



# **Innovation, technology and Services: Marketing, Art and Culture**

**Carolina Charques Trallero**

Thesis to obtain the Master of Science Degree in  
**Industrial Engineering and Management**

Supervisor: Prof. Carlos Manuel Pinho Lucas de Freitas

## **Examination Committee**

Chairperson: Prof. Maria Teresa Romeiras de Lemos

Supervisor: Prof. Carlos Manuel Pinho Lucas de Freitas

Member of the Committee: Prof. Ana Sofia Mascarenhas Proença Parente da Costa  
Sousa Branca

**November 2014**



# ACKNOWLEDGMENTS

This study is the result of a high effort, work and dedication that I could not have reached without the support of the people around me.

First and foremost, I would like to express my sincere gratitude to my tutor, Professor Carlos Lucas de Freitas for the continuous support during this research as well as for his patience, his immense knowledge and his guidance to each step of this work. Thank you a lot for your time given to me and this project and for your dedication.

I would also like to acknowledge both Dr. Tiago Bueso, from the Berardo Museum and Dr. João Carvalho Dias, from the Gulbenkian Foundation, for their collaboration with the study and for being willing to help me. Thank you both for giving me some of your time to do the interviews and for being so clear and precise during the entire interview, it was really a pleasure to talk to you.

I also want to thank all the students that participated in the survey, which I know that it was not short. Thank you for making the effort of responding all the answers, as without them the study could not have been developed.

Acknowledgements to the museums that participated in this research, by answering the questionnaire and for the interest presented on the development of it.

To conclude, I want to thank my family, for their unconditional support along all this study and the whole academic route, who have always believed in me.

Last but not least, I would like to acknowledge all the friends I met in Lisbon, for being day after day supporting me for this study as well as giving me the opportunity to have such a wonderful experience with this exchange program, I will miss you all.

A final acknowledge to my friends from Barcelona, who have supported me from the first moment, even though there were not physically with me during this study.

# ABSTRACT

One of the objectives of marketing research is studying the customer's behavior in order to perceive their degree of satisfaction. When delivering a service it is important to know customers' attitudes, interests and preferences in order to improve it and guarantee a future satisfaction for new audiences.

This study is focused on factors influencing the behavior of museums visitors, more specifically their attitude towards technology. As nowadays technology has occupied an important part in people's life, it is understandable that cultural institutions such as museums want to know customers' preferences and opinions about technology.

The services marketing perspective was studied and informed the preparation of the interviews in two relevant museums in Lisbon as well as the elaboration of two questionnaires, one for museums and one intended for visitors (customers).

The empirical results do not show a clear relation between the youthful sample current behavior and other factors such as their attitude towards Apps, Social Networks or Interactive Technologies. However, the study shows that the visitors' opinions and preferences related to technology are very similar to the ones from museums, which may increase the future attractiveness of museums from this market segment, important for those cultural institutions.

**Keywords:** museums, technology, communication, services marketing, attitude, behavior.

# RESUMO

Um dos objetivos da pesquisa de marketing é estudar o comportamento do cliente para perceber o seu grau de satisfação. Quando se trata de um serviço é importante conhecer as atitudes, os interesses e preferencias dos clientes para melhorá-lo e garantir a futura satisfação de novas audiências.

Este estudo focaliza-se em fatores de comportamento dos visitantes dos museus, mais concretamente a sua satisfação com a tecnologia. Como atualmente a tecnologia tem ocupado uma parte importante das vidas das pessoas, é perfeitamente compreensível que as instituições culturais, como os museus, queiram conhecer as preferências e as suas opiniões dos seus clientes sobre a tecnologia.

Por este motivo, estudou-se a perspectiva de marketing de serviços, considerada na preparação de uma entrevista dirigida a dois museus distinguidos de Lisboa, assim como na elaboração de dois questionários, um dirigido aos museus e o outro dirigido aos potenciais visitantes (clientes).

Os resultados empíricos não mostram uma relação clara entre o comportamento atual dos jovens da amostra e outros fatores como a sua atitude relativamente a Apps, redes sociais ou tecnologias interativas. Ainda assim, este estudo mostra que as opiniões e preferências dos visitantes e as dos museus em relação à tecnologia são similares, o que poderá aumentar a atração dos museus para este segmento do mercado, importante para aquelas instituições culturais.

**Palavras chave:** museus, tecnologia, comunicação, marketing de serviços, atitude, comportamento.

# TABLE OF CONTENTS

ACKNOWLEDGMENTS .....	iii
ABSTRACT.....	iv
RESUMO .....	v
LIST OF FIGURES .....	viii
LIST OF TABLES.....	ix
LIST OF ABBREVIATIONS.....	xi
CHAPTER I: INTRODUCTION .....	1
1.1. Objectives.....	1
1.2. Motivation .....	2
1.3. Outline.....	2
Chapter II: LITERATURE REVIEW .....	4
2.1. Cultural Institutions and Marketing .....	4
2.1.1. Marketing .....	4
2.1.2. Market and the competition .....	5
2.1.3. Motivation and promotion .....	6
2.1.4. Distribution .....	7
2.1.5. Cultural organizations .....	7
2.2. Services Marketing .....	11
2.2.1. Services and products .....	11
2.2.2. Service quality .....	14
2.2.3. Customer satisfaction .....	16
2.3. Marketing research .....	19
2.3.1. Marketing research definition and process .....	19
2.3.2. Definition of the problem and research objectives .....	20
2.3.3. Development of the research plan.....	21
2.3.4. Collection of the information.....	25
2.3.5. Analysis of the information and presentation of the findings.....	25
2.3.6. Marketing research of museums .....	26
2.4. Technology in museums .....	26
2.4.1. Use of new technologies in museums .....	26
2.4.2. The technology acceptance model.....	33
CHAPTER III: METHODOLOGY AND DATA COLLECTION .....	35

3.1. Methodology.....	35
3.1.1. Research questions .....	35
3.1.2. Interviews to museums.....	36
3.1.3. Data collection from students.....	40
3.1.4. Data collection from museums.....	41
CHAPTER IV: DATA ANALYSIS AND DISCUSSION .....	44
4.1. Data analysis.....	44
4.1.1. Factor analysis .....	44
4.2. Presentation and discussion of results .....	46
4.2.1. Results from students.....	46
4.2.2. Results from museums.....	62
4.2.3. Discussion: comparison between museums and students .....	69
CHAPTER V: CONCLUSIONS .....	73
FUTURE WORK.....	75
REFERENCES.....	76
APPENDIX .....	81

# LIST OF FIGURES

Figure 1. AIDA model in Marketing (Vit Horky, 2009).....	6
Figure 2. Criteria to distinguish arts institutions and cultural industries (Colbert and Cuadrado, 2003).....	8
Figure 3. Services gaps (Hill, 1996).....	18
Figure 4. The evolution of Relationship Marketing (Payne, 1993).....	19
Figure 5. The marketing research process (Kotler, 2000).....	20
Figure 6. Electronic guidebook and headphones (Grinter et al., 2002).....	28
Figure 7. Visitor reading the information at the information kiosk (Heath & Lehn, 2005).....	30
Figure 8. Classification of VR devices depending on their degree of interaction (Carrozzino & Bergamasco, 2010).....	32
Figure 9. Museum of Pure Form, full immersive installation (Carrozzino & Bergamasco, 2010).....	33
Figure 10. Graphic showing the mean for each statement regarding students' attitude towards cultural events.....	47
Figure 11. Graphic showing how often students visit a museum according to a five-point frequency scale .....	48
Figure 12. Opinion of museums about technology, measured with a Likert scale .....	64
Figure 13. Museum's opinion about technological devices, measured with a Likert scale .....	65
Figure 14. Museum's opinion about the need of giving more information about the exhibits, measured with a Likert scale.....	65
Figure 15. Different ways of communication about new collections in a museum, measured by a five-point important scale.....	67
Figure 16. Comparison between the ways of communication from the point of view of students and museums.....	71

# LIST OF TABLES

Table 1. Marketing mix definitions (Colbert and Cuadrado, 2003) .....	4
Table 2. The role of the consumer when determining the place, moment and duration of the consumption (adapted from Colbert and Cuadrado, 2003) .....	7
Table 3. Offering a service or a product? (Douglas Hoffman and Bateson, 1997) .....	13
Table 4. Identification of the significant factor loadings according to the sample dimension (Hair et al., 1999) .....	46
Table 5. Sampled students' profile .....	47
Table 6. Interesting comments and ideas extracted from the open questions of the students' survey .....	48
Table 7. Factor rotation matrix with VARIMAX for section A .....	49
Table 8. Factor rotation matrix with VARIMAX for section B .....	51
Table 9. Factor rotation matrix with VARIMAX for section B1-B7 .....	51
Table 10. Factor rotation matrix with VARIMAX for section C .....	53
Table 11. Factor rotation matrix with VARIMAX for section D .....	54
Table 12. Factor rotation matrix with VARIMAX for factor 1 .....	55
Table 13. Factor rotation matrix with VARMIAX for factor 2 .....	56
Table 14. Factor rotation matrix with VARIMAX for factor 3 .....	56
Table 15. Factor rotation matrix with VARIMAX for factor 4 .....	57
Table 16. Factor rotation matrix with VARIMAX for factor 5 .....	57
Table 17. Factor rotation matrix with VARIMAX for factor 6 .....	58
Table 18. Comparison of Alpha of Cronbach of both factor analysis .....	58
Table 19. Regression coefficients with F5_Behavior as a dependent variable .....	60
Table 20. Summary of results using F5_Behavior as a dependent variable .....	60
Table 21. Regression coefficients with X1 as a dependent variable .....	61
Table 22. Summary of results using X1 as a dependent variable .....	61
Table 23. Interesting answers for the first open question of the survey to museums .....	62
Table 24. Main answers for the second question of the museums' survey .....	63
Table 25. Types of technologies focused in museums of each country .....	66
Table 26. Comparison between the different technologies of a museum according to students' opinion .....	69

Table 27. Comparison between the different types of technologies that museums prefer to have .....70

# LIST OF ABBREVIATIONS

**CRM:** Customer Relationship Marketing

**TAM:** Technology Acceptance Model

**TRA:** Theory of Reasoned Action

**MFA:** Museum of Fine Arts

**PEOU:** Perceived Ease Of Use

**BI:** Behavioral Intention

**B:** Behavior

**QR:** Quick Response

**VR:** Virtual Reality

**PU:** Perceived Usefulness

# CHAPTER I: INTRODUCTION

Technology is nowadays approaching to all fields in an unimaginably rapid way playing a significant role that can even be determinant of the benefits of an institution or company. Specially in cultural centers, where some years ago technology was inexistent, a change has been done in society and technology is more and more demanding, reaching a point in which it can even be crucial to prolong their future.

There are different attitudes facing technology and not all the visitors from cultural institutions have the same feelings towards it or react in the same way. Those different behaviors can be studied by different models and tools to see the main factors that affect a technological change which can help the institution whereas making the change or not. On the other hand, the institutions themselves act differently and have diverse opinions towards a change or regarding technology and it is interesting to view those differences and try to understand all these positions.

With Marketing Research it is easier to improve users' satisfaction, ascertaining their needs and wants in order to please them. The results of this type of research are regarded by many institutions which never thought of implanting it because of their nature and other constraints and are now desperately looking for researchers to make a study for them to see what they should change or preserve.

Services marketing benefits from being well defined and treated differently from goods marketing. Many well designed strategies are required to measure a design and make it satisfying for customers, which is the aim of every service. Usually these strategies go beyond the traditional marketing and it is an interesting challenge for cultural organizations.

## **1.1. Objectives**

The aim of this study is to understand the importance of studying customers' attitude in cultural institutions as well as the ways in which they behave their preferences and opinions. The objectives and methods used in marketing research to make improvements in cultural institutions and help them to have as many satisfied customers as possible are also issues to study in this project.

Another goal to be reached is the study of different technologies that can be found nowadays and posteriorly in the future in museums, their innovations and new ways of making the museum attractive and interesting to its publics.

Finally, the last goal is to understand the interest that cultural institutions have on technological devices as well as their attitude and way of thinking towards technology.

## **1.2. Motivation**

The main motivation to develop a study in this field was the opportunity of approaching to cultural institutions in a marketing way. Focusing especially in museums, which are the most studied institutions in this research, they are very different one from another and the feelings regarding one type of art or another can differ considerably. Also, getting to know the different types of technologies that are museums using nowadays and the attitude and opinions they have towards using more or less electronic devices was also something completely unknown. Going to museums gives you an approach to culture, which is always an enriching experience.

Given that going to museums is not one of the favorite hobbies from young people, it was also interesting to see what they thought about them and if their inevitable connection with technology in today's world could be an incentive for them to visit them more frequently. Also to see if their opinions towards technology in museums were similar or not with the ones that the museums have is an interesting think to know, to see if museums understand what their future customers want, need and find more motivating when visiting a museum.

Furthermore, the little knowledge about marketing research, services marketing and customers' satisfaction was an additional incentive to be motivated to learn more and find as much information as possible to understand every concept and way of thinking.

Due to all of these aspects I applied for and accepted the topic proposed by professor Carlos Lucas de Freitas, concentrated on culture and marketing when I had to make the choice after my acceptance to the Instituto Tecnico de Lisboa.

## **1.3. Outline**

The dissertation is divided into 5 different chapters:

- CHAPTER I: Introduces the topic of study, presents the main objectives to reach and the motivation that brought me to make the study.
- CHAPTER II: Presents a review of the literature needed for further research, with detailed description of the main concepts of marketing research, services marketing and customers' satisfaction field, as well as the current situation of museums with technology.
- CHAPTER III: The methodology followed in this research is explained, including the way in which the data was collected, the interviews that took place with museums and the design of the two questionnaires. Also the research questions are presented in this section.
- CHAPTER IV: The analysis for the data collected is done, explaining the process that has been developed to achieve the results. Also presents the results and their discussion.

- CHAPTER V: Final conclusions and recommendations
- Appendix

# Chapter II: LITERATURE REVIEW

## 2.1. Cultural Institutions and Marketing

### 2.1.1. Marketing

In terms of marketing, as Colbert and Cuadrado (2003) said, “the essential objective is the optimization of the relationship between the company and the customers and the maximization of their mutual satisfaction”. The sense of marketing refers to four main elements: the needs of the customer, the satisfaction of this need, the connection between the organization and the customer and finally the optimization of the benefits.

When concentrating on the cultural world, the field of culture and arts, the sense of marketing is slightly different. Kotler (1967) pointed out that cultural organizations, referring to museums, libraries, auditoriums or universities, all produced “cultural goods”. Each of these organizations took into account the need of being competitive, to attract more customers and also to get more resources. Diggles (1986) believes that “the main objective of marketing in the cultural world is to bring a certain number of people to an appropriate way of connecting with the artist and when doing it, to reach the best result”. Summarizing, Colbert and Cuadrado (2003) defined cultural marketing as “the art of reaching the market’s segments interested in the product by adapting it to the commercial variables, such as price, distribution and promotion, with the aim of approaching the product to a high number of customers to reach the objectives of the cultural organization according to its mission”.

“A marketing strategy has always four components: product, price, place and promotion. The success of every marketing strategy will depend on a correct balance of all four elements” (Colbert and Cuadrado, 2003).

Table 1. Marketing mix definitions (Colbert and Cuadrado, 2003).

