TECHNOLOGICAL INNOVATIONS IN MUSEUMS AS A SOURCE OF COMPETITIVE ADVANTAGE

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ABSTRACT: In an economic environment characterised by permanent and rapid technological evolution, successful organisations are the ones that are able to adapt their processes and activities to change. This article starts from the assumption that museums can use various modern technologies in order to raise their market competitiveness. Technological innovation allows museums to become more attractive and fulfil their functions better while also using their resources more efficiently. The first part of this paper presents a series of technological innovations specific to museums and the way in which these innovations can lead to an increased museum performance. The study case in the second part of the paper presents the results of an analysis of the technologies used by the museums in Baia Mare in comparison with other Romanian museums. The improvement solutions proposed based on this analysis can prove useful not just for the museums studied, but also for other museums in similar situations. Another, indirect, purpose of this research is to help raise the tourist attractiveness of Baia Mare by bettering the competitiveness of its museums.

KEYWORDS: innovation, technology, museums, competitive advantage, strategy, development

1. INTRODUCTION

The impact of new technologies on museums is high and can be studied from a number of standpoints. The research carried out so far has proved that technological as well as organisational innovations play an important part in achieving performance in cultural organisations [1]. Through technology, museums can manage their collections better, offer unforgettable experiences to their visitors and exceed their physical limits by using online distribution and communication channels [2]. Also, through technological innovations museums achieve a competitive advantage by providing better visiting experiences. This results into a higher number of visitors that are attracted and an increase in museums' own income. Therefore, one of the important reasons for which museums innovate is that they are trying to increase the income they attract directly from their beneficiaries to compensate for the decline of public funding allocations [3].

Although in both the private and the public sectors innovation strategies aim at increasing the number of clients/beneficiaries, the effects of the application of such strategies in the two sectors are slightly different. Whereas trading companies innovate in order to acquire an advantage over their competitors, in the museum sector the same strategies have in view to increase the attractiveness of a museum, but it is little probable that they can result in a decrease of visitors in another museum. Given that most museums are considered not interesting enough by a large number of people, a museum which uses technological innovations to differentiate itself from other museums will attract a larger number of visitors, without this leading to smaller numbers of visitors to other museums. This happens as a result of the fact that Romanian museums have quite low competitiveness and do not succeed, through the services they offer, to cover the entire potential market. More exactly, in Romania there is a large number of museum non-visitors. For example, in the year 2014, 70% of the Romanians did not visit one single heritage site outside their home towns [4].

On the other hand, technology can represent a threat to more conservative museums which resist change. Due to technology, the Internet and the higher access to information and products from afar, many museum experts are concerned that in the future the public might prefer digital images and virtual experiences to static works of art [5].

This duality of technology, which can give rise to both advantages and disadvantages, can lead to many museums not taking any action towards technological innovation. Marchetti & Valente [6] assert that museums do not adopt new technology on a larger scale because they do not understand clearly its role in the innovation process. According to these authors, many museums prefer to keep their old low-tech settings which are perceived to be (nearly) as captivating/engaging, but less disturbing, cheaper and easier to maintain.

Taking into account these considerations, the first part of our study presents a synthesis of the technological innovations which can be used by museums. The research in the second part analyses the degree to which new technologies are used by the museums in Baia Mare in comparison with the international trends and offers a series of recommendations for the future technological development of these museums with a view to increasing their competitiveness.

2. THE USE OF TECHNOLOGY BY MUSEUMS

The expression "business innovativity" refers to the extent to which a company is able to create new products and services by using knowledge gathered from its consumers, competitors and technology [3]. Museum innovation was defined by Eid [7] as the creation of novel or improved products, processes or business models through which museums can fulfil their social and cultural mission efficiently. Vicente et al. [8] group museum innovation into three categories: *technological innovation in management, technological innovation in visitor experience and organisational innovation*.

The technological innovation consists of adopting new technologies to be applied to products, services or production processes [3]. According to Black & Skinner [9] the technological innovation is the means through which museums can offer people an active visiting experience. People who visit museums are in search of a pleasant social outing, but also wish to discover new things and broaden their horizons [9]. For this reason, learning must be embedded in a social activity which combines relaxation, conversation, social interaction, participation and collaboration. Innovating approaches and the development of a participating content with the help of modern technology are ways through which museums can rise to this standard. Below are presented the chief fields in which museums can use modern technologies successfully so as to become more competitive.

