way (Monaco, 2008).

The internal network system (Intranet) describes all the new technologies used by people working for the museum. These technologies offer businesses the possibility to carry out their internal managerial activities more efficiently and to promote a successful communication among the internal departments (Anderson, 1999). In fact, ICTs are able to affect the internal structure and processes of a business directly, thereby revealing to be not only efficient in the communication with the museum's public, but also profitable at the organizational level, with visible effects both internally to the business and externally in the marketplace.

The other typology of ICTs included in this category refers to restoration and preservation technologies, where digital and laser technologies are of fundamental importance. Digitization gave museums the opportunity to recreate artworks and objects in a digital version (Li et al., 2010). For this reason, museums can now access and manage their collections through digital means, by collecting and storing information relative to the objects in completely innovative ways. Likewise, laser technologies are also extensively adopted in museums for the conservation of their collections. These technologies prevent the deterioration of antiquities and attempt to maintain the artwork in its original form (Tornari et al., 2000).

4. Innovation in Museums: The case of Italy

While the international cultural scene is forcefully evolving to meet the new cultural technological standards, the situation in Italy is proceeding at a slow pace (Solima, 2012). For years Italy has positioned itself behind the other European countries in the adoption of innovative tools and devices for the museums' sector. Until recently, Italian museums inadequately enhanced the value of cultural institutions and their impressive vast patrimony. This was not only due to the possible infrastructure problems of the surrounding area, linked for the most part to the lack of efficiency in

Italian public services and transportation, but also and above all, to the internal weaknesses of the museums themselves.

Albeit belatedly, Italian cultural institutions have now understood the imminent need for modernization and the urge for a technologic renewal of services and enrichment of their offer. Therefore, these institutions are gradually transforming themselves into cultural enterprises, by modifying their own identity and evolving into a successful blend of the cultural and the business sector (Bollo, 2012*).* Investing in technological innovation can, therefore, represent a synonym for investing in the cultural patrimony and should be seen as an opportunity for the development of our country.

In this concern, it is noteworthy to highlight the importance of digital communication and ICTs as fundamental means for the promotion of the cultural patrimony. Technology, in the form of digitalization of the patrimony, allows undertaking innovative projects that combine history, culture, and tradition, making a number of materials accessible to a vast public. *"Challenged by the establishment of a utilitarian framework that has substituted merit good policies, and by the new paradigm of instrumentalism, demanding for results-based accountability to provide evidence of efficient and effective use of public funds, museums are striving to find a balance between market pressures, resources competition and the defense of the intrinsic cultural value of heritage institutions"* (Ferraro 2011, pp. 134-135).

It would be impossible now to live at the margin of this highly networked society, that continuously communicates, interacts and connects through the medium of the Web. Already in 2001, M. Castells warned about the impossibility for institutions to ignore the innovation process, since it would represent one of the most damaging forms of exclusion from a country's economy and culture (Castells, 2001). Nowadays, Italian museums are increasingly aware of the forthcoming necessities to provide a greater and improved availability of services to their public. This awareness makes it possible

for Italian museums to fulfill their institutional objectives, that relies on promoting a high standard cultural offer and economic sustainability.

In fact, Italian cultural institutions are now facing a dual challenge: it is no longer sufficient to attract new and current visitors, but it is absolutely necessary for museums to find new ways to communicate their cultural heritage to them, by going closer to the necessities of both citizens and tourists. More and more institutions in Italy are taking up the challenge of transforming themselves to become increasingly efficient and to respond to the preferences of both young and aged audiences. Indeed, digital innovation, that has determined a radical change on the market in the last years, could now represent a fundamental factor of transformation for the Italian cultural sector. This inevitable adoption of innovation contributes to the creation of a platform for dialogue between business and culture, pushing museums to adopt new standards to reshape and enhance their identity (Spallazzo, 2009).

The first technological innovations to be adopted by cultural institutions in Italy date back to the early 70's with the arrival of the interactive platforms hands-on. By means of the interaction provided by these platforms, that was essentially mechanized, the museum started to have the possibility to interact directly with its visitors, by supplying more information and contents (Cataldo, 2007). From that moment, the ultimate objective of museums started being the one of identifying the set of actions necessary to undertake in order to fully exploit the potential of the institution, to respond to the diversified customers' needs and increase their level of attractiveness and, in turn, the number of visitors. Therefore, by the end of the 80's the technologies for cultural information evolved and the first hypertext and interactive simulations appeared (Merzagora, 2007). In fact, Internet and the new technologies fostered the innovation within museums, mainly interactive technologies, initially used to involve the user through a visual transmission of information.