<b>Product</b>	It is the main objective of any company. It includes tangible goods, as well as services, causes and ideas. The product in this field is associated to any creative manifest, such as a performance, an exposition, a book, a TV program or a concert.
<b>Price</b>	It is not only the financial value associated to a product, but the effort made by the customer when buying the product.
<b>Place</b>	It refers to different elements like the physical distribution, the distribution channels and the establishments.
<b>Promotion</b>	It is composed by four different components: advertising, personal sales, sales promotion and public relations.

These four elements shown in table 1 are the components of the main marketing strategy, called marketing mix.

However, as services are not tangible, the marketing mix for services has three additional elements: People, Process and Physical evidence (Lovelock & Wirtz, 2010). People are an essential ingredient in service provision, as they make judgments about the service and the delivery, which is based on people and is one of the few elements of the service that they can see. Specifically in museums, people are the ones that will interact with new technologies and will transmit their satisfaction with the service. The process refers to the system used to deliver the service and in the case of museums it would be the impact that technology has on customers, if they are enhanced or distracted. Finally, the physical evidence is about where the service is being delivered from, which in the museums' field would be the different technological devices used, such as interactive ones, screens, headphones and others that are part of the scenery.

The main problem with marketing and cultural institutions is that they have come to a point in which they regard marketing as a benefit, which hopefully will increase their visitor figures and will help them generate further income to their institution (McLean, 1997).

Even though marketing is an important point to succeed in a company, it is not the only aspect that must be taken into account for customers. Drucker (1954) underlines the importance of good staff calls upon service organizations to promote teamwork instead of working always individually.

### 2.1.2. Market and the competition

In terms of market, there are two aspects that should be considered: the social and cultural environment and the demographic environment (McLean, 1997). Attitudes in society change over the time, like the role of women and also cultural aspects do, like the diversity of ethnic minority groups. Equally, there are changes in the size and structure of the population and all those aspects are critical to predict the museums' demand. But demographic trends vary from one country to another and these trends will for sure affect visitors' profile. Especially talking about ages, as there is nowadays a trend towards earlier retirement, which means that the number of over-65s is increasing, as life expectancy increases (McLean, 1997). That is why, depending on cultural, social and demographic environments of a particular country, the museums will have some characteristics or others.

"The competition in the arts and culture world must be placed in a wider context: the market of entertainment". (Colbert and Cuadrado, 2003). Cultural activities can only be developed during leisure time, while people are not working or sleeping. This is why the cultural product has to compete not only with the other cultural products, but those who have been designed to occupy people's free time, such as sports, trips and other physical activities. The competition in this field is very strong for entertainment organizations, especially in big cities, where the number of cultural products and entertainment activities can be huge. Moreover, some institutions offer products with a very short life, like temporary collections in museums, which makes it even more difficult to reach their objectives (Colbert and Cuadrado, 2003). However, it has been argued that when the competition increases it intensifies the speed of the museums' changes (Middleton, 1985). This is why, maybe due to the

existence of this high competition among cultural institutions, more changes and new ideas are developed faster and can make a museum more attractive nowadays.

### 2.1.3. Motivation and promotion

Consumers won't get the idea of acquiring a product if they are not strongly motivated to do it. Motivation is placed in the center of consumer's behavior. Motivation from a consumer can just come from the consumer itself, from a specific situation or as a result of a promotion (Lewin, 1951). Motivation is also related to the consumer's previous experience and the consumer's involvement with the product. Then, depending on the degree of motivation of the customer a product will be bought or not. Promotion has one of the main roles here, as it has to deal with the product to make it attractive enough to motivate the consumer to take it. Research has found that lack of awareness and information is one of the main reasons why some people don't visit museums often (McLean, 1992). The museum may be brought to the attention of visitors through its promotional activity.

As Mokwa (1980) points out, the main objectives of promotion are: to inform the consumers about the existence of the product, to persuade them by using the image of artists, facilities or recognition of the product and to provide the consumers the necessary tools to evaluate the product's specific characteristics. Promotion is a communication tool; it is a way to communicate that the company uses to spread the message and image of the company. The main function is (Colbert and Cuadrado, 2003) to communicate a message to change the customers' mind and make them motivated towards the product. Promotion tries to generate positive attitudes towards the product and its sales. Four steps can be defined (figure 1) for the promotion of a product: to attract the consumer's attention, to generate interest, to generate desire for the product and to cause the final action of buying it (McLean, 1997). These are the steps of the AIDA model (Attention, Interest, Desire, Action).

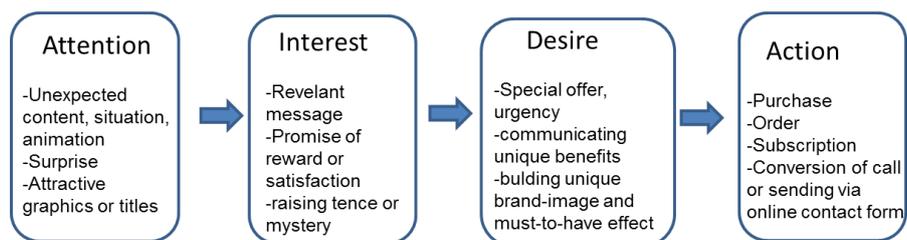


Figure 1. AIDA model in Marketing (Vit Horky, 2009)

Consumers are constantly receiving a great amount of messages and encouragement from all directions and have to develop some mechanisms to filter some of them. This means that it is important to capture their attention and make one product to be the one that they are retaining. The development of the message a museum wants to transmit involves four issues (McLean, 1997): content (what to say); structure (how to say it logically); style (good presence) and source (who develops and emits it). The museum then has to decide what portion of its budget is going to be assigned for promotional activity.

#### 2.1.4. Distribution

The way in which a product in the cultural area is consumed determinates its way of distribution. There are products that have to be consumed together, in the same certain place. There are also products designed for an individual consume, those that can be enjoyed at any time in the place the consumer wants. This means that depending on the cultural event that we talk about, the role of the consumer in terms of time, place and way to consume the product or service changes (Colbert and Cuadrado, 2003). In each situation the control the consumer has on the place, moment and duration of the product is different. In table 2 it is shown the control the consumer has in different cultural events according to place, moment and duration.

For example, talking about an exposition in a museum, some years ago, according to Colbert and Cuadrado (2003) the place couldn't be chosen, as the consumer had to go to the museum to see it, but they could choose the moment when they want to visit it, always respecting the museum's schedule. They could also be able to choose the time they wanted to spend during their visit. But nowadays, thanks to technology, it is possible to choose also the place, as there are Apps that let you see some museums and also webpages. This is why, due to these advances in technology, the original table of Colbert and Cuadrado (2003) has been modified (the modifications have been added in bold). However, there will always be the discussion of whereas visiting a webpage of a museum or its App is the same experience as going physically to the museum to see the exhibits directly, not by a device. The same happens with films, as it is not the same to watch them at home buying a DVD than being at the cinema watching it in a big screen. However, this shows that for the films also the place and the moment can be chosen from the consumer, as they can watch them at home or at someone's place. The only cultural event that has not changed its variables of place, moment and duration is the performance, as you have to go to a specific place in a concrete moment to see the play that you want, with no possible electronic device or technological installation that can change that, at least in today's world.

**Table 2. The role of the consumer when determining the place, moment and duration of the consumption (adapted from Colbert and Cuadrado, 2003)**

	<b>performance</b>	<b>exposition</b>	<b>film</b>	<b>video</b>	<b>book</b>	<b>Piece of art</b>
<b>Place</b>	-	<b>+</b>	<b>+</b>	+	+	+
<b>Moment</b>	-	<b>±</b>	<b>+</b>	+	+	+
<b>Duration</b>	-	<b>+</b>	-	-	-	+

#### 2.1.5. Cultural organizations

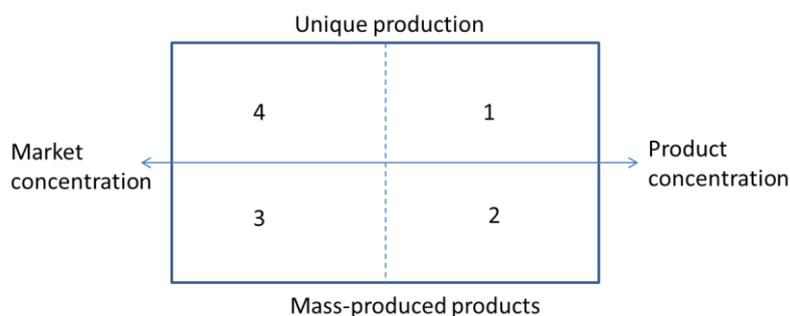
##### i. Setting the limits of cultural organizations

The best way to limit cultural organizations is to categorize and differentiate them into two specific criterions. The first one refers to the direction in which the mission of the organization goes. It

can be seen as concentrating on the product or on the market. An institution that concentrates on the product makes it the main reason of everything (like a concert or a children’s festival). While in the other extreme, companies that concentrate on the market are placed (Colbert and Cuadrado, 2003).

The other criterion is about the way in which the product is produced, being a unique production in one side and mass-produced products in the other side. The combination of both criterions, as it is shown in figure 2, allows distinguishing between cultural industries and institutions of art (Colbert and Cuadrado, 2003).

The first quadrant of the figure represents those companies concentrated on the product. In general terms those institutions constitute the “arts area”. They are usually non-lucrative institutions. Museums and art galleries would be placed in this quadrant, as there are unique pieces of art, with a non-lucrative objective. In quadrant number 3 are placed the companies concentrated on the market. Obviously they refer to companies with a lucrative aim where mostly cultural industries are placed. Quadrants 2 and 4 represent combined situations. So, quadrant number 4 includes musical productions such as Broadway musicals, which produce unique performances, as they are acting and they cannot be exactly the same every time and are concentrated on the market. They are cultural industries, then. In quadrant 2, though, are situated institutions concentrated in their product and they produce a large amount of copies of their product. A book editor could be placed in this quadrant, as a significant example of it. These kinds of institutions are also considered as cultural industries but usually have more things in common with the area of arts.



**Figure 2. Criteria to distinguish arts institutions and cultural industries (Colbert and Cuadrado, 2003).**

ii. Museums

“Museums are wonderful, frustrating, stimulating, irritating, hideous things, patronizing, serendipitous, dull as dishwater and curiously exciting. The real magic is that any of them can be all of these simultaneously” (Bonniface and Fowler, 1993).

A museum’s main mission, apart from its characteristics, is to collect objects in a particular place to show them to the public and inspire people to support the museum (Kotler and Kotler, 1998). A museum really needs to be supported, otherwise it cannot last much. Each museum must have its

own mission in order to direct it to be predominantly research and offer limited public services or present it as an offer of both educational and entertaining issues providing the appropriate services.

A museum visit is usually not accidental or unplanned. Every visitor has to make a choice when going to a museum, among several options finally one is chosen, taking into account different aspects that make the visitor choose a museum. These aspects are usually behavioral characteristics (attitude and preferences) related to visitor's interests and to what they like to do for entertaining and free time. But sometimes these aspects are also related to the services the museum offers or the kind of collections they are having at that moment. That is why museums have to focus on communicating the qualities and values that people might find in their museum, the services they offer and other unique specific characteristics that won't be found in other recreational activities (Kotler and Kotler, 1998).

The length of a museum visit is sometimes related to a museum's offerings. Obviously it also depends on the visitor's experience, as if a visitor is used to going to museums often will probably spend more time during the visit (Kotler and Kotler, 1998). Some museums are changing their spaces in order to make it more comfortable for visitors and try to slow their visit by capturing their attention. An increasing number of museums are placing a variety of small gift shops instead of having a big one, so that visitors can spend more time going from one to another, looking for their gifts. Research has shown that visitors who obtain orientation and way finding information tend to spend a longer time in a museum than visitors who do not (Lankfort, Bitgood and Cota, 1995). Usually when visitors spend more time it is because they are enjoying the experience; that is why it is useful to have additional information to make it more interesting and attractive to visitors.

### iii. Museums audience

The museums have various publics. Davies (1994) suggests four sources of demand: visitors, users, other stakeholders and society. Visitors and users are very similar and they can use the services from a museum in different ways, like only visiting it or undertaking research, enquiring about objects or obtaining materials. Visitors would be the ones that would only go to a museum to see art, to appreciate the different objects of the museum and having this experience. Users, though, would be these visitors that go to a museum with some purpose such as a research study, but not only for experiencing the museum, as a visitor would do. Other Stakeholders are "individuals, groups or organizations which have a legitimate interest in the sector, at the national, regional or local level" (Davies, 1994). This last group includes museum organizations, local government, business, the media the staff, members and volunteers. The last group, society, refers to the fact that museums exist for the benefit of society or for anyone in society who wants to use their services.

Concentrating on visitors, they are very varied and they differ by every museum and every type of it (depending on their area: History, Science, Art...). Most of the museums are opened to the public every day of the year, which gives the opportunity to families to go there the days when other leisure activities are closed and they don't know what to do with their children. John Falk and Lynn

Dierking (1992) making studies in England and the United States, report that an almost 70 percent of visitors at the Natural History Museum in London visit as members of social groups, mostly family groups. In the United States, in contrast, families with children are usually found at amusement parks, science and technology centers or children's museum, but are not commonly at art or history museums.

The audience differences are not just about age but also about other aspects like educational attainment. The population is becoming more educated as more students graduate from higher education (McLean, 1997). A striking characteristic in this field is that most of the museum visitors have high educational attainment, followed by high income. However, as with the age, variations in educational level vary depending on the type of museums: visitors of the U.S. art museums usually have the highest educational level, followed by the ones who visit science and technology centers and history museums.

#### iv. Segmentation in the museum

Most museums know what they want to achieve, but have not evaluated the needs and wants or the potential audiences that are still not attending. Segmentation subdivides a heterogeneous market into different and easily identifiable homogeneous submarkets. Market segmentation "is the process of splitting customers into different groups, or segments, within which customers with similar characteristics have similar needs. By doing this, each one can be targeted and reached with a distinct marketing mix" (McDonald and Dunbar, 1995).

Usually market researchers tend to subdivide the market according to four different criteria categories: geographic, demographic, psychographic and behavioral. (McGoldrik, 1990). Geographic segmentation can be separated into local residents, day trippers and tourists. A museum may be more or less attractive for visitors depending on the distance that people are willing to travel to reach the museum and the time it takes them to travel this distance (Davies, 1994). Psychographic segmentation is the one referred to people's lifestyle, their interests, favorite activities and opinions, as well as psychological aspects such as social standing and personality (McGoldrik, 1990). In the museums' field, this segmentation refers to their preferences in leisure activities, such as if they are interested in cultural activities or sports or reading books or others. Also it refers to their cultural opinions about artists, paintings or sculptures, if they think the objects are worth it and of course their preferences. Although most museums tend to focus on demographic and geographic socioeconomic segmentation, there is a variety of alternative bases for segmentation, which are not that popular but could be more useful.

As Davies (1994) pointed out, "traditional segmentation (as employed in the commercial marketing sector) is not always appropriate for museums and galleries". It is usually better to consider the problems that museums will have to face with in segmenting audiences, due to their heterogeneity rather than homogeneity, because museums are services, generally small, usually public and non-profit organizations.

The visitor becomes a part of the product through the experience in the museum. Depending on the area of the museum, people will decide going to a museum or not, depending on their interest and probably they will only visit the ones whose subject area is attractive to them. Haley (1968) said that segments can be grouped according to benefit sought, in this case a special interest. Segmenting by special interest, though, would require a greater understanding of the essence of the museum and the potential visitor than just their demographic characteristics.