2.1 Technological innovations in collection management

Since the function of museums is the record keeping and preservation of heritage, any software which helps organise and manage a digital data base including all the items held by a museum is particularly useful. Electronic data bases facilitate the management, collection and storing of information and based on them can be generated reports on the movement of items within and outside the museum, the number of exhibitions for each item and the restoration procedures to which each item was subjected. They also help systematise and display the information about the museum's visitors, income and exhibited collections. Such information, in its turn, simplifies the experts' task of conducting research on the museum's collections [10].

In Romania the National Heritage Institute puts at the disposal of museums a programme entitled DOCPAT. After the digitalisation of their patrimonies, museums can use the Internet in order to facilitate the access of the public to images and information about their collections. However, many museums are reluctant to offer the public access to their collections for two reasons: the access is unlimited and free, and the museum is unable to control the way in which the images of the items in its patrimony will be used subsequently. A possible solution to this problem might be for museums to offer access to their data base based on online registration and subscription. In other words, by using modern technological solutions, museums could create data bases, which could be individual for each museum or centralised on a national scale. The advantages of the creation of a national data base are many: (1) the data base could include all the museums, even the ones that do not have the necessary resources (human, material, etc.) for the creation and management of a data base; (2) from the

users' point of view, the value they are offered is much higher (this is an important factor towards the market success of the project); (3) the museums will not have to manage their incomes individually, since these will be managed by the data base administrators, after which, on an annual basis, each museum will receive a share of the amounts collected, depending on how many times the items in their respective collection were accessed/viewed.

2.2 Technological innovations aiming at improving the visiting experience

From the point of view of the visiting experience offered to the public, the main media used within exhibitions are the following [11]:

- Audio-visual media used attractively as part of passive presentations. This generally means video presentations on simple screens or projected on a wall.
- Guided presentation with the help of audio guides, video projections and other means which accompany the visitors throughout their visit and are offered as an alternative to the guide tours made by museum experts.
- Interactive navigation stations including information about the museum's collections and educational programmes (usually "push the button" stalls and easy to learn interfaces).
- Media that offer opportunities for direct creation or production, take-away experiences, interactive and innovative experiences.

The multimedia elements within the exhibitions fulfil a number of functions, such as: offering explanation; showing exhibits that the museum is unable to put on display directly, due to insufficient space, fragility of such items or the fact that they need special handling; making the visitors feel a certain emotion and facilitating visitors' involvement and interaction with the museum exhibits [10].

In recent years museum technological innovations have involved the implementation of such solutions which would allow the visitors to act as active participants. Thus, the emphasis lays on interactive exhibitions where visitors can interact in various ways with the content of the exhibition rather than just receive information passively. In this respect, the latest museum technologies include hands-on interactive exhibits, which allow visitors to learn various things while interacting with the exhibits, as well as simulation media, interactive films, 3D graphics and, last but not least, virtual reality through which visitors can travel in space and time, without actually having to leave the museum buildings [11].

New technologies can be used by museums in order to develop their edutainment (education through entertainment) content and improve the quality of the services offered to their visitors. In this respect, Lepouras & Vassilakis [12] propose the use of 3D game-playing technologies with the purpose of developing accessible virtual media that are easy and pleasant to handle. As the authors state, the advantage of virtual reality technologies is that they provide museum visitors with a vivid, pleasant and realistic experience. Virtual reality technologies are also very useful for visualisation and simulation of environments, buildings or objects which no longer exist or are not accessible for visitation [12].

The application of modern technologies is a must, firstly for science and technology museums as part of the process of informal education provided by these museums to visitors. For example, the Museum of Science in Boston uses interactive technologies which offer not only the possibility of conveying to visitors information about nanotechnology, but also a way of getting the visitors involved and stimulate them to express their own ideas and opinions about the subject under discussion [13]. In another case a museum showcases an immersive virtual medium which enables students to live in a gorilla habitat, assume the personality of a teenage gorilla and interact, as a member, with a gorilla family [12]. Although these technologies were used for the first time by science museums, Gül & Akmehmet [14] state that there are more and more museums of art worldwide which have interactive spaces/objects. This proves that, whatever their types, museums can use modern technologies so as to offer their visitors an unforgettable experience.