4.2 Overview of Italian Museums

As revealed by Istat in a statistical report of 2011, almost five thousand museums, archaeological sites, monuments, and similar cultural institutions are present on the territory of Italy. In particular, museum institutions extend over all the Italian peninsula from North to South, respectively: 45.9% of museums are located in the North of Italy, 29.0% in the central regions and the remaining 25.1% develops in Southern Italy and in the islands. Among Italian regions, the ones with the highest number of cultural institutions are Tuscany (550), Emilia-Romagna (440) and Piedmont (397). On the contrary, the regions with the lowest number of cultural institutions are Valle d'Aosta (74), Basilicata (53) and Molise (34).

Our country encompasses a plentiful and valuable cultural heritage, as shown by the diversified nature of the antiquities, artworks, and objects exposed. However, what seems to have a cultural value, are not only museums' collections, but also the structure in which they are located. As a matter of fact, almost 70% of Italian museums reside in a highly prestigious historical or artistic building, which furtherly attracts numerous visitors. For over half of museums (51.8%), the main factor of visitors' attractiveness is represented by its permanent collections. In 30.2% of museums, collections and building are equally valued in attracting the public, while in 14.5% of cases, it is only the building that pushes visitors to enter the museums.

Although the Italian patrimony is vast and valuable, it is not always adequately managed and enhanced. Nowadays, many museums are opening their boundaries to digital innovation, but still few among them are truly able to offer interactive installments, technological devices, and online services.

In 2016, the "Osservatorio Innovazione Digitale dei Beni e Attività Culturali" (OBAC) developed an investigation on a sample of 476 Italian museums, equal 10% of the museums opened to the public in 2015, focusing on the development of digital

innovation within Italian museums and their presence online. As a result of the research, it has been found out that 52% of Italian museums are deemed as social. However, their respective digital services, both online and onsite, are limited. These conclusions had already been developed in previous years by Istat, which came up with a ranking of the most used digital services by museums in 2015. Istat's ranking illustrates that 57% of Italian museums own a website, 41% are registered on a social network, even though only 13% is registered on all the main ones (Facebook, Twitter, Instagram) and 25% relies on the communication through the newsletter.

According to the OBAC's investigation, there is still much left to do. Starting right from the most widely used service among Italian museums, that is the website, many institutions have failed to realize its full potential. Although a considerable percentage, equal to 57% of Italian museums, possesses it, the communication through the Web still appears to be characterized by a static behavior. Specifically, the website's initial home page does not appear to be adequately oriented towards the user and its needs, therefore it is not always straightforward for users to access it. Almost all Italian museums' websites (78%) have a section entirely dedicated to information and contacts, but the percentage decreases dramatically if we consider the website section "Where We Are" (available in only 42% of cases) or multimedia galleries (only 36% of websites possesses one). In addition, the majority of homepages of Italian museums, reveal to be confusing for many visitors. In particular, foreign visitors do not always have the opportunity to read the website's content in their native language (the English version of the website is available only in 54% of museums), or the website has not been constructed to address particular customer segments (families, groups, disabled people, etc.). In point of fact, only 20% of museums include sections for these specific purposes. Percentages become even lower when dealing with the online purchasing of museum's merchandise (possible only in 6% of the cases) or making donations and participating in crowdfunding campaigns.

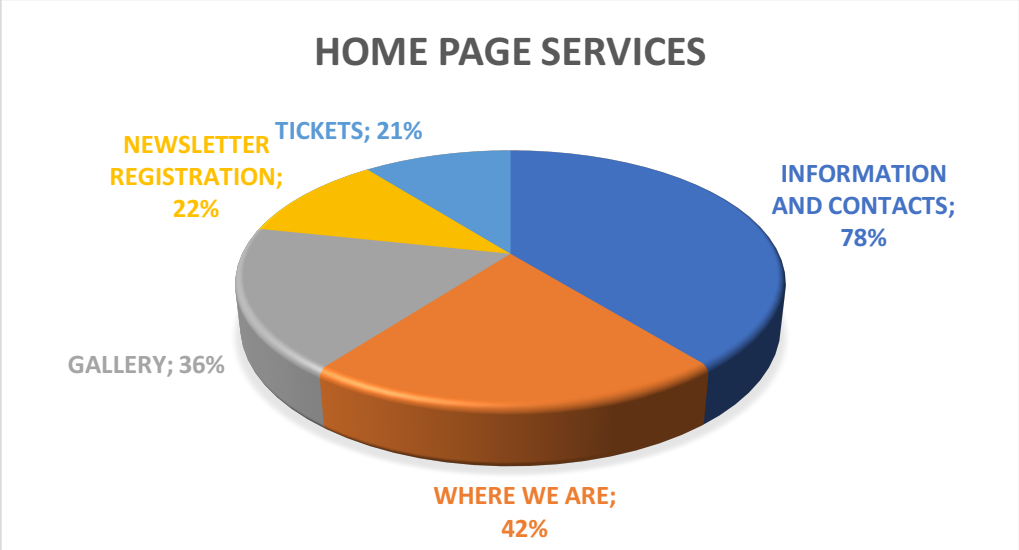

Fig. 4.1: Services on websites' home page.