Lifestyle, benefit and usage segmentation should also be considered as a menu of possibilities, taking into account the individual museum and its goals to make the appropriate choice.

Many service organizations and museums above all, experience significant variations in demand over time, going from over-capacity to under-capacity along the years, because of their nature of perishability (Rathmell, 1974).

A lot of potential visitors end by not visiting museums because of lack of time, while others visit them in order to fill in some time, particularly tourists. Holman and Wilson's (1982) explanation of shopping preferences in terms of time can be adapted to museums. They suggest that most costumers try to reestablish one of the two types of "time equilibrium" that exist. Some of them have too much obligatory time, which doesn't allow them to enjoy their free time, while the others have too much leisure time. Concentrating on the museum, the inclusion of lectures, guided tours and maybe even museum clubs would be a suitable solution for those visitors with discretionary time. Museum clubs refer to areas inside the museum, for visitors, in order to exchange opinions or comments with other people and being able to spend more time there. In contrast, for those visitors whose free time is limited, the museum could give them the opportunity of guided tours of only one part of the museum or extended opening hours in the evening. When museums make their decisions in terms of segmentation they should analyze these types of "time equilibrium".

To be effective, market segments have to be measurable (easy to identify and homogeneous); substantial (large enough to justify developing a marketing mix); accessible (easy to reach through promotion); and stable (the segment will be around until decisions and actions are taken) (Dibb, Simkin, Pride and Ferrell, 1991).

## **2.2. Services Marketing**

### **2.2.1. Services and products**

Service industries are playing an increasingly important role in the overall economies of the countries of developed and developing countries. The 21<sup>st</sup> century is considered to be as the service industry. There are many definitions regarding the concept of service. Gronroos (1983) defined service as: "An activity of more or less intangibles nature that normally, but not necessarily, take place in interactions between the customer and service employees and/or physical resources or goods, which are provided as solutions to customer problems". Kotler, Armstrong, Saunders and Wong (1999)

defines it like: “Any activity or benefit that one party offers to another which is essentially intangible and does not result on the ownership of anything, and it may or may not be tied to a physical product”.

The distinction between a product and a service is not always perfectly clear. In fact, many services contain at least some goods elements, as well as most goods at least offer a delivery service. In general goods can be defined as objects, devices or things while services are defined as deeds, efforts or performances. Services, unlike goods, are not physical products and they cannot be touched, but “they are possibly perceptible by one of the four other senses” (Flipo, 1988).

The concept of intangibility is the only characteristic that is common to all services (Klein and Lewis, 1985). Talking about museums might seem at first sight a little bit incongruous, but when talking about intangibility it has to do with the emotions that the museums evoke. Obviously the artefacts are clearly tangible, but it is the experience, therefore, that is the intangible characteristic of the museum, while support services that it might have like a bar or a little shop, lie along the product-service continuum, which goes from “pure product” to “pure service” (Shostack, 1977).

There are some characteristics specific for services to distinguish them from products (Douglas Hoffman and Bateson, 1997):

- Intangibility

Services are all or mostly intangible. There may be physical evidence that the transaction took place, but the work that was done behind to prepare it is intangible.

- Simultaneity of buyer and provider

For most services, both the buyer and the provider need to be at the same place at the same time for the service to occur. This means that simultaneity is needed for a service.

- Lack of inventory

Services cannot be stored, warehoused or kept on hand for times when demand is high. They are developed in a specific time, usually whenever the customer wants.

- Sensitivity to time

As services cannot be inventoried, they also cannot be backordered, as customers would then change to another place that offers them a similar service.

- Difficulty in maintaining, measuring and controlling quality

As defined before, most services are highly intangible, so it is difficult to measure and control quality. People provide services; they are not manufacturers and cannot operate as reliably as a machine. This makes it very difficult to customers to evaluate quality and for employers to

measure control quality. In addition, the evaluation depends largely on attitudes, opinions and expectations of customers, which makes it even more difficult to be measured.

- High degree of risk

Given the difficulty in measuring and controlling quality, services are often risky. Usually there is a result after the service, a result that must like the customer, which often is difficult to reach.

- Customization of the offering

Services cannot be standardized as products, when they are delivered by people, the manufacturing process is not delivered by a machine, so usually the degree of customization is a measure of service quality. Therefore, services are transactions, so it makes it difficult to completely standardize the offering.

- Personalization of the buyer-provider relationship

Many services are processes, which mean that they are developed by a person or a team. Their talents and attitudes will be the responsible for the final outcome and the level of customer satisfaction. The attitude, knowledge and communication skills of the person providing the service are usually as important as the service itself.

In table 3 there is a summary to help to classify a service or a product depending on the characteristics mentioned before.

**Table 3. Offering a service or a product? (Douglas Hoffman and Bateson, 1997)**

<b>Test or criteria</b>	<b>Services</b>	<b>Could be either</b>	<b>Products</b>
<b>Intangibility</b>	Fully intangible; may be physical evidence	Partially tangible	Fully tangible
<b>Inseparability of buyer and provider</b>	Both must be present	Remote transactions possible	Remote transactions easy
<b>Lack of inventory</b>	Cannot warehouse or store the service		Easily inventoried
<b>Sensitivity to time</b>	Needed on demand or sale is lost		Can usually wait to receive the product
<b>Difficulty in measuring and controlling quality</b>	Measure and control people and processes instead of products	Measure and control people, processes and products	Measure and control product quality only
<b>High degree of risk</b>	Cost of failure very high; may not be able to make whole or replace the service	Partial replacement is possible	Product can be replaced
<b>Customization of the offering</b>	Customization likely to enhance customer perception of perceived quality	Customization has peripheral effect on perceived quality	Customization increases costs, but unlikely to affect perceived product quality
<b>Personalization of buyer-provider relationship</b>	Relationship at least as important as service	Relationship can play an important role	Product is the focus of the transaction

Some marketing problems are caused to services because of their main characteristic, intangibility. One of these problems is the difficulty of displaying or communicating services. It is difficult to make customers take notice of a product that they cannot see, so, service marketers have to deal with this promotional issue. Due to intangibility it is a challenging task to explain the product's merits to consumers and make them attractive (Douglas Hoffman and Bateson, 1997).

Another problem to deal with is the difficulty of pricing services. Usually prices are related to the production costs of the good, the manufacturing process can be more or less expensive, which will help to decide the final price for the product. The challenge involved in the pricing of services is that there is no cost of goods sold. Consumers are not able to measure a service and they can only use people's recommendations, word of mouth and the physical skills they see in the area where the service is being developed to qualify the service. This difficulty of ascertaining quality by the costumers makes it more difficult to figure out whereas a price is fair.

"The primary cost of producing a service is labor. It is very difficult to place a value on time, especially on someone's time" (Colbert and Cuadrado, 2003).

### 2.2.2. Service quality

Parasuraman, Zeithaml and Berry (1985) defined service quality as "the global evaluation or attitude of overall excellence of services". So, service quality is the difference between customer's perceptions and expectations of services. Nitecki and Hernon (2000) defined service quality in terms of "meeting or exceeding customer expectations, or as the difference between customer perceptions and expectations of service".

There are important reasons to improve service quality, some internal and some external. Douglas Hoffman and Bateson (1997) include in the external forces increasing customer expectations, new government regulation, quality improvements by competing firms, new technologies that allow firms to complete tasks faster and more efficiently and the need to think and act globally.

Maintaining service quality at certain level and improving service quality must be life-time efforts to those companies who desire life-time prosperity in customers' heart (Cronin & Taylor, 1992). Angelova and Zekiri (2011) have argued about the importance of quality in service firms and have demonstrated its relationship with profits, return on investment, customer satisfaction and future purchasing intention. Also, service quality is becoming more and more popular between the different firms, even getting to the point in which a company can be more competitive than the others just because of having this powerful competitive weapon (Berry, 1986).

#### i. Measuring service quality: SERVQUAL

Service quality compares consumer perceptions to what consumers should expect from a service. We cannot see, touch or compare services in the same way we do with products. Gronroos (1983) considers three components of service quality: technical quality, functional quality and

corporate image. Technical quality means if the service was performed correctly or not and can be measured by asking questions of the delivery of the service, if it was taken on time and as expected. Functional quality refers to the way the service was performed, the utility of the same, if it was useful or not to order that service and to test it a simple question to see if the customer was pleased with the service is needed. Finally, corporate image refers to the surroundings in which the service takes place and the atmosphere where it is set. A good way to test it is asking customers about the images they remember from the place, to see if those are the same as the company wanted them to remember. All three components can be measured, but they all have their challenges regarding the methods of measurement. Service quality cannot be measured objectively and remains an abstract concept as it is based mostly on visitor's experience and opinions. As Zeithaml, Parasuraman and Berry (1990) affirmed, "The only criteria that count in evaluating service quality are defined by customers".

A frequently used measure of service quality is the SERVQUAL scale, developed in the USA in the 1980s. It is a diagnostic tool used for most companies to find out their strengths and weaknesses and be able to deal with them (Malhotra, 2007). The SERVQUAL instrument is based on five service quality dimensions chosen from extensive interviews to consumers. Those five dimensions come from the 10 original ones, found by exploratory research done by Parasuraman, Zeithaml and Berry (1985) which were: tangibles, reliability, responsiveness, communication, credibility, security, competence, courtesy, understanding the customer and access. After some factor analysis appeared the final items for the SERVQUAL scale, being three of them the original ones and the other two combined dimensions of the others: tangibles, reliability, responsiveness, assurance and empathy.

- 1- Tangibles: physical facilities, equipment, communication materials and appearance of personnel
- 2- Reliability: ability to perform the promised service dependably and accurately
- 3- Responsiveness: willingness to help consumers and provide prompt service
- 4- Assurance: knowledge and courtesy of employees and their ability to convey trust and confidence
- 5- Empathy: caring, individualized attention the firm provides to its customers

Each of the criteria has statements associated to them, which have a quality score based on a visitors' questionnaire, which was answered according to a scale ranging from "strongly agree" to "strongly disagree" (Likert scales).

The SERVQUAL instrument consists of two different parts, to evaluate and compare the perceptions and expectations of the consumers. Both parts have a 22-item section and their results are compared to arrive at "gap scores" for each of the five dimensions mentioned before. If the gap is large, means that the customer's perceptions are very different from their expectations, so that the quality service of the evaluation is low.

## ii. Service quality in a museum

Quality must be seen from the visitor's point of view. As services are intangible, Zeithaml and her colleagues (1990) suggest that there are five general dimensions that influence customer assessment of service quality in a museum. The first is reliability, that is, developing the service accurately, which they believe to be at the heart of service marketing excellence. When an organization is always making promises to make the museum more attractive or interesting and they later on fail to deliver those promises, it can only disappoint customers. The second dimension suggested is tangibles, such as the appearance of the physical facilities, personnel and communications material. Customers cannot see a service, because of its intangibility, so they need to evaluate what they are trying with the various tangibles (the physical evidence of a service) they can see, that are associated with the service. Tangibles such as the employees' uniforms, the decoration of the organization's building or the publicity leaflets, offer clues about the invisible service. The third dimension is responsiveness, which is the willingness to help customers and to provide prompt service. Related to this issue there are the other two dimensions: assurance and empathy. Assurance means the knowledge and kindness of employees and their ability to be reliable and trustful. Empathy refers to the provision of caring, individualized attention to customers. Each of these three dimensions emphasizes the crucial role of staff in the performance of the service.

Zeithaml and her colleagues (1990) also emphasize the importance of marketing; first, to existing customers to build strong and longer relationships, and second, to empower them to assume responsibility for providing service quality.

### 2.2.3. Customer satisfaction

Several definitions of customer satisfaction have been found in the literature and the most popular one, defined by Grigoroudis and Siskos (2010) "satisfaction is a standard of how the offered total product or service fulfils customer expectations". Another interesting one (Zifko-Baliga, 1998, mentioned by Grigoroudis and Siskos, 2010) defines customer satisfaction as "a standard for how well the customers can predict the performance level at which a product or a service will satisfy them". Kotler (2000), defined satisfaction as: "a person's feelings of pleasure or disappointment resulting from comparing a product in relation to his or her expectations". There are some factors that affect customer satisfaction, such as friendly employees, courteous employees, knowledgeable employees, helpful employees, accuracy of billing, billing timeliness, competitive pricing, service quality, good value, billing clarity and quick service (Hokanson, 1995). This is one of the reasons why customer satisfaction is difficult to measure.

Many companies are approaching maturity in the service sector which makes firms more competitive in the dimension of customer service. Customer satisfaction is not easy to control, as it is often not part of the marketing function, so, sometimes marketing staff do not deal with this issue. Also, it involves more people than just the ones working on customer service, like people who develop

quality controls, staff who modify software applications or salespeople who interact directly with customers.

Customers know exactly how they feel about a service, or about a change made in a service, and take their own conclusions based on their experience. It is essential that they express such opinions and feelings, as sometimes they do not know that this importance will help companies to define their expectations later on.

As Lovelock and Weinberg (1988) warn: "Numerous nonprofit organizations have discovered to their dismay that consumer expectations are higher than management had anticipated, and users demand quality service from public and nonprofit organizations just as they do from private firms".

Companies try to improve customer satisfaction and keep their current customers, rather than looking for new ways of promotion to chase potential new customers. It costs five to eight times (Cacioppo, 2000) as much to get new customers than to hold on to current customers, one of the reasons why customer satisfaction is that important, as the satisfaction of the clients has to be as higher as possible, so that they will come back to the same company again when they want to use the service.

Customer satisfaction is again related to perceptions and expectations. A satisfied customer is the one whose perceptions meet or exceed expectations, the expectations are then confirmed, while dissatisfied customers are those whose expectations are disconfirmed, because perceptions are below expectations. There are two types of disconfirmations, the positive and the negative ones. The positive ones refer to those perceptions that exceeded expectations, meaning that the customer is very satisfied and will result in positive word-of-mouth publicity. Whereas negative disconfirmations are those which perceptions don't reach expectations, and the customer is then dissatisfied and will probably lead to lower or no future purchase and to negative word-of-mouth publicity. Customer perceptions are really important on the theory of "service gaps" (figure 3), which studies the difference between experience and perceptions. Dissatisfied customers are always related to the quality service that they perceive, usually caused by the following gaps (Hill, 1996):

- Promotional gap: inability of the business organization to fulfill expectations created in the minds of customers mainly by marketing communications.
- Understanding gap: the gap occurred due to inaccurate understanding of customer needs and priorities by the managers of the organization.
- Procedural gap: the gap occurred due to the translation of customer expectations into appropriate operating procedures and systems with the business organization.
- Behavioral gap: the difference between customer expectations and organization's performance, focusing on how procedures adequately cover service delivery requirements.
- Perception gap: the difference between customer performance perceptions and reality.