2.3 Technological innovations aiming at process and activity automation

The process of ticket purchase has started to change under the influence of technological innovations. Although the greatest majority of museums, through their employees, are still selling tickets for cash, there are now museums where tickets can be purchased from an electronic machine. The advantages of the latter are that visitors can pay by card in a number of different currencies and the fact that the machine has a 4-language interface. An even higher level of innovation can be found in the museums which offer their visitors the possibility of buying tickets online. This is an important advantage for the tourists who are planning their trips themselves. It also proves to be very convenient from the museums' point of view, since in this way any possible queues growing in front of ticket desks is eliminated. By combining these technological solutions with the co-operation strategies, museums can offer an even higher value to their visitors. This is the case of 11 museums in Venice which sell online a unique common entry pass for all the 11 museums.

2.4 Web-based technological innovations

Museums can use the Internet as a product and service distribution channel [15] or as a communication and promotion means. In Romanian museums online distribution is generally free; museums offer virtual visitation and provide access to various educational and informational resources. In other countries museums also offer, besides the things above, electronic shops where various products are sold. An example is the Hermitage Museum which sells online souvenirs worldwide [16].

The Internet is also a means of promoting a museum's mission and events and encourages the attendance and involvement of the public in the activities provided by the museum. All these, in their turn, generate higher public awareness on cultural values, the community's support through volunteering, donations and grant earning [17]. The most important social media instruments which must be taken into consideration include the following: image distribution (i.e., via Instagram), podcasts (i.e., via soundcloud, iTunes or TuneIn), microblogs (Twitter), blogs, social networks (Facebook, Google Plus etc.), virtual worlds, online interactive exhibits and video distribution (Youtube) [17].

2.5 Technological innovations used for resource and operation management

The introduction of modern technologies in order to minimise the consumption of non-regenerating resources requires in the first place important investments which few museums are able to make. Things are simpler when new museum buildings are erected or structure extensions are built. The new structures can be designed to be highly energy-efficient. The advantage comes from the fact that in the long run the museum's operating expenses will be smaller. Also, in this way museums will apply to a larger extent the principles of sustainable development, improve their image on the market and become an example of good practice for other organisations.

Modern technologies can also be used for an easier and more efficient management of the operations carried out within museums. In this category can be included anything from stock management systems to the software used for carrying out certain functions, such as accounting, purchase and human resources.

3. METHODS

The purpose of this research is to analyse the extent to which new technologies are used by the museums in Baia Mare and identify ways of increasing the competitiveness of these museums through technological innovation. This research was carried out in the context of Baia Mare being shortlisted for the title of European Capital of Culture in 2021. The usefulness of our research results from the fact that the city's cultural development is closely linked to the development of its cultural institutions. It is well known that museums are among the main cultural tourist attractions. Thus, the existence of attractive museums in a city

can contribute to its tourist development. In the current competitive context, any effort towards bettering the landscape and organising cultural events in order to attract tourists is not enough. One single weak point in comparison with other cities (such as unattractive museums) can make the difference between a developed tourist community and one which has failed to arouse tourists' interest. Therefore, we believe that this research can prove useful not only for the studied museums, but for the entire city of Baia Mare, its inhabitants and its neighbouring regions.

In order to attain our purpose, in the period 22-23 May 2016 we visited the following museums: "The Artistic Centre Baia Mare" County Museum of Art, the Maramureş County Museum of History and Archaeology, the County Museum of Ethnography and Folk Art, the Museum of Mineralogy and the Astronomical Complex Baia Mare. We analysed the visual identities of these museums on the Internet (sites, blogs, and Facebook, Youtube and Twitter accounts). The collected data were correlated with the conclusions presented in the literature, the authors' experiences visiting other museums and the information collected online about other Romanian museums. Below are synthesised the most important results of our research.