Source: Adapted from Osservatorio Innovazione Digitale

Among the most used digital services by Italian museums, the social networks take the second place. In most cases, museums use their social accounts to provide visitors with numerous technical information (opening and closing hours, tickets, and special events). However, the most successful contents are those regarding the museum's history, its collections and people related to it. According to the investigation carried out by the Osservatorio Innovazione Digitale, 41% of Italian museums own at least a social account. Although, the percentage decreases to 13% if we consider the museums registered on the three main social platforms (Facebook, Twitter, and Instagram). In addition, 10% of museums that still do not possess an official website, seem to have begun from Facebook their digital path. The investigation furtherly shows that Instagram, despite its visual nature, suitable for documenting the museum's experience, is not widely chosen by Italian museums: surprisingly only 15% owns an account.

From this research, it is fair to deduce that Italian museums have just started to adopt a new mindset, oriented towards technological innovation. Although this process started developing only in recent years, it is satisfying to see that customers' satisfaction is high relative to the overall evaluation of Italian museums and to their

experience. Indeed, 62% of Italian cultural institutions are on TripAdvisor, a leading social platform reporting reviews, and feedback from users, which showed that 67% of Italian museums received a positive evaluation from visitors. What most satisfies Italian museums' visitors is space management (the halls, the paths, and the installations contributed to an 84% of positive evaluations) and the overall experience (positively assessed by 81% of users). Less successful were the activities and events organized within the museum (only 69% received a positive feedback) as well as supplementary services, such as Wi-Fi connection, guides, and bookshops (satisfactory only for 65% of users). Among the elements that contribute to the museum's experience, both location and ticket price were positively evaluated by visitors, respectively in 88% and 73% of the cases.

4.3 Case Studies

Within the Italian museum's landscape, it is noteworthy to analyze the impact of innovation and technology within two specific Italian museums, both located in the capital city of Rome, that is, Ara Pacis Museum and Galleria Nazionale d'Arte Moderna (GNAM). These case studies are aimed at illustrating the reasons behind innovation, and how the innovation process is visible within the two selected museums. Furthermore, this section delineates innovation's effect on customer's satisfaction and customer's relationships, in order to acquire a true understanding of how museums work in the digital era.

4.3.1 Case Study I: Ara Pacis Museum

Ara Pacis Museum is part of Sistema dei Musei in Comune of Rome. It hosts the altar Ara Pacis Augustae, commissioned by Augustus in 9 BC in honor of Pax, the Roman goddess of Peace. During the fascist era, the architect Vittorio Ballio Morpurgo realized

an external pavilion to surround the altar, in order to protect this ancient monument. However, the architectural construction soon revealed to be unstable from a structural point of view, and it would have been risky for the preservation of the altar. Therefore, in 1970, the increasing concerns towards the preservation of the Ara Pacis Augustae led to an intervention of restoration on both the pavilion and the monument, that was repeated again in the '80s. However, the restoration was not enough and it soon became clear that the altar required a new, modernized and improved protective measure. In 1996, this urge was translated into the creation of a new venue for the museum, realized by the architect Richard Meier, who was interested in the creation of a structure able to preserve and enhance the value of the Ara Pacis Augustae.
The new Museum of Ara Pacis was opened to the public in 2016 and it represents one of the few cases where archaeology meets contemporary architecture, but mostly it serves as a tool of protection for the monument and enhancement of the museum path, which is set up around the ever-changing altar.

Since its opening, the museum always attempted to organize different innovative cultural events. Already in 2008, the Ara Pacis Museum offered a guided tour of the museum, "I Colori dell'Ara Pacis", where visitors could admire the monument through a reconstruction of its original colors, by means of a sophisticated lighting system. In 2010, the projection technique was updated and renewed thanks to the new digital projectors that enable the museum to modify the profile and the colors in real time.