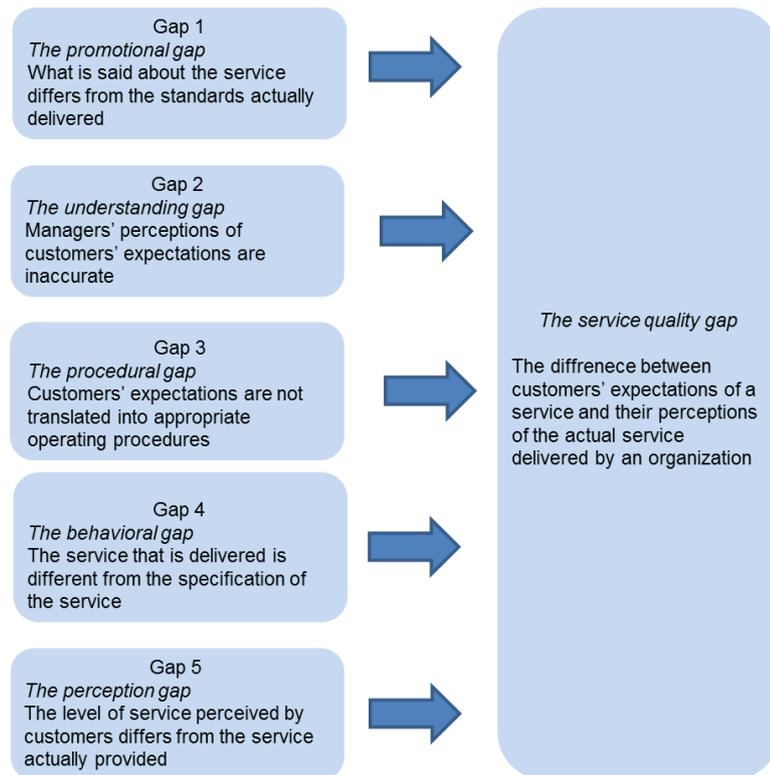


Figure 3. Services gaps (Hill, 1996)

Therefore, improving customer satisfaction is an important task to improve all aspects provided by a service, which are seen by customers, and also those invisible to customers. It is always important to prevent a problem and the best way to handle customer service is eliminating the possibility of problems' appearance.

The best way for measuring customer satisfaction is by using surveys. Customer's opinion and experience are the basics to evaluate customers' satisfaction. For all customer satisfaction research there are three goals (Douglas Hoffman and Bateson, 1997):

- To develop a rank ordering of all the purchase factors customers take into account when selecting a vendor and when deciding whether or not to change vendors.
- To learn how well or poorly the company is performing relative to customer expectations and compared to competitors.
- To identify emerging needs that must be met to maintain or increase overall customer satisfaction.

i. Customer relationship marketing

As it has been shown, customers are changing every day and they are more demanding. They are getting familiar with new technologies and they are constantly asking for changes, new products and new services. Customer Relationship Marketing is a practice that involves those marketing

activities related to establish and maintain customer relationships in a successful way (Angelova and Zekiri, 2011). As maintaining customer relationship has become a key point in companies, relationship marketing develops long-term relationships and improves corporate performance through customer loyalty.

There are several definitions of relationship marketing, such as the one from Gronroos (1983), who thinks that “Relationship marketing is to identify and establish, maintain and enhance relationships with customers and other stakeholders, at a profit, so that the objectives of all parties are met; and that is done by mutual exchange and fulfillment of promises”.

A study developed by Reichheld and Sasser (1990) at the Harvard Business School, showed that most of the customers are only profitable during the second year that they do business with the company. A lot of money is spent by companies in terms of marketing, to advertise them and find out what are really customers looking for. To maintain customer’s loyalty with a company, relationship marketing (CRM) can be used by their managers as the strongest weapon.

Relationship marketing has evolved and it involves in just one concept various streams of marketing which makes it potential (Payne, 1993) and the evolution can be seen in figure 4.

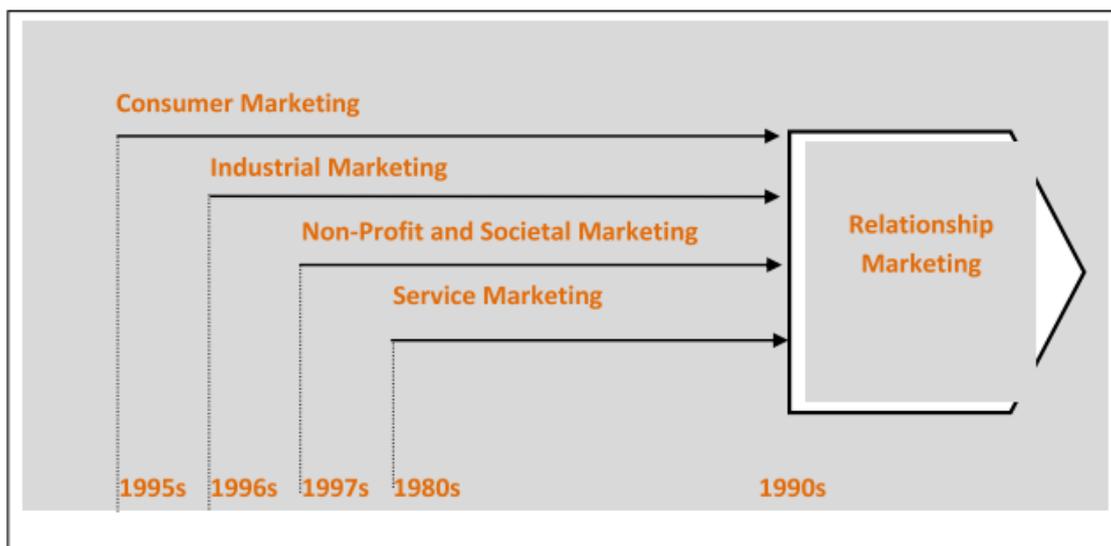


Figure 4. The evolution of Relationship Marketing (Payne, 1993).

## 2.3. Marketing research

### 2.3.1. Marketing research definition and process

Marketing research is “the systematic design, collection, analysis and reporting of data and findings relevant to a specific marketing situation facing a company” (Kotler, 2000).

According to Kotler (2000) there are five steps involved in marketing research (figure 5): Define the problem and research objectives, develop the research plan, collect the information, analyze the information and present the findings.

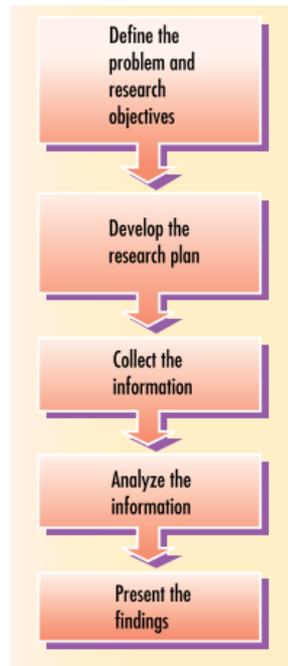


Figure 5. The marketing research process (Kotler, 2000)

### 2.3.2. Definition of the problem and research objectives

The problem must be defined, not in a very narrow or broad way (Kotler, 2000). If it is too narrowly defined, it might be difficult to find the exact information that is needed. On the other hand, if the problem is too broadly defined, a lot of unnecessary information will be collected.

The researcher must understand the complete problem and he/she should perform a situation analysis of the problem area and the circumstances surrounding it (Hair, Bush and Ortinau, 2006). This tool means to focus on collecting the background information to identify the events and factors that have led to the current problem situation.

As a fundamental part of the problem definition, there is the determination of the unit of analysis, which will provide direction in later activities like sampling and scale development (Hair, Bush and Ortinau, 2006).

There are different types of research (Kotler, 2000):

- Exploratory research: the aim is to reach the real nature of the problem and later on be able to suggest new ideas and solutions.
- Descriptive research: it seeks to get to certain numbers or magnitudes.
- Causal research: its goal is to test cause-and-effect relationships.

There is also the quantitative research (Conybeare, 1991), which is used to determine empirical, statistical relationships. This research usually assumes a high degree of generalization of the outcomes and relies on principles of statistical testing. It is based in objectivity and it is faulted to force

individuals into rigid categories (Miles and Huberman, 1994). Researchers of quantitative research let the data speak for itself, without any involvement or judgment other than the revelation of what the numbers say. Their methods are detailed plans of operation with predetermined hypotheses, usually using statistical sampling techniques to survey representative samples that allow them to generalize the population that was being studied.

It cannot be confused with qualitative research, whose aim is to achieve understanding, whereas the main objective of quantitative research is prediction (Sechrest and Sidani, 1995). Qualitative research is mainly based in subjectivity and often labeled as soft and unscientific (Pope and Mays, 2002). Researchers want to capture life as it is lived, by watching people in their own settings and interacting with them, as they believe that to understand a phenomenon the best way is to study it in its context and be immersed in it (Denzin and Lincoln, 1994). The methods they use are more flexible than quantitative research, as they do not use a structured survey with fixed questions, as they try to become more familiar with the area of the subject of study, they let the questions to emerge and change.

Quantitative researchers criticize qualitative researchers for being shaped by prejudices, views and beliefs of the researcher and for being too particularistic, focusing closely in the individual behavior not being able to generalize it and make connections with larger situations (Denzin and Lincoln, 1994). In contrast, qualitative researchers criticize quantitative research arguing that human behavior and experience cannot be described with numbers or by measuring and controlling variables.

### 2.3.3. Development of the research plan

This step deals with the creation of a plan to get the information needed for the further study. An estimated budget should be developed to get an idea of the cost of the research, especially if it is referred to a company. Developing and designing the research plan involves taking decisions on data sources, research approaches, research instruments, sampling plan and contact methods (Kotler, 2000).

#### i. How to collect data?

The researcher can collect primary data, secondary data or both. Primary data is gathered only for a specific project or research, whereas secondary data refers to information already collected for another purpose that at the moment exists somewhere (Kotler, 2000). It is usually common to start with secondary data, to examine the problem and see if it can be partly or wholly solved without collecting primary data, which is costly. Secondary data provides a starting point for research and it has advantages like the instantly availability and the low cost compared to primary data (Churchill, 1995). When the needed data does not exist or it is inaccurate or incomplete, the researcher will need to collect primary data (Kotler, 2000). Primary data can be collected in different ways:

- Observation tools: it refers to trained observers that use their senses or some electronic devices to observe and record physical phenomena (Hair, Bush & Ortinau, 2006).
- Focus-group tools: is a gathering of a group of people who spend some time with a skilled moderator to discuss about a product or a service of a company (Kotler, 2000).
- Survey research: self-administrated questionnaires that are designed to let the respondent take the roles of both interviewer and respondent and are usually administrated to know about people's knowledge, satisfaction, beliefs and preferences (Hair, Bush & Ortinau, 2006).
- Interviewers: people that ask respondents specific questions and accurately record their responses, usually using high-technology devices (Hair, Bush & Ortinau, 2006).
- Behavioral data: customers leave evidences of their purchasing in store scanning data or customer databases and it reveals their real preferences by analyzing this data, which is usually more reliable than statements they offer to market researchers (Kotler, 2000).

## ii. Instruments of research

There are mainly two types of instruments of research when collecting primary data: questionnaires and mechanical devices (Kotler, 2000).

Questionnaires are tools of data collection that consist on getting answers to some written questions directly from the studied respondents (Murillo, 2009). Questionnaires are the most common instrument used to collect primary data mainly because of its flexibility (Kotler, 2000).

One major advantage of questionnaires is their ability to accommodate large sample sizes at a low cost, which increases the demographic flexibility of the research (Hair et al., 2006). The data collected using this method can be analyzed in many different ways depending on the diversity of the variables and can also be based on multiple variables. Questionnaires also facilitate the collection of standardized data, as all the respondents have to answer to the same set of questions and this allows direct comparison between respondents (Hair et al., 2006).

There are four main areas that can be extracted from a questionnaire delivered in a museum ( McLean, 1997):

- Levels of use, which include variations over time and space.
- Characteristics of the visit, where two aspects are included, both the visit itself and also the characteristics of the trip.
- Characteristics of the visitors, from where the museum can learn about their visitors' profile.
- Publicity information, as the media profile can be determined for publicity purposes.

Mechanical devices are only used occasionally in marketing research. Galvanometers, for example, are used to measure the emotions caused by staring a picture or an ad (Kotler, 2000). An audiometer can be attached to participating homes televisions to record when it is turned on and which channels they are watching (Kotler, 2000). As it is seen, they are very specific devices for specific research and are usually much more expensive than questionnaires.

### iii. Sampling plan and contact methods

After deciding the research instruments, the researcher has to create a sampling plan, which has different steps that require taking some decisions (Hair et al., 2006):

- Define the target population: it is the first step and consists on determining the group of objects or people to be investigated.
- Select the data collection method: using the information from the problem definition and the research objectives, a method for collecting data is chosen.
- Determine necessary sample sizes and overall contact rates: deciding how much time is available to collect the data as well as the number of ended questionnaires that are necessary for the study. Usually large samples give more reliable results. However, it is not necessary to sample the entire target population to achieve reliable results.

Once the sampling plan has been created, the next decision to be taken is the way respondents are going to be contacted. There are many ways of contacting for questionnaires and interviews.

The mail questionnaire is usually very common, and one of the best ways to reach who would not give personal interviews or whose answers would not be reliable because of the insecurity of being interviewed. These questionnaires are very clear and simple and easy to elaborate but unfortunately the response rate is usually low or slow (Kotler, 2000). Furthermore, some restrictions can be added, like compulsory answers, which will make respondents complete the whole survey before sending it.

Telephone interviewing is a very quickly method to get the information instantly and it is a very clear method, as the interviewer can clarify every question that is not being understood but this method is getting more difficult because of telemarketing and answering machines (Kotler, 2000).

Personal interviews are the most versatile method, as the interviewer can ask more questions and take into consideration other aspects like the dressing or the body language, apart from the answers, that can also be recorded to analyze them later on (Kotler, 2000). It is the most expensive method, requires more administrative planning and it is usually more time consuming.

Another method is online interviewing, which usually refers to a questionnaire included on a web page that offers an incentive, like a price or a raffle to participants. This information can be useful for exploratory research in suggesting hypothesis that can be analyzed and investigated with a subsequent survey (Kotler, 2000).

#### iv. How to create a questionnaire?

“The success of a survey lies in the design, as it should be well planned and carefully executed” (Conybeare, 1991).

When preparing a questionnaire, the researcher has to choose not only the questions, but the form, wording and sequence (Kotler, 2000). The questionnaire should be concise and have clear instructions explaining how to complete it (McLean, 1997). It must have a little explanation about the survey's field and purpose and the instructions to be completed (Murillo, 2009). The instructions should be defined very accurately, as they are essential to get the correct answers from the respondents and be able to analyze them afterwards. Another important aspect to take into account when creating a questionnaire is that, even though it might have a lot of questions, it has to seem that it is a short survey in order to motivate as much people as possible to complete it (Murillo, 2009).

The questionnaire should be concise and the questions should kept simple, above all avoiding ambiguity and being specific (McLean, 1997). It is recommendable to keep the demographic and personal questions until the end, since they can be sensitive (McLean, 1997). There is an important differentiation related to the questions format in a survey, structured or unstructured questions (Hair et al., 2006).

Unstructured questions are open-questions that allow the respondents to answer using their own words, having all the freedom to reply, as there is no limit or predetermined answer (Hair et al., 2006). Usually these questions require more effort from the respondents and it is sometimes difficult to get a complete answer.

Structured questions are closed-ended questions that require the respondent to choose a response from a list of answers or scale points (Hair et al., 2006). This type of questions reduces the effort from the respondents and is easy to analyze by the researcher, as all the answers are limited.

Murillo (2009) divides the types of questions into 4 different groups, two of them open-questions and the other two close-ended ones. There are closed dichotomist questions, which means that there are only two answers available being yes or no and closed categorized questions, that are the ones in which the respondent has to choose between some presented answers or scale points. For the open-questions, there is a distinction between numerical answers, where only a number is required or the common open-questions, where the respondents have the complete freedom to answer following their own criteria.