4. RESULTS AND DISCUSSIONS

Following the analysis that we carried out, we found that all the museums in Baia Mare organise video projections using various learning aids on a regular basis. Besides these video projections some museums use other technologies as well with a view to improving the visiting experience they offer. Although the exhibitions of the museums in Baia Mare include to a certain extent modern technologies, these are unidirectional, i.e. they do not allow the visitors to take part and get involved actively.

The Astronomical Complex in Baia Mare has a hall equipped with LCD screens where educative materials about the Universe and our solar system are shown. Visitors can listen to the explanations provided on headphones connected to these screens. On one of the walls of the same hall, children can watch learning video films adapted for young audience. In another room there is a SKYMASTER ZKP4 LED planetarium projector. This is a "modern optical-mechanical stellar projector using optic fibre, the LED technology and industrial computers in order to simulate a sky studded with over 7,000 stars, installed in the 6-metre dome, renovated and provided with comfortable armchairs, a sound system and a ventilation system" (https://planetariubm.ro/prezentare/). The complex also has a number of telescopes visitors can use to explore the sky.

At the Museum of Mineralogy, inside the exhibition hall, there is a screen on which documentaries about the museum, its exhibits and mining are shown. In front of it there are chairs so visitors feel welcome to watch these materials.

The strong point of the Museum of Art is the sound system through which instrumental and classical music is played in the exhibition halls, which improves the quality of the visiting experience. The same museum has also a number of LCD screens inside its permanent exhibition halls, but these are used only at times. On the occasion of the Night of Museums a functional screen was placed at the entry and projections of video documentaries took place upstairs. A shortcoming was that no chairs were put in front of these screens so visitors could sit and watch the video materials.

At the central premises of the Museum of History and Archaeology there are no modern technological solutions used in order to improve the visiting experience. However, at the Butchers' Bastion, a site belonging to this museum, there is a documentary projecting system which is used regularly. At the County Museum of Ethnography and Folk Art they also play from time to time films on ethnographic subjects.

As for the technologies used on the web, we found that only four out of the five analysed museums have their own websites, but none of the four sells things through online shops. However, the museums which do have websites post the items they offer for sale and the interested visitors can order these items via email. At the date of our research two museums

were offering virtual visitation. Also two of the museums in Baia Mare own Youtube channels and Twitter accounts. All the four museums which have their own sites have Facebook official accounts as well, and the Museum of Ethnography and Folk Art also has an unofficial Facebook page. The information we collected in connection with the use of online communication and distribution instruments by the five museums in Baia Mare are presented in Table 1.

Table 1. The use of online communication and distribution instruments by the museums in Baia Mare

Museums	Sites / Blogs	Virtual tours	Facebook likes	Youtube channel	Twitter followers
The Astronomical Complex	www.planetariubm.ro	N/A	5920 *1737	https://www.youtube.com/user/planetariubm	323
The Museum of Mineralogy	www.muzeuminbm.ro	Yes	2818	N/A	N/A
The Museum of Art	www.muzartbm.ro http://muzeuldeartabaiamare.wordpress.com	Yes	2899 *5761	https://www.youtube.com/user/MuzeulDeArtaBM	279
The Museum of History and Archaeology	www.maramuresmuzeu.ro	N/A	5101	N/A	N/A
The Museum of Ethnography and Folk Art	N/A	N/A	132	N/A	N/A

* The Astronomical Complex has two Facebook pages, one with 5920 and the other with 1737 likes. The Art Museum has two Facebook pages, one with 2899 and the other with 5761 likes.

Unlike the museums in Baia Mare, there are museums in Romania which are more advanced from the point of view of the technologies they use. Among these, the "Grigore Antipa" National Museum of Natural History is the leader from the point of view of the innovation strategies used. Starting from the exhibition design and finishing with the related services offered to its visitors, this museum distinguishes itself from among the other Romanian museums. The first different feature can be noticed from the very entry. Whereas in other museums visitors buy the tickets from a museum employee, at "Grigore Antipa" Museum tickets can be bought from two ticket machines, very similar to the ones used in some banks where utility invoices are paid. Also, at "Antipa" visitors can pay for their tickets by card. This is particularly useful for foreign visitors, who are used from other countries to pay in various currencies (euro, dollars, forints, etc.) and generally don't have Romanian lei upon them when they come to visit museums in Romania. The other Romanian museums only accept payment in the national currency. Thus, from the very entry, some museum visitors can be unhappy with the services offered by a particular museum. Payment by card can solve a problem and at the same time signal the museum's desire to keep pace with current technological developments.