Nevertheless, the key turning point in the history of Ara Pacis Museum was the year 2016. In fact, in October 2016, the museum launched a new project "L'Ara Com'era". The project is organized by Zètema Progetto Culturale and overseen by ETT SpA, while it is promoted by Roma Capitale, Assessorato alla Crescita Culturale – Sovraintendenza Capitolina ai Beni Culturali, which is also in charge of coordination and scientific content. In occasion of this new exhibition "L'Ara Com'era", the museum evolved its traditional visit into a multimedia path based on the use of computer graphics, virtual and augmented reality. Here technology and history blend into a multisensorial

immersive visit of Ara Pacis, where characters, animals, and gods are animated in 3D to illustrate the origins of Emperor Augustus's family and the city of Rome.

Already in the first three months, the great success of the exhibition was clear: 11 thousand visitors, citizens, and tourists, came to the museum to experience the first event of valorization in augmented and virtual reality on one of the most important masterpieces of Roman art. The high turnout of the exhibition is also due to its high accessibility since the visit is supplied in five different languages: Italian, English, French, Spanish, and German. The exhibition takes place on Friday and Saturday evening, where it can host up to 400 visitors, that are divided into small groups, for a duration of 45 minutes each.

The project of "L'Ara Com'era" provides for a combination of hardware and software devices, that together create an experiential path that leads the visitor to the discovery of the Ara Pacis. Thus, different types of technologies contribute to a ground-breaking innovative experience of augmented and virtual reality. At the entrance of the museum, visitors are supplied with specific AR visors (Samsung Gear VR) equipped with particular cameras, that allow the users to live a first-hand interactive experience of the museum. The Samsung Gear VR visor, combined with the smartphone Samsung S7 is a solution designed for the fruition of both virtual and augmented reality, by showing users the video recorded on the smartphone through their headset. At present, this technology is the only one able to immerse the visitors in a 360° space where both virtual and real elements blend into the field of vision of the viewer.

The overall visit is divided into nine points of interest (POI). The true novelty of this project resides in the first two point of interests, POI 1 and POI 2, realized with the combination of cinematographic scenes, virtual reality, and immersive technologies. The visitors are immersed in a virtual scenario, in which they can experience an overhead view of Campo Marzio, the Ara Pacis in its original colors and assist at the

virtual reconstruction of a Roman sacrifice. After this experience of virtual reality, the visitor is invited to move across the space surrounding the Ara Pacis to live an experience in augmented reality that encompasses the following points of interests (POI 3-9). In this second part of the exhibition, the AR application recognizes the three-dimensionality of bas-reliefs and sculptures on the Ara Pacis and it tracks them in real time. In fact, for the realization of the project, ETT employed a 3D tracking system for the museum experience in augmented reality, that is based on one of the most advanced algorithms for the computer vision. In this way, virtual contents overlap with existing sculptural elements.

4.3.2 Case Study II: Galleria Nazionale d'Arte Moderna e Contemporanea

The Galleria Nazionale d'Arte Moderna e Contemporanea of Rome was established in 1883, with the aim of representing the national art of the newly unified State. It was initially located at the Palazzo Delle Esposizioni in Rome until in 1911 it was definitely moved to Padiglione Delle Belle Arti, built by Cesare Bazzani for the International Exhibition. This monumental building is able to catch the viewer's attention prior to entering the museum, with its impressive staircase and the four sculptures in white marble placed above the building. Entering the museum, the highly illuminated and ample spaces serve as a frame to the museum's collection of over 24.000 artworks. Among them, 800 are exhibited in the halls of the museum, and cover a time period from the early 1800s, to the end of the XX century. The works of the permanent collection follow a chronological and thematic order and are located in three different parts of the building. Besides the permanent collection, the museum furtherly hosts around twelve temporary exhibitions each year. Moreover, the Galleria Nazionale has been the first museum to introduce an educational section in 1946. Currently, the education services coordinate the numerous activities within the museum, that are connected both to the permanent collection and to the temporary exhibitions. The main objective is the one of proving all citizens the enjoyment of the cultural

patrimony, in the hope that the direct interaction with the artworks and the museum will stimulate visitors' interest and enhance public knowledge.

Galleria Nazionale began a new chapter of its history under the direction of Cristiana Collu in 2015. The museum placed the digital among its priorities, tracing a digital path during the month of July 2016, with the presentation of the new website lagallerianazionale.com and the consolidation of the participants on the main social networks. Recently a new App has been realized for the museum, that granted a free Wi-Fi connection in all the museum's spaces opened to the public. In addition, the museum experimented new digital strategies, in relation to communication, mail marketing, and online advertising. Moreover, in autumn 2017, the museum began working on the digitalization of the archives, that allowed for the consultation of Galleria Nazionale's vast patrimony, with the consequent online publication of all its collections, uploaded with both pictures and a descriptive sheet.