The last step to end the questionnaire is its validation. “It is essential for a questionnaire to be piloted on a sample of respondents, as this will allow several potential problems to be predicted” (Fitzpatrick, 1991). The easiest way is usually to find a close friend or member of the family that has similar characteristics or behavior as the future respondents of the survey and see if there is any ambiguity or if the questions are well written (Murillo, 2009). For a more significant and critical opinion about the questionnaire it can also be asked to a group of experts in questionnaires to test it and

change the possible mistakes or misunderstandings that might have. After the validation, the questionnaire is ready to be completed.

#### v. Attitude scales: Likert scale

There are tools used to measure different characteristics about the social life as objectively as possible (Murillo, 2009). The basis of this procedure consists on asking the respondents to indicate from a list of items or statements which ones they accept or prefer. There is no good or wrong answer on this type of tests and there are always two opposite responses and eventually some neutral (Murillo, 2009).

According to Murillo (2009), there are different types of attitude scales, like the pointing scales, where the respondent has to punctuate (usually from 1 to 10) depending on their degree of acceptance. There are also the order scales, where the respondent needs to order the statements or objects following their tastes. Scales of social distance are also common, like the Bogardus scale, which is used to measure the intensity of the prejudices towards a certain nationality or ethnic group.

A very used attitude scale is the Likert scale. This scale asks respondents to indicate the extent to which they either agree or disagree with a series of behavioral statements about a given object or service (Hair et al., 2006). It is thought that Likert scales can measure a person's complete attitude, but in fact it can only capture the cognitive components of a person's attitude (Hair et al., 2006). Also, the responses on the Likert scale have a rank order, but the intervals between values cannot really be assumed equal (Jamieson, 2004). This type of scale is very useful for self-administered surveys or other online methods to collect data and it is not used on telephone surveys, as it is difficult for the respondent to remember all the degrees of the scale (Hair et al., 2006).

#### 2.3.4. Collection of the information

When collecting information, especially with surveys, it is very common that some problems arise; like that respondents are not willing to collaborate or they leave the survey uncompleted or are just not being honest with the answers (Kotler, 2000). Though, thanks to technology, data collection is improving and can be done rapidly with "robot" interviewing by the internet or the telephone.

#### 2.3.5. Analysis of the information and presentation of the findings

This step of the marketing research refers to the extraction of findings from the collected data. Usually averages and measures of dispersion are computed for the major variables and some advanced statistical methods might also be applied like factor analysis (Kotler, 2000).

The last step in the marketing research, the results are presented and relevant decisions facing the management of the service or the company are taken (Kotler, 2000).

### 2.3.6. Marketing research of museums

Marketing research can describe the marketing environment, which will be useful for museums management, as it is always important to know and be conscious of the environment in which a company is working (Kotler and Kotler, 1998). It will help museums to collect data, important for a company to decide if strategy changes are needed or not and operationally it can be used to predict with some accuracy the consequences of a price increase (Kotler and Kotler, 1998).

Even though marketing research can be very useful and helpful for museums, there is still some resistance to it in museums, according to Kotler and Kotler (1998):

- **Cost:** museums still see marketing research as an expensive undertaking, but as it has just been observed, there are low-cost ways of effective research, like volunteers or staff doing a focus group or people just observing visitors. Once managers are conscious of the benefits that well-planned and well-executed marketing research can provide to the museum, they will ask for a budget for it.
- **Technical knowledge:** museums are sure that because of their lack of technical aspects in research they will have to hire marketing personal to develop the research. But their unfamiliarity with this world can be solved by learning the easiest and simplest principles of sampling, questionnaire design and interpretation of results. It is essential for the museum staff to know whether the museum's research needs are being adequately satisfied.
- **Professional resistance:** Some of the museums managers think that the museum's mission might be altered by applying marketing research and might be afraid of it. But marketing research can help the museum adding excitement and interest to their visitors, an approach to stimulating public interest in a specific area of art.

## 2.4. Technology in museums

The basic principles of contemporary museums were established in the 20<sup>th</sup> century, according to Carrozzino and Bergamasco (2010) "museums should be able to become a privileged tool for communication, assisting the cultural experience and, whenever opportune, making use of technologies".

### 2.4.1. Use of new technologies in museums

Technology is developing so quickly that new developments in security, environmental controls and documentation are becoming significant for the collections, especially when talking of computer technology, which facilitates our daily working lives (McLean, 1997). When referring to new developments or technologies it means basically two types of technologies, ones that are visual and put the image at the center of the communication and interactive technologies, which demands the collaboration of the visitors by acting or making a choice (Carrozzino and Bergamasco, 2010). In these

interactive technologies, the users observe and perceive the object by means of their senses but control it through their movements, what makes the object usually more attractive to them.

These new developments are welcomed by the museums but also present some problems. Curators, designers and museums managers are constantly dealing with the difficulties in designing interactive resources that are easily accessible and not too complicated to be used by a highly diverse population with different interests that might want to spend some time alone or discuss with others (Lehn, Hindmarsh, Luff & Heath, 2007).

“Looking for a new technology to keep up with the demand is one of every museum’s goals and motivations” (Verdaasdonk, Van Rees, Stockmans, Van Eijck and Verboord, 1996).

i. Audio guidebooks and Sotto Voce

Museums have employed since the 1950s portable electronic guidebooks and have kept being a subject of research and development in the museums’ world and still raise many design challenges (Grinter, Aoki & Hurst, 2002).

One of the main challenges is the physical delivery of the information and content given by the device. Only two options were studied for the moment, the first one is to use open speakers, which are only used in children’s or interactive museums (Grinter et al., 2002). In other types of museums, where noise making might not be pleasant, the audio content is delivered with earphones, which usually have to deal with a problem for visitors, their companions (Grinter et al., 2002). As a result, audio guidebooks can isolate visitors from their companion, as they can be seen but not easily heard (Martin, 2000). It is not enough, then, to design a useful device for individual visitors, as usually museums visits are social. The design challenge appears from what visitors exactly need, by understanding what visitors like to share experiences when visiting a museum (Grinter et al., 2002).

After doing some research in this field some new devices were developed improving the classic audio guidebooks. Sotto Voce was one of these developments, the most completed and efficient one, which is designed to support social interaction between visitors and their companions (Grinter et al., 2002). The mechanism was designed to let visitors wearing earphones share the content they were hearing in a similar way (figure 6). According to Grinter et al. (2002), “Sotto Voce can be described as content-centered audio media space, one that allows two visitors to coordinate their playing of audio descriptions”. The main advantage of this new device is the combination of the use of audio both for awareness and sharing an experience. Sotto Voce is not a communication system, as it does not provide a mechanism for talking (Grinter et al., 2002).

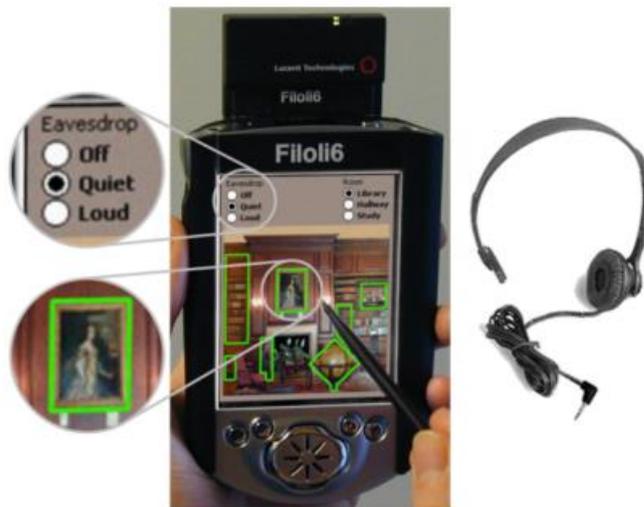


Figure 6. Electronic guidebook and headphones (Grinter et al., 2002)

Sotto Voce has a high degree of mobility, what gives to visitors the freedom to move from one collection to another and explore the museum remaining relatively co-located, always remaining in the same setting, the museum, which is the only space constraint (Grinter et al., 2002).

The aspect that really differentiates Sotto Voce from other devices is the fact of supporting interaction among visitors. Regarding the need of visitors of sharing their reactions after listening to descriptive information together and at the same time having control over their experience, Sotto Voce strikes a balance between these two (Grinter et al., 2002).

Nowadays, some other technological devices are used, such as mobile augmented reality systems. This device has an image recognition technology based on the mobile Augmented Reality (AR) guide method designed by Zhang, Hou and Chang (2012). It employs a lens on the device to recognize the real appearance of a painting, which allows visitors to get information about it. It promotes the interactivity between visitors and lets them widen their knowledge in a specific painting.

There exist two types of systems. The painting guide consists on positioning the camera lens of a mobile device in front of the artwork, so that it recognizes the whole picture and later on it allows them to view or listen to the corresponding commentaries about the painting that would guide them in observing the painting carrying out descriptions, art appreciating instructions or its impressions (Chang, Hou, Sung, Chao & Lee, 2014). The other system is the painting observation, which permits visitors to focus on localized scopes of the painting by the usage of operating functions of zooming and provides localized descriptions of the artwork and detailed explanations. It also assists visitors to analyze the form of the painting and obtain the meaning of the image.

## ii. Smartphones

“An extensive research and adoption of mobile and smartphone in cultural spaces has shown significant impact to the visitors, particularly on the visitors’ engagement, learning, as well as their interaction with the museums’ multimedia guide” (Othman, Petrie and Power, 2013).

New technologies such as smartphones can make the museum one of the more attractive and more accessible places to spend time at, as they are important tools to promote opportunities of learning in cultural spaces (Othman, Petrie and power, 2013). Many different options can be developed with smartphones, like audio and multimedia tours, multimedia presentations and video guided tours, which can enhance visitors for being the providers of free choice learning (Vavoula, Sharples, Rudman, Meek & Lonsdale, 2009).

The main doubt that museums face with when creating an App for smartphones or any of the different options mentioned before, is the way in which it is going to be used, as the device can be displayed by the museum or every visitor can bring their own device and just download an App or a program. The main advantages of using their own device are the visitor’s familiarity with their personal smartphone instead of having to learn the functioning of a new device (Bautista and Wallis, 2012). It is also beneficial for museums, as they save money by not having to purchase devices for their visitors and it is also easier for them to upload information (Bautista and Wallis, 2012). Using personal smartphone can help museums to communicate, as visitors can share their experience and expand it outside the museum (Lehn & Heath, 2005). This happened to the Museum of Fine Arts (MFA) in Boston, where a program was designed in 2009 to use only wirelessly in the museum, and it enables visitors to download images of the museum’s collection to be used as mobile wallpapers and the MFA really believed that this service would enhance visitors and would also expand the visitor’s experience beyond the doors of the museum (Bautista and Wallis, 2012). Furthermore, the fact of having the information in their own devices can motivate visitors to keep looking for information or keep learning once they have left the museum, what can encourage them to come back.

Some disadvantages are also regarded, like the danger of letting visitors alone with the smartphone that can easily distract them instead of appreciating the art they have in front of them (Bautista and Wallis, 2012). Another important issue is the fact that downloading podcasts on their devices requires a planned visit ahead before going to the museum, which is not always pleasant for younger visitors, which are going to be ones that favor these devices (Bautista and Wallis, 2012).

However, some cultural institutions are not willing to adopt new available technology because of their fear to failure. One of the main reasons might be a lack of understanding visitors’ needs and expectations, which, as shown before, are the main points to take into account to make an improvement in a museum (Othman et al., 2013).

## iii. Interactive devices

“Interactive devices are used to support the interpretation of exhibits as well as to increase the appeal of museums to the public” (Lehn & Heath, 2005).

Technological research has encouraged managers of art museums to add electronic devices to their collections, mainly PDAs, touch-screen computers and Quick response (QR) codes, as researchers are studying how to increase the time visitors spend in a museum as well as how to provide them with additional information to facilitate interaction between visitors and exhibits (Grinter et al., 2002).

Evaluations of different kind of devices have shown that more time is spent in museums when visitors have those devices and also interaction and discussion between visitors or companions is promoted (Heath & Lehn, 2005).

PDA's were portable devices used to select objects by touching the small screen that displays information. The visual content like multimedia, text, images and videos appears on the screen, while the headphones deliver the audio information (Heath & Lehn, 2005). Despite the mobility of PDA's, usually the visitor stands in front of the object, in a stationary position while listening to the information and later on examines the object according to the explanation that has just heard, following the suggestions and advices given in the PDA. This is why, sometimes, the PDA can become a substitute to the authentic object (Walter, 1996). A study showed that visitors using PDA's are usually not aware of events in their local as they seem desensitized from other people and the environment where they are, being sometimes an obstacle for other visitors (Heath & Lehn, 2005). Although being very useful and popular some years ago, nowadays PDA's are not very common in museums, as they have been substituted by smartphones and tablets, where Apps can be downloaded.

There is also a huge interest in museums in using fixed displays to provide information about the exhibits as they present significant advantages like letting visitors to select different types of information by different media and the usage of complex materials such as pictures or short films (Thomas & Mintz, 1999). In the British Galleries at the Victoria and Albert Museum they have installed a small numbers of these fixed screens (figure 7), called information kiosks that illustrate the design and operation of the exhibit using a short film that starts with the touch of the screen (Heath & Lehn, 2005).



Figure 7. Visitor reading the information at the information kiosk (Heath & Lehn, 2005).

However, when the museum is very crowded, it becomes difficult to examine the exhibit and watch the video on the fixed screen, so, it is very common to take only a rapid look to the exhibit while the video is being displayed and it is not surprising therefore to see that in some cases the display becomes a substitute of the object (Heath & Lehn, 2005).

Both devices reveal that visitors who use them spend more time in the exhibits and usually are first attracted for the device rather than the original object and usually create a social interaction and talk among visitors (Heath & Lehn, 2005).

Most museums have only a little explanation on the plaque of the exhibit, which sometimes is not enough to understand the object if you are not well versed in the subject. The answer to this problem in museums is not to put a bigger plaque, as it would not be physically attractive and would not be comfortable for crowded days, but QR codes can help to improve the visitors' experience (Boyle, 2013).

QR codes were developed by Denso Wave in 1994 and are similar to bar codes which are capable of storing a higher capacity of information (Schultz, 2013). To use a QR code it is necessary to have a smartphone, iPod, netbook or similar with a camera, a QR reader App and usually access to Internet. They are also very common in museums and they encourage a more participatory visitor experience as when they are read each provides different data, like videos, images or background information (Bautista and Wallis, 2012). Technical support and good-planning are important issues when installing QR codes.

The usage of QR codes can be very diverse; it is common to find them next to the exhibits, e.g. to give information about them or show a video of the artist while creating the object. There are also QR codes found in the entrance of the museum that link up to social networks such as Facebook or Twitter (Schultz, 2013). In the Museum of Inuit Art, in Toronto, they also locate them next to some special exhibits, enabling patrons to leave comments or ask questions that will be answered by the artist afterwards via a blog (Schultz, 2013). At the entrance of the museum they have a sign which explains what QR codes are and how to use them.

#### iv. Virtual reality

“Virtual reality (VR) can be properly defined as a complex technology which exploits more low-level technologies in order to create a digital environment which users feel completely immersed inside, and which they may interact with” (Carrozzino & Bergamasco, 2010).