Once inside the exhibition, visitors to "Grigore Antipa" Museum encounter more surprises which contribute to higher visitor satisfaction. In some Romanian museums the only way visitors can find out information about the exhibits is by buying, besides the visiting ticket, guiding services. In other museums, in each exhibition hall there are posters and panels describing the most important items on display. At "Antipa" each exhibition window display has a touchscreen digital information panel. The starting page of the screen presents the exhibited items on a map, so the interested visitors can select a certain item about which they want to find out more information.

Following the model offered by "Antipa", in recent years more and more Romanian museums have introducing technological solutions in order to increase their attractiveness for the

public. An example in this respect is the "Mihail Kogălniceanu" Memorial Museum in Iaşi, which is part of the "Moldova" National Museum Complex in Iaşi. In order to distinguish itself from other museums and attract a larger number of visitors, this museum uses modern technologies in its permanent exhibition. More exactly, since 2012, when the museum was re-opened, visitors can, in one of the exhibition halls, interact with a natural-size hologram of Mihail Kogălniceanu. Due to a 3D software specially designed in the U.K., this hologram can greet visitors and tell, in the language of Kogălniceanu's time, about the house where the politician lived and about 19th century events.

If we compare the situation encountered in the museums in Baia Mare with the best practices in other Romanian museums and the technological innovations used internationally, we can note that the museum sector displays a large range of reactions to modern technological solutions. Some museums in Baia Mare do not use any modern technology almost at all, whereas others use information-transmission technologies without focusing on interactivity and interaction with their visitors. On the other hand, on the national level some museums have started to adapt the products and services they offer to international museum trends. However, even in the top Romanian museums there is much room for improvement, from opening of online shops to implementing virtual reality systems. Complimentary to the technological innovations aiming at visiting experience improvement, Romanian museums face yet another problem – the digitalisation of their patrimony. Whereas state-of-the-art technologies require big investments, which is the chief cause for the fact that these technologies are absent from museum exhibitions, digital data bases cannot be created because there are few experts specialised in digitalisation and the number of items which have not yet been registered and/or re-evaluated is huge.

5. CONCLUSION

The introduction of technological innovations combined with a good collaboration between museums can lead to unique experiences offered to museum visitors. For example, by visiting a number of museums consecutively, in a certain order, visitors can re-live various periods in the past, present and future, all in one single day. Also, by correlating their exhibitions, different museums in the same city can help tourists understand better the culture, values and features of the region than they could if they only visited certain sites. Thus, smaller communities such as Baia Mare can apply innovation strategies in correlation with their collaboration strategies so as to offer the tourists a different experience from the one they can have in large cities. To this end, the museums' experts should collaborate towards creating connections between their respective exhibitions and draw up tours for their visitors. Also, we believe that Baia Mare would get a competitive advantage from the presentation of this project on the Internet and selling the tourists unique visitation passes online.

Therefore, it is easy to notice that technological innovation strategies impact positively upon a museum's sustainability. Economically, the implementation of such strategies requires certain investments, which translated into higher costs, but leads to obtaining higher own income as a result of attracting a higher number of visitors. On the other hand, socially and culturally the effect is 100% positive. Scientific information, if presented in an attractive, interesting way, can be assimilated easier. Moreover, new technologies are likely to contribute to a higher desire of the community to get involved into a museum's activities. As technological innovation is used as a rule for the transmission of educative contents in a "friendly" way, this strategy can contribute to improving a museum's ecological sustainability, as long as there are also materials/contents which lay and emphasis on environmental protection.

However, we must note that not any museum can use any type of technology. The science museums are the ones which can use modern technological solutions easiest. Conversely, in village museums the same technologies can ruin the time reversal experience the visitors seek there. For this reason, museum experts must use their innovativity and find the best solutions for implementing the best technologies so as to better the visiting experience and not for the sake of technology itself.

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