Undoubtedly, visitors' participation, online and offline, is the major transformation deriving from the introduction of digital innovation at the Galleria Nazionale. This had been particularly evident during the "Museum Beauty Contest", a project by the Spanish artist Paco Cao held at Galleria Nazionale from October 2016 to March 2017: a true beauty contest on the portraits of the museum's collection. The public actively participated to the preselection phase of the artworks with more than 100.000 votes, through the online section of the website dedicated to this project, and consequently to the final phase, to announce the winners Mister and Miss Galleria Nazionale 2017, with over 15.000 votes expressed.

Therefore, the introduction of innovation has considerably increased the participation and involvement of the audience. Most importantly, the partnerships and the adoption of the program "Google Arts & Culture" additionally allowed to lower the costs of research and development relative to the digitalization and the online sharing of museum's collections, and of the most innovative and experimental projects. In this

way, costs have been limited to the sole management and implementation of the website and to the communication and promotion of the activities. The benefits are relative to the positioning of the Galleria Nazionale at the international level, to the conversion of visits on the web, and to the sale of tickets online.

Referring to Galleria Nazionale's relation with other museums in the use of digital innovations, the museum is always aware of what happens around it. For the Galleria Nazionale, this means heading in a direction and, at the same time, keeping always an eye to the external world, by following the trends and developing "open" formats and projects to share with the museums from all over the globe. As for the case of #SCROLLTHEEXHIBITION, the format to share the exhibitions online on the social networks launched in March 2017 and introduced by other museums and accounts. Another way in which the museum relates to other similar institutions resides in the communication strategy of lending artworks for research and education. This is characterized by a continuous interaction between worldwide museums for a mutual promotion of exhibitions, events, and projects connected to the collection of the Galleria Nazionale.

After the online sharing of the museum's collections and the opening of the digital archive, the Galleria Nazionale will continue its digital path with the launch of a new online platform that will allow the museum to dedicate to each project a digital focus open to experimentation. Furtherly, the introduction of new social channels, such as WhatsApp and Spotify, will foster communication with the public in a more direct and immediate way and will offer shared playlists of songs on the occasion of events, laboratories and guided tours.

5. Conclusion

The museum today is required to preside over the production of contents, by exploiting the infinite potentials of the digital and demonstrate their ability in understanding the needs of their public. Most importantly, the term “digital” should not be perceived simply as referring to the area of digital technologies, rather it must be understood in a broader meaning, which implies the fulfillment of the museum's mission and the ways through which it is possible to attain it. People working inside the museum need to fully understand where they are going and what to expect from the museum in the forthcoming years.

Museums must recognize their own identity, by specifying who they are, what is their role and mostly what do they have with respect to the other museums. Only in this way, they will understand how to use in an efficient way the digital tools to communicate to society their own contents. Digital technologies should not be seen as a goal to reach, rather as a means through which museums can revolutionize their existence, becoming relevant places for the society for the everyday life.

In this framework, the new technologies emerge as a principal means of communication. Their use enables a close relationship with the spectator, who starts to interact with the museum’s environment and foster his personal knowledge. Therefore, technology reveals to be a key feature for the cultural institution, which is now able to pull down the barriers with the vast public. Not only the digital revolution promotes a greater number of visits to the museum, but it also enhances the fruition of culture through personalized and customized experiences.

As museums will continue to keep themselves updated with the advancements in technology, there will be a time in which education, interaction, and participation will be combined together in new innovative ways. We are undoubtedly living now in a time of museum’s revolution, that apart from a greater exploitation of the cultural

patrimony is giving rise to an increasingly dynamic user-generated process. This ultimately promotes customer's participation, public involvement, and places the user in the role of the main protagonist of the museum's scene.

Furthermore, the growing success of smartphones, wireless technology, and social networks, will furtherly lead museums to question their offer and their role. As we approach a new technological view of the world, how can museums continue to improve and enhance their exhibitions and programs in order to engage the visitor into a more immersive experience?

"Cultural institutions and museums are here to stay, and they will continue to inspire people by giving them an opportunity for shared learning and the experience of the real thing. But despite the challenges of implementation, digital technology allows us to do what we have never done before: to reach the millions who do not or cannot visit in person; to help all the people, not just a few, understand our culture, the cultures of others, and life in all its dimensions". (G. Wayne Clough, 2012, p.6).

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