Because of its unique characteristics of immersion and interaction VR is very commonly used in specific sectors. Depending on the levels of immersion and interaction various types of VR systems can be regarded, but all with the common characteristic of participants getting immersed into an artificial world (Styliani, Fotis, Kostas & Petros, 2009).

# Interaction

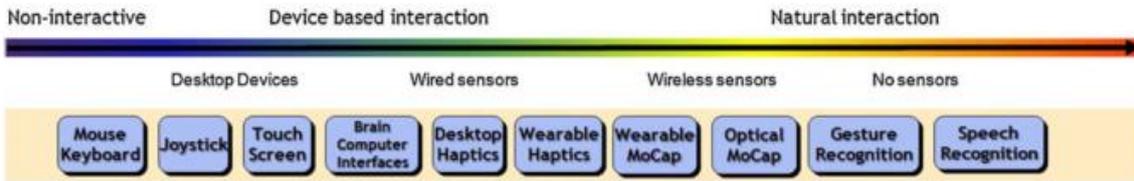


Figure 8. Classification of VR devices depending on their degree of interaction (Carrozzino & Bergamasco, 2010).

When talking about the interaction, three categories can be found (figure 8): non-interactive, device based interaction and natural interaction. The index in this classification is placing systems from a lower to a higher level of interaction, from devices which need a high degree of mediation to devices that recognize human behaviors up to those having a direct correspondence with human actions (Carrozzino & Bergamasco, 2010).

Some of their uses, which are essential in museums can be to preserve damaged artworks or used as an assistance tool for restoration actions without affecting the original object. Apart from this, the main uses of VR are for learning or divulgation tool as information is shown by sensorial feedback (images, videos, sounds...) which makes it more attractive to visitors (Carrozzino & Bergamasco, 2010). VR is not often used to communicate the existing art-works, though; it is commonly used as a means to create new forms of art (Carrozzino & Bergamasco, 2010).

The idea of a virtual museum was introduced in 1947 by André Malraux, who created the concept of an imaginary museum, without walls, location or spatial boundaries being surrounded by the objects and information (Malraux, 1996). Virtual museums need high-resolution images to provide as much information as possible but usually these kinds of digital images produce very large files due to the high level-of-detail, which sometimes is difficult to manage and to transmit across networks (Styliani, Fotis, Kostas & Petros, 2009). It is an important issue that museum researches are dealing with nowadays.

Heim (1993) considers weak VR as those systems which have the appearance of a 3D environment but are displayed on a 2D screen, whereas on the other hand, strong VR refers to the total sensory immersion that might include immersion displays and tracking and sensing technologies.

3D games are also developed and they provide superior visualization and physics support. They are a new concept of education and learning and areas of communication, visual expression information, interactivity and entertainment take place in this system. The main backgrounds are that they can not be supported by mobile devices like smartphones and that the installation and design require very technical and advanced programming skills (Styliani et al., 2009).

An important difference regarding traditional museums and virtual museums is the fact of not being able to touch the objects, only observe them, which is an impediment to blind and visually impaired users. Through VR, the Museum of Pure form has been developed, a project that offers art as a way beyond such limits (ifugre 9) by giving the opportunity of experimenting haptic perception for the exhibits (Carrozzino & Bergamasco, 2010). This system allows users to perceive tactile stimulation, giving them the real feeling of touching the surface being visualized in the space beneath their own hands (Carrozzino & Bergamasco, 2010).



Figure 9. Museum of Pure Form, full immersive installation (Carrozzino & Bergamasco, 2010).

#### 2.4.2. The technology acceptance model

Bailey and Pearson (1983) identified 39 factors that could influence user satisfaction. After such a long list, other researches tried to abbreviate it to make it more practical, like Cheney, Mann and Amoroso (1986) that separate the factors into three groups: uncontrollable, partially controllable and fully controllable. It was not until 1989 when Davis (1989) and Davis, Bagozzi & Warshaw (1989) proposed and developed the Technology Acceptance Model (TAM) to address why users accept or reject information technology. TAM assumes that technology acceptance can be clarified by individual's beliefs, attitudes and intentions (Ibrahim, 2014).

The TAM comes from the Theory of Reasoned Action (TRA), which affirms that “favorable attitudes produce positive decisions concerning the behavior of interest” (Ibrahim, 2014). The TRA is used to explain the person behavior across different circumstances and it was developed by Fishbein and Ajzen (1975). The TAM states that there are many factors that influence a user when using a new kind of technology (Khee, Wei Wei & Jamaluddin, 2014). However, Davis (1989) assumes that the acceptance of an individual's information system can be determined by two variables: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU).

Davis (1989) also affirmed that “researches should explore additional factors that influence technology use”. Nowadays, according to Lee, Kozar & Larsen (2003), TAM's four major variables are: PU, PEOU, Behavioral Intention (BI) and Behavior (B).

The results of an investigation in the Greek University, according to Khee et al. (2014), showed that the main factor for adopting Moodle was the relation of ease of use and usefulness. Lim & Ting (2012) also developed a study on how consumers form their attitudes and their intentions with online shopping, getting as a result that PEOU had a really positive effect on the attitude towards online shopping and that online shoppers' attitude was predictable due to technological tools on the website.

# CHAPTER III: METHODOLOGY AND DATA COLLECTION

## 3.1. Methodology

The purpose of this research is to understand the interest of communication technologies and other technological devices used in cultural institutions such as museums. It is important to know both customers and museums' interests, in order to offer a service according to their needs and interests. Preliminary research was first developed in the field of museums and technologies. This means reviewing literature and performing exploratory research with a qualitative approach by the development of in-depth interviews in museums.

Firstly, to have an understanding of the museum's field and their attitude towards technology, two in-depth interviews took place in Lisbon, in the Berardo Museum and in the Gulbenkian Foundation.

Once the interviews were developed, some conclusions were taken, as well as useful information. The next step was the creation of a questionnaire related to the feelings and the attitude that people had when visiting a museum, concentrating in one target, students. The purpose of this first questionnaire is to study the preferences visitors have in terms of technologies when visiting a museum and also their motivation and opinions about the different electronic devices that can be found in a museum to see if they are satisfied with them.

Finally, after analyzing the first questionnaire, a second questionnaire was created for museums. This one has the objective of understanding the museums' feelings towards technology and be able to make a comparison between their opinions and the students' ones.

For the analysis of the data collected, a factor analysis and a linear regression were developed for the first analysis, according to the different variables that had previously been defined. For the second questionnaire a general statistical analysis was developed for the results.

### 3.1.1. Research questions

The aim of this research project is to widen the knowledge in the museums' field. One of the objectives is to understand their behavior when facing technology and their attitude towards it. It is inevitable for museums to take technology into consideration and have some preferences or others when having to decide in which type of technology to invest.

After the analysis of this study some questions should be answered and interesting conclusions should be taken from them. For example, the type of technologies in which the museums are more interested or their preferences on the ways of diffusing information about their collections. These are important issues to be considered and solved along this research, as they really focus on

the attitude that museums have towards technology. Nowadays many different types of technologies exist, some that are more “traditional” than others that have just arrived to the market, thus by identifying which type of technologies they are using or would like to use it could be reflected their attitude towards technology. There might be differences among museums and it will be interesting as well to see them and take the corresponding conclusions to explain them.

However, this research is not only focused on the museums’ point of view, but also in the visitors’. As it has been mentioned before, part of this research has focused on students, which are the new generations that will be arriving to museums. Some questions about their behavior in terms of visiting museums and their preferences should also be answered with this study. Above all, students’ favorite types of technologies. Also there might be some factors that really affect their attitude towards museums or some motivations that they might have related to the types of technologies when visiting a museum. The main research questions are:

- Is technology important for museums?
  - a) Perspective of museums
  - b) Perspective of a young segment of (potential) visitors

These questions are expected to be solved and clarified, as well as the preferences that both museums and students have in common as well as the matters in which they differ.

With this research it is expected to achieve the responses to the questions mentioned before as well as to extend the knowledge about museums and the use of technologies.

### 3.1.2. Interviews to museums

The little research that is referred to people’s museum experiences is extensively based on interviews (Goulding, 1999). This data collection method was used in the present research for the initial exploratory stage.

Two in-depth interviews were administered for this research, of twenty minutes each. Considering the museums of Lisbon, two of them were selected, being one the Gulbenkian Foundation and the other one the Berardo Museum. The Gulbenkian Foundation was chosen, as it has some interesting technologies addressed to customers that were perfectly noticeable when visiting it. The Berardo museum was chosen because it has a lot of temporary exhibitions and it was interesting to know how they could manage this issue with technology.

The same questions were asked to both museums, arising from the literature review and attempting to better understand the attitude of museums towards technology and their perspective of the visitors’ opinions. Both museums were from the first minute willing to collaborate with the study.

i. Berardo Museum: “technology as a way to communicate”

The Berardo Museum is specialized in modern and contemporary art. There is always a permanent presentation of the Berardo Museum collection and some other temporary exhibitions where works by artists from different backgrounds built the art history of the last century. The temporary exhibitions help the Berardo Museum to focus on specific artists or art contexts, so that this can enable the museum to expand new perspectives of a certain period as well as the new practices and attitudes that define the present art. It is internationally acclaimed as a significant art collection with works of excellence that allow visitors to see the main artistic movements of the twentieth century. It has more than 900 works showing more than 70 artistic tendencies, what reflects that it is not a static collection as it allows different art readings of contemporary art and it has a high didactic nature and richness on its content.

The interviewer was the Marketing and Events Manager of the Berardo Museum.

- Technologies at the moment

At the moment they are not using any technological device in the museum. However, to spread information about the exhibits they use:

- Facebook
- Instagram
- Twitter
- Website
- Youtube Channel
- Google Art project (website that contains a high number of images of pieces of art from museums all over the world and they are shown like a virtual gallery)

Those social networks are being used to communicate the program that they are having at the museum and the type of exhibition that they are having or they will have later on. They are especially useful to get to a new target that is not used to go to museums and need more communication and advertisement of what is going on in a museum.

The results of the creation of social networks cannot yet be perceptible, as they have developed them during the last year, but at least they are getting more visits to their pages and website and more pictures of the museum are being uploaded. This means that there is a real interest of people when going to a museum to visit social networks before and during their visit and that it attracts people and creates an interest to use them.

- Future technological plans

In the future the Berardo Museum is planning to develop an App for the permanent exhibition they have, like a guided tour to give more information to visitors in order to guarantee a better understanding.

- Constraints

Due to the temporary exhibitions that they have during the year and because their permanent collection is changing every month as they lend some of their objects to other collections, it makes it difficult and expensive to create an App with more up-to-date information about the exhibits. This is the main constraint they have to deal with and solve to keep on progressing on the technological field.

- Attitude towards technology

To conclude they explained that: “We are working on technology so that every time that people look on the internet what to see in Lisbon, the Berardo Museum appears as an interesting thing to do and we do it especially when important events are taking place in Lisbon”.

Summarizing, the Berardo Museum regards technology mainly as a way to communicate with people that are not used to go to museums and might find it interesting if they know exactly what kind of exhibitions are they having. “Technology is vital for this kind of communication”.

## ii. Gulbenkian foundation: “technology as a way to attract people”

The Calouste Gulbenkian Foundation was established in 1956 as a Portuguese foundation for the humanity, according to Calouste Sarkis Gulbenkian will in order to promote knowledge. The main objective of the foundation is to promote the quality of life throughout education, arts and science. All the objects and exhibits are from Calouste Sarkis Gulbenkian, who demonstrate his passion for art at an early age and had this collection that was growing year after year. It presents more than 1000 objects in the museum and its focus areas are: art, education, science, development and global initiatives.

The interview was done with the assessor of the graphic arts’ collection of the museum.

- Technologies at the moment

At the moment they are using some technological devices:

- QR codes

- Fixed tablets with information
- Classic audio guides
- App (Application to download on a smartphone, which informs about the collection, curiosities of the founder and some news about the foundation)

It is observed that in this museum they are more used to technology and that they don't use it mainly to communicate, they have other purposes and aims to reach with it. They say that classic audio guides are very useful at the moment, although they only have them in Portuguese and English and the tablets and QR codes are also very helpful for people that want to get more information from the exhibits.

The social networks that they use, like facebook, twitter, Instagram and youtube, are also used to communicate and inform people about their exhibits and they also think that they are essential for this purpose, to get to know new objects or collections that they will have.

- Future technological plans

In the future they are planning to create an App for a new exhibition that they are having in a few time which will give more information about the exhibits and will be only be downloaded to their own tablets that will be delivered in the entrance of the museum. They are also planning to use a multimedia kiosk, like an informal panel at the entrance of the museum that welcomes visitors electronically and can help them to plan their visit. They will be big panels with information about their collection, so that visitors can have a good impression when entering in the museum. They will also have a mini kiosk that can be moved from one exhibit to another to give additional information to visitors.

- Constraints

In the museum they have received some complaints about lack of information in the exhibits, which they are going to solve by adding a little text next to each object with curiosities and thoughts that the collector, Mr. Gulbenkian, had when he acquired the objects. The main constraint that they have to face nowadays is that the building is very old and Wi-Fi is limited, this is why they are planning to create Apps, so that they are already downloaded and not much Wi-Fi is needed.

- Attitude towards technology

The Gulbenkian foundation believes that it is important to be careful of the amount of technology that it is being used in a museum because the visitors must not lose the feeling of experiencing the real object, not virtually. "People sometimes tend to look to mobile phones or other devices instead appreciating the real art that they have in front of them. It is difficult to find the balance".

To conclude, the Gulbenkian foundation uses technology as a way to reach all publics, by employing new and modern devices and applications that can attract different targets that could not be adequately reached without technology. "Different types of technology can be together, because it is important to reach all kind of publics, and to substitute one for the other would exclude a lot of people. We keep looking for new technologies, as it is the most demanding nowadays because of new generations".

### 3.1.3. Data collection from students

The method used for this study is a self-administrated online questionnaire. It has been especially designed for students, which are the future generations that might have a higher demand on technological devices in museums. The aim is to know their opinion about having technologies in museums, to see if this is attractive when visiting a museum, as well as understand the connections between different technologies. The full questionnaire can be found in the Appendix.

The survey was opened online during ten days, from the 3<sup>rd</sup> to the 13<sup>th</sup> of June and there was one in English and another one in Spanish. All the questions had to be answered in order to complete the questionnaire; otherwise, the answers were not registered. The link of the questionnaire was posted on different pages of Facebook, always with the same message, saying that help from students was needed for an engineering thesis and that if they could collaborate by filling in a survey about technologies in museums. The original message appears in the appendix.

The questions were divided into eight different groups in order to administrate the data in a better way:

- Section dealing with culture

This section of the questionnaire is related to the attitude of students towards cultural events and institutions. The statements are answered according to a five point frequency scale.

- Frequency of visiting a museum

This section contains only one question, referring to the frequency of students of visiting a museum. This question is also answered according to a five point frequency scale.

- Apps

This is a small section to inform about the usage of the Apps of the museums. It is measured with a five-point frequency scale.

- Attractiveness of technology in museums

These questions include statements about the types of technologies that are more attractive to students and the attitude that they adopt when they find technological devices in museums. The statements here are answered according to a five point likert scale.

- Importance of being informed

Section destined to know how important students think the different ways of communication are, such as social networks, traditional ways or the simple webpages. The statements are answered according to a five point importance scale.

- Motivation

These statements are related to the types of technological devices or ways of social communication that the museums have which makes it attractive for them and may be determinative when deciding if going to a museum or not. Once again, a five point importance scale is used.

- Open questions

These are the open questions regarding their interests and what they want to find when they visit a museum.

- Personal profile questions

These are used to classify the profile of the students by including the field of studies and their range of age.

#### 3.1.4. Data collection from museums

The method used in this study is a self-administrated online questionnaire. It has been designed for all types of museums, without making a distinction on the country where they are or the kind of collection they have. It was decided to send a personalized email to each museum, by creating a general template and changing only the name of the museum to which it was sent. To decide which museums were going to be studied, some lists of the most visited museums of the world were searched. A list of the top 100 art museums attendance, according to Allemandi (2014), was used to make the list of the museums chosen for the study. Also, due to the easy access, some more museums of Spain, Portugal and Singapore (due to a vacation travel) were considered in the list. For every chosen museum, the email address had to be searched in its website to be able to contact them. Finally, 107 emails were sent, one to each museum, with the a message introducing briefly the field of study for this thesis and asking them if the museums could collaborate by answering a questionnaire about their opinion and preferences about technology.

The survey was online from the 29<sup>th</sup> of July until the 1<sup>st</sup> of October and it was only in one language, in English. All the questions had to be answered to proceed with the survey except the last

part, which were sensitive questions and some museums may not be willing to answer them. The full version of the questionnaire can be found in the Appendix.

To get as many surveys answered as possible, more than one email had to be sent to some museums, sometimes even up to four emails were sent if they did not respond. Some of the museums answered the first email saying that would not be able to answer the survey due to lack of time or inappropriateness of the questions. The list of the 107 museums where the emails were sent appears in the Appendix.

The questionnaire administered to museums was divided into different sections:

- Introduction

These questions request a general description of the museum, to see what type of collections they have and where they are set. These are open questions because of the huge range of possibilities of the answers.

- Technology

This section is to get an idea of the attitude towards technology as well as the types of technological devices that they prefer. Also these questions help to understand what museums think that will motivate their customers in terms of culture. For this section a five point Likert scale is used for the statements.

- Information diffusion

These include the questions regarding ways of communication via social networks, Internet or traditional ways, to see what museums use and find more important to get to all the publics. The statements are answered using a five-point importance scale.

- Apps

Section dedicated to questions related to Apps in order to understand the opinion of museums about having Apps or not and their usage. The statements are thought to be answered using a Likert scale.

- Interaction with the museum

Section dedicated to questions regarding the interaction of the visitors with the museum and the importance museums think they have as well as their opinion of the different technological devices used in this field. The statements are again answered using a five-point Likert scale.

- Open questions

These are open questions regarding the museums' future plans as well as the constraints that they have in the museum and don't let them improve or add the technologies that they wanted.

- Sensitive questions

Those questions are the only optional ones, because they are related to specific information of the museums and their name, which is understandable that they want to keep it anonymous.

# CHAPTER IV: DATA ANALYSIS AND DISCUSSION

## 4.1. Data analysis

### 4.1.1. Factor analysis

Factor analysis has its origin in the early twentieth century (Spearman, 1904) and according to Gaskin and Happel (2014) it has become nowadays an integral statistical method useful in the social, health, biological and physical sciences.

The main purpose of factor analysis is to describe the covariance relationships between several variables in terms of a few underlying random quantities, called factors (Johnson & Wichern, 2007). The effects of a certain number of factors are simultaneously investigated and all the treatments include all the possible combinations that can be formed from the different factors (Cochran & Cox, 1965).

The essential goals to achieve using a form of the factor analysis, which is the principle components analysis, are the summary and the reduction of data (Hair, Anderson, Tatham & Black, 1999). When summarizing data using this method, underlying factors are obtained and once they have been interpreted and understood, they give a description of the data with a lower number of concepts than the original variables. Basically, the factor analysis supposes that all variables from a particular group are highly correlated among themselves, while they present small correlations with variables in a different group (Johnson & Wichern, 2007). Each group of variables represents a single factor, which is responsible for the observed correlations.

Basically, with the factor analysis in each replication of the experiment all possible combinations of the levels of the factors are investigated. The definition of the effect of a factor is the change in response produced by a change in the level of the factor (Montgomery, 2005). This analysis is an interdependence method in which all the variables are analyzed and considered simultaneously, each one related to all the others.

Many decisions must be taken in a factor analysis study. The most important one is probably the choice of the number of common factors (Johnson & Wichern, 2007). Usually the final choice of this number of factors is based on some combination of the proportion of the sample variance, subject-matter knowledge and the “reasonableness” of the results.

The basic assumption of the factor analysis is that there are factors or dimensions, underlying a specific group of variables that can be used to explain in a simple way, complex phenomena.

Considering a general case, the model for a factorial analysis for a variable  $p$  can be determined (Johnson & Wichern, 2007):

$$X_p - \mu_p = l_{p1}F_1 + l_{p2}F_2 + \dots + l_{pm}F_m + \varepsilon_p$$

Where the random vector  $X$ , with  $p$  components has mean  $\mu$ . The model postulates that  $X$  is linearly dependent upon a few random variables  $F_1, F_2, \dots, F_m$ , called common factors and  $p$  additional sources of variation  $\varepsilon_1, \varepsilon_2, \dots, \varepsilon_p$  called errors. The coefficient  $l_{ij}$  is the loading of the  $i$  variable on the  $j$  factor.

The first step to be considered before the factor analysis should be the analysis of the correlation matrix. Correlation models are used to study the nature of the relations between the variables. Furthermore, the variables in a correlation model play a symmetrical role, with no variables automatically designated as a response variable (Neter, Kutner, Nachtsheim & Wasserman, 1990). The correlation between two variables is the division of the covariance by the product of their respective standard deviations.

“In general it is the most useful measure of interdependence between variables, as two, or more coefficients of correlation are directly comparable whatever units the variables are measured in” (Esbensen, 2002).

Once the correlation matrix has been analyzed, the next step is to obtain the first factor matrix, which will indicate the number of factors that have to be extracted. This matrix contains the factorial loadings for each variable above every factor, which are the correlations between them.

Usually this solution given of the factors and loadings is not completely clear when having to decide whereas a factor is significant or not (Hair et al., 1999). It is common to use a factor rotation method to achieve factorial solutions that are simpler and apparently more significant. In most cases the factor rotation helps to interpret the ambiguity that might appear in the initial factor solutions. Since the original loadings may not be readily interpretable, it is usual practice to rotate them until a “simpler structure” is achieved.

The basis of the factor rotation is similar to sharpen the focus of a microscope in order to see the details more clearly (Johnson & Wichern, 2007). The effect of making such rotation to the factor matrix is to redistribute the variance from the first to the last factors to achieve a simpler and more significant factor pattern (Hair et al., 2006).

One of the most used methods of orthogonal factor rotation is VARIMAX. This method concentrates on simplifying the columns of the factor matrix, which means that tries to reduce the number of factors and make the correlations clearer among the different factors. This approximation method maximizes the sum of the variances of the loading factors required in the factor matrix (Hair et al., 2007).

After the factor rotation has been done, the factor loadings have to be analyzed and decisions about the significance or not of each factor for each variable have to be taken. To decide whereas a loading factor is significant or not (table 4), the study has been followed according to Hair et al. (1999):

**Table 4. Identification of the significant factor loadings according to the sample dimension (Hair et al., 1999)**

<b>Factor loading</b>	<b>Sample dimension needed for the significance of a factor</b>
0.3	350
0.35	250
0.4	200
0.45	150
0.5	120
0.55	100
0.6	85
0.65	70
0.7	60
0.75	50

Finally, the last step to determine the factor solutions and claim that there are no mistakes, a reliability measure can be done. Reliability is defined as the consistency between the different measures of a variable (Hair et al., 1999). The alpha of Cronbach is the most used reliability measurement (Nunnally, 1979) and its limit is defined above 0.7, even though it can be lower, through above 0.6, in exploratory research.

## **4.2. Presentation and discussion of results**

### **4.2.1. Results from students**

#### **i. General results**

As it was mentioned in chapter III, the questions in the survey from students were divided into eight sections: Section dealing with culture (A), Frequency of visiting a museum (X), Apps, Attractiveness of technology in museums (B), Importance of being informed (C), Motivation (D), open questions and personal questions.

Seventy-six answers were collected from the survey and the age from the students oscillated between 20 and 26 years old. Their studies were both scientific and social, dominating the ones studying engineering, medicine, advertisement, psychology and business (table 5).

Table 5. Sampled students' profile

Age		Studies	
18-20	8	Engineering	31
21-25	58	Psychology	10
26-30	10	Medicine	8
		Advertisement	9
		Business	7
		Other social studies	5
		Other science studies	6

To have a first idea of the attitude of students towards culture and to see what they are used to visit, some analysis regarding the means of each item were developed. The items are measured between 0 and 5, following a five-point frequency scale, being 0 never and 5 very frequently. As it is perfectly perceptible in figure 10, what students usually do referred to culture is reading books, going to the cinema and assisting to concert. However, the mean for each of these variables is still very low, mostly around 3, which means that they do it or assist there occasionally.

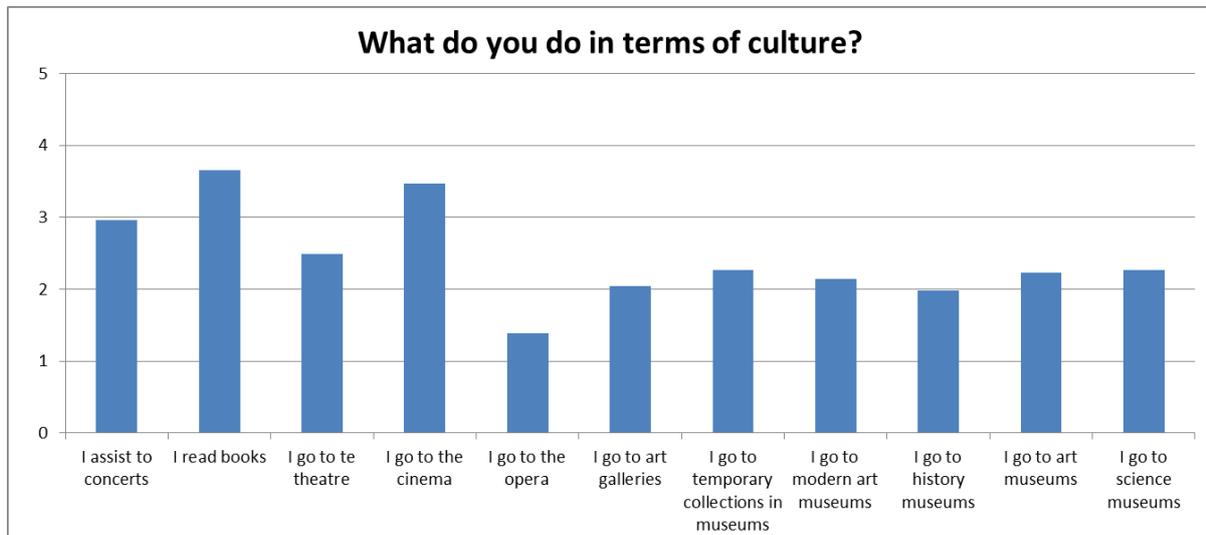


Figure 10. Graphic showing the mean for each statement regarding students' attitude towards cultural events.

To focus on museums, the object of study, and to have a general idea of how often students visit them, the graphic below (figure 11) depicts the percentage of students that go to a museum according to the degree of frequency (item X1): never, rarely, occasionally, frequently and very frequently.

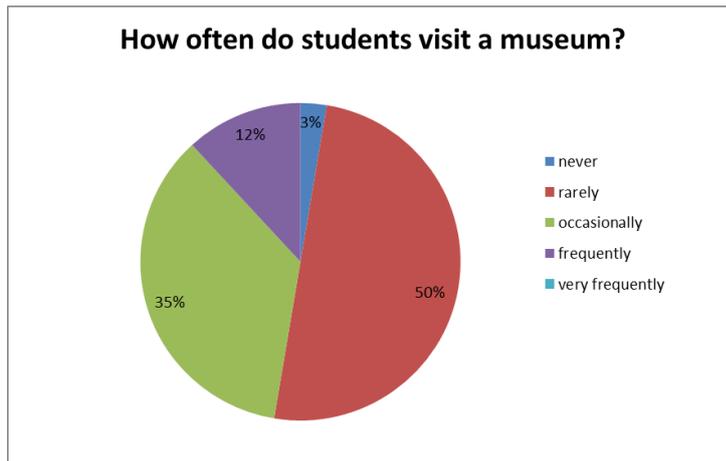


Figure 11. Graphic showing how often students visit a museum according to a five-point frequency scale

For the questions about Apps, almost none of the students had ever downloaded an App from a museum or used it.

The answers from the open questions were very useful and interesting ideas for the following survey to museums were extracted (table 6). For the first open question students found useful to have more information about the exhibits using Apps, interactive devices such as videos as part of the exhibits and audio guides. For the second question, adopting the role of the manager of a museum, students would invest above all in communication (via facebook, email and twitter) in order to give promotions and information about the collections, as they think that students and young people usually do not know exactly what kind of collections are there in museums. Also, a lot of them would invest in giving more information about the exhibits with any device, as they think that sometimes additional information is needed for a better understanding of the exhibit and finally they would also invest in interactive devices to make the visit more interesting to young people.

Table 6. Interesting comments and ideas extracted from the open questions of the students' survey

Interesting comments/ideas
Adding free Wi-Fi so that visitors can look for the information they want
Create areas with videos of the artist's life and curious facts about him/her
Having audio guides with different grades of details, so that depending on how interested a visitor is on every specific exhibit can have more or less details about it
Not making the museum too modern, to conserve the charm and atmosphere of it
Sometimes in a museum we spend too much time reading information instead of paying attention to the exhibit we have in front of us
For publicity not only use internet, use traditional ways, such as flyers
Download an app of a museum is time consuming and will no longer be used when I go home
For advertisement use as well the TV, radio, and social events

In the following sections, two different principle components analyses have been developed, to see the different correlations between the items and to find the items that are loading heavily on the different factors of the analysis.

ii. Factor extraction (a)

For the first analysis, only 4 sections were studied: A, B, C and D. The Apps section could not be analyzed, because almost none of the students had used them before, as it was mentioned above. The open questions cannot be analyzed with a principle components analysis and the results have just been presented and discussed, as well as the personal questions.

For each section, a factor matrix has been extracted to identify the variables that have a similar behavior in terms of correlations. In order to simplify and analyze the factor loading meaning in a clearer way, a factor rotation has also been applied to all the sections. The analyses for every section have been done according to this last factor rotation, using the VARIMAX approximation. All the analyses have been developed with the SPSS program.

To select the significant loading factors, according to Hair et al. (1999), as the sample dimension is 76, the loading factor will have to be between 0.6 and 0.65 to be significant.

**Section A: Terms of culture**

**Table 7. Factor rotation matrix with VARIMAX for section A**

Items	Factor loading 1	Factor loading 2	Factor loading 3
A9- I go to history museums	0.867		
A10- I go to art museums	0.826		0.318
A7- I go to temporary collections in museums	0.816	0.323	
A8- I go to modern art museums	0.779		0.329
A6- I go to art galleries	0.738		
A11- I go to Science museums	0.611		
A3- I go to the theatre		0.766	0.326
A5- I go to the opera	0.329	0.697	
A1- I assist to concerts		0.619	
A4- I go to the cinema			0.855
A2- I read books	0.321	0.381	0.514

For section A there is a clear distinction (table 7) between the three factors that explain the behavior of the section. However, a reliability analysis must be done to verify that the group of items are loading heavily on the factor and explain its behavior.

The only group that presents a significant Cronbach Alpha is the first one (A9, A10, A7, A8, A6, A11) with a 0.902. This group of items can be considered as just one, with a similar behavior of all of them (factor 1).

### **Section B: Attractiveness of technology in museums**

Different analysis were developed for section B, as it has a large number of items and it was complicated to see the ones that are loading heavily on each factor.

First of all, there were two items, B7 (I don't care about technologies in a museum, I just go there to see art) and B17 (technology does not make a museum more attractive to me) that had to be reverted as they had a negative meaning.

The first analysis was done without any restriction on the number of factors and there were 5 factors to analyze and it was difficult to find a loading factor above 0.6 – 0.65. Furthermore, when the reliability test was done to the selected items, no reliable significance was found to most of the groups and the ones whose Cronbach Alpha was high had no rational relation. This is why a factor rotation analysis restricted to 3 factors was developed.

For section B it is more difficult to relate some items to a particular factor (table 8). From the 3 groups of items found in the factor matrix only one presents a reliable Cronbach Alpha. The group, formed by B9, B12, B13, B14, B15 and B16, presents a Cronbach Alpha of 0,852 and are the items loading heavily on this factor (factor 2).

As presented, the items from section B between 1 and 7 do not appear finally. This is why a new analysis with a division of sector B has been developed (table 9), as there is a clear difference between the topics from 1 to 7 and the ones from 8 to 17, being the first ones referred to technology in museums and the second ones to the attractiveness of museums.

Table 8. Factor rotation matrix with VARIMAX for section B

Items	Factor loading 1	Factor loading 2	Factor loading 3
B16- A museum would be more attractive to me if it had audio guides to download on the phone during my visit	0.762	0.380	
B9- A museum would be more attractive to me if it had audio guides to support the exhibit with additional information	0.751		
B13- A museum would be more attractive to me if it had an App to download on the phone during my visit with a guided tour	0.746	0.423	
B14- A museum would be more attractive to me if it had audios or videos as part of the exhibit	0.729		
B11- A museum would be more attractive to me if it had additional information about the exhibits in its networks (Facebook, Twitter, Instagram...)	0.671		0.418
B12- A museum would be more attractive to me if it had videos presented in fixed electronic displays	0.66		0.324
B15- A museum would be more attractive to me if it had interactive games about its content	0.584		
B10- A museum would be more attractive to me if it had additional information about the exhibits in its website	0.571		0.476
B8- A museum would be more attractive to me if it had Apps with information about the exhibit	0.543	0.48	
B4- Technology really motivates me to visit a museum	0.536	0.384	0.315
B6- If I would have to choose between two museums of the same field I would go to one that has more technological devices	0.507	0.482	0.467
B5- I always look for museums that have more technologies and devices	0.317	0.732	
B3- I access the webpage of a museum during my visit		0.732	

B7- I don't care about technologies in a museum, I just go there to see art (R)		0.577	0.522
B2- I access the webpage of a museum after visiting it		0.303	
B17- Technology does not make a museum more attractive to me (R)			0.704
B1- I access the webpage of a museum before visiting it			0.677

Table 9. Factor rotation matrix with VARIMAX for section B1-B7

Items	Factor loading 1	Factor loading 2
B5- I always look for museums that have more technologies and devices	0.834	
B6- If I would have to choose between two museums of the same field, I would go to one that has more technological devices	0.785	
B7- I don't care about technologies in a museum, I just go there to see art (R)	0.7	
B4- Technology really motivates me to visit a museum	0.75	0.491
B3- I access the webpage of a museum during my visit	0.532	
B2- I access the webpage of a museum after visiting it		0.8
B1- I access the webpage of a museum before visiting it		0.775

Having separated the group helps to decide about the items that are loading heavily on a factor. In this analysis two groups are clearly found. For the first group of items (B5, B6, B7 and B3) the Cronbach Alpha obtained is 0.724, to value their reliability, which means that it is a significant group and the variables can be considered together (factor 3).

For the other group, B1 and B2, presented a Cronbach Alpha of 0.558, which is usually not enough to consider both items as only one. However, as mentioned before, sometimes it is not only the value of the Cronbach Alpha the only measure or criteria to consider when deciding whereas the items are reliable or not. Here appears the theoretical sense, which is applied when the Cronbach Alpha is almost 0.6 and the items make rational sense to be considered together. Also, they present a

high correlation (0.39) with significance at 1% level. This is why these two variables could also be considered significant for section B, something that will be discussed later on.

### **Section C: Importance of being informed**

**Table 10. Factor rotation matrix with VARIMAX for section C**

<b>Items</b>	<b>Factor loading 1</b>	<b>Factor loading 2</b>	<b>Factor loading 3</b>
C12- Youtube	0.82		
C11- Twitter	0.776	0.407	
C13- Instagram	0.749	0.311	
C3- Facebook	0.73		0.383
C5- Internet advertisement	0.691		
C1- Website	0.668		0.353
C10- Apps	0.566	0.522	
C9- Mail		0.828	
C2- Text message (SMS)		0.597	
C8- email	0.424	0.597	
C6- Friends, family			0.824
C7- Magazines, newspapers		0.322	0.645
C4- TV		0.463	0.538

Section C presents 3 clearly separated groups when doing a the principle components analysis (table 10), leaving only item C10 alone. The first group (C12, C13, C3, C5 and C1) presents a Cronbach Alpha of 0.867, which is very high and means that these 5 variables can be analyzed as only one because they vary in a similar way (factor 4). This group consists on the items related to Internet such as social networks or other ways of advertising new information on the site. The second group, formed by C9, C2 and C8, presents a Cronbach Alpha of 0.612, which is enough to consider them items for the factor (factor 5), according to Nunnally (1979). The last group, C6, C7 and C4 presents a Cronbach Alpha of 0.601, which is considered also significant, as it was said before (factor 6). These three items are about more traditional ways of informing about a museum, without using the new technologies that exist nowadays.

## **Section D: Motivation**

Table 11. Factor rotation matrix with VARIMAX for section D

Items	Factor loading 1	Factor loading 2	Factor loading 3
D11- Audios as part of the exhibit	0.827		
D12- Videos as part of the exhibit	0.821	0.35	
D5- Interactive technologies: videos (touchable screens)	0.783		0.368
D6- Interactive technologies: games (touchable screens)	0.766		
D4- Classic audio guides	0.622		0.368
D9- Twitter (as a way to inform about new collections)		0.899	
D8- Facebook (as a way to inform about new collections)	0.308	0.850	
D10- Instagram (as a way to inform about new collections)		0.839	
D7- Webpage of the museum with information		0.37	0.343
D1- Apps for smartphones with guided tours			0.858
D3- QR codes (codes that can be read from the smartphone, that give more information of the exhibit)			0.837
D2- Apps for smartphones with more information about the exhibits (explanations, comments from the artist, similar exhibits to visit and others)	0.333	0.377	0.763

Section D presents 3 groups of items, each one with items assigning meaning to each factor (table 11). The first group (D11, D12, D5, D6 and D4) presents a Cronbach Alpha of 0.877, which means that all these items can be considered together (factor 7). They all refer to interactive devices found in the museums, from videos or audios that are part of the exhibits to touchable screens. It is the group that presents a higher mean (3.46), which reveals that students are more motivated in a museum when it has these types of devices.

The second group (D8, D9 and D10) contains the items for Facebook, Instagram and Twitter. This group shows a Cronbach Alpha of 0.923, meaning that these 3 items can be considered together (factor 8). It is also a rational group, as all the social networks have a similar behavior, but inside this

group, the difference of means between the items is higher, being D8 the higher one, which means that students are more motivated to go to a museum if they are informed about their collections and exhibits by Facebook. It would have been the second group of items that motivates students to visit a museum, but it is not, due to the item D10 (Instagram) which presents a very low mean. It might be because this social network is still not as popular as the others due to the fact that it was the last one to enter in the social networks market.

The last group is formed by D1, D2 and D3, which are items that refer to Apps and QR codes. They present a Cronbach Alpha of 0.899, which means that are significant for the factor (factor 9).

### iii. Factor extraction (b)

For this second analysis, all the items have been studied together, without separating them into sections, to relate some items with a particular factor easily and understand the significance of the factors to reach. Once again, the items analyzed are the ones from sections A, B, C and D.

At the beginning 13 factors appeared for the analysis, but after some reliability tests and analysis for each factor with its items, a total of 6 factors have been found to explain the 52 items of the study. Some of the items that are significant for the same factor might be similar to the ones found in the first analysis, but with this analysis, there is a more general idea of all the items together with all their possible combinations.

#### **Factor 1: Interact (Motivation for interactive technological devices)**

Table 12. Factor rotation matrix with VARIMAX for factor 1

Items	Factor's loading
B12- A museum would be more attractive to me if it had videos presented in fixed electronic displays	0.756
B14- A museum would be more attractive to me if it had audios or videos as part of the exhibit	0.772
B15- A museum would be more attractive to me if it had interactive games about its content	0.764
D5- Interactive technologies: videos (touchable screens)	0.567
D6- Interactive technologies: games (touchable screens)	0.564
D11- Audios as part of the exhibit	0.764
D12- Videos as part of the exhibit	0.753

This first factor (table 12) refers to all the technological devices that let visitors interact with the museums, such as videos, audios or games. They can either be fixed displays informing about an

exhibit or touchable screens, as both strengthen the interaction between the visitor and the museum. These seven items present a Cronbach Alpha of 0.902.

### **Factor 2: MApps (Museum Applications)**

**Table 13. Factor rotation matrix with VARMIAX for factor 2**

<b>Items</b>	<b>Factor's loading</b>
B8- A museum would be more attractive to me if it had Apps with information about the exhibit	0.820
B9- A museum would be more attractive to me if it had audio guides to support the exhibit with additional information	0.535
B13- A museum would be more attractive to me if it had an App to download on the phone during my visit with a guided tour	0.680
B16- A museum would be more attractive to me if it had audio guides to download on the phone during my visit	0.675
C10- Apps	0.546
D1- Apps for smartphones with guided tours	0.844
D2- Apps for smartphones with more information about the exhibits (explanations, comments from the artist, similar exhibits to visit and others)	0.677
D3- QR codes (codes that can be read from the smartphone, that give more information for the exhibit)	0.716

These eight items (table 13) refer to the need of having a portable device to get more information about the exhibits. They refer to Apps, QR codes and audio guides, which are all applications and devices used in a museum while visiting it. Their Cronbach Alpha is 0.919, which means that students consider these three types of technologies similarly and that they can be grouped together.

### **Factor 3: Wsite (Website informing)**

**Table 14. Factor rotation matrix with VARIMAX for factor 3**

<b>Items</b>	<b>Factor's loading</b>
B10- A museum would be more attractive to me if it had additional information about the exhibits in its website	0.652
C1- Website	0.798
D7- Webpage of the museum with information	0.674

This factor (table 14) regards the need and motivation of being informed by the webpage of the museum. This factor reflects that students do not consider all the social networks or other internet

ways of informing the same, as the items for the webpage are behaving different from the others. The Cronbach Alpha for this factor is 0.803.

**Factor 4: SocialApps (Other internet information)**

Table 15. Factor rotation matrix with VARIMAX for factor 4

Items	Factor's loading
C5- Internet advertisement	0.574
C11- Twitter	0.766
C12- Youtube	0.561
C13- Instagram	0.824
D8- Facebook (as a way to inform about new collections)	0.746
D9- Twitter (as a way to inform about new collections)	0.795
D10- Instagram (as a way to inform about new collections)	0.853

Factor 4 regards other ways of informing about the exhibits that use Internet but are not the Website (table 15), as it was seen above that it behaves differently. The Cronbach Alpha for this factor is 0.923. Of course there are little differences in their opinions, as they can be seen on their means and standard deviation, which are not the same for each item, but they can be studied as a group.

**Factor 5: Behavior**

Table 16. Factor rotation matrix with VARIMAX for factor 5

Items	Factor's loading
A6- I go to art galleries	0.811
A7- I go to temporary collections in museums	0.854
A8- I go to modern art museums	0.880
A9- I go to history museums	0.791
A10- I go to art museums	0.880
A11- I go to Science museums	0.558

Factor 5 reflects the attitude students have in terms of cultural institutions (table 16). They present a Cronbach Alpha of 0.902. This factor shows that all these 6 items present the same behavior for students, which means that there are not really big differences for them when visiting one type of museum or another.

### **Factor 6: Dmail (Direct mailing)**

Table 17. Factor rotation matrix with VARIMAX for factor 6

<b>Items</b>	<b>Factor's loading</b>
C8- email	0.728
C9- mail	0.854

This factor (table 17) regards the ways of diffusing information that are specifically written for a person, which means that have to be written one by one for the different visitors. Both (post) mail and email are direct mail, which means that are addressed to a specific person. Also, these channels of communication are for customers that have already visit the museum, as they gave their personal details to be contacted for new information. The Cronbach Alpha for this factor is 0.713.

#### iii. Factor extraction decision

After studying both analyses, a decision must be taken to use one of the factor analysis. In the first analysis nine factors where found, with a total of 39 items. The Cronbach Alphas are high enough, except for the two factors of section C, that were just in the limit of reliability. Also, there was another factor, whose Cronbach Alpha was very low, but the correlation between the two variables that formed the factor was significant, thus they could be consider as another factor. On the other hand, the second analysis has six factors, with a total of 33 items. The Cronbach Alphas in this analysis are, all of them, very high, as it can be seen in table 18, even for the factor with only two items (factor 6).

Table 18. Comparison of the Cronbach Alpha of both factor analysis

<b>Factors for analysis 1</b>	<b>Cronbach Alpha</b>	<b>Factors for analysis 2</b>	<b>Cronbach Alpha</b>
Factor 1	0.902	Factor 1	0.902
Factor 2	0.852	Factor 2	0.919
Factor 3	0.724	Factor 3	0.803
Factor 4	0.867	Factor 4	0.923
Factor 5	0.612	Factor 5	0.902
Factor 6	0.601	Factor 6	0.713
Factor 7	0.877		
Factor 8	0.923		
Factor 9	0.899		

Both analyses are very similar in terms of the items used, number of factors and Cronbach Alphas. This is why, to make this decision, not only the results have to be taken into account but also the rational part, the theoretical sense. In the second analysis the items that appear in each factor have a common sense and are related the ones from a section with the others of another section which have a similar meaning rationally. Also, in the first analysis, there are two factors with a very low Cronbach Alpha and if the decision was to eliminate those factors, important information could be missed, as some of these items do appear on the second analysis, with a higher Cronbach Alpha.

Due to the higher Cronbach Alpha presented in all factors and the theoretical sense for every combination of items of each factor, the analysis chosen for the study is the second one.

#### iv. Linear regression

Regression analyses are used in the current research to study and to try to explain the causal relationship between items. The six factors mentioned before have been used for the regression analysis. Also, another item (X1 – How often do you go to a museum?) which can be used as a dependent variable, explaining the students' behavior when visiting museums.

In this section two different approaches are discussed with respect to several relationships between items, being:

- *F5\_Behavior* as a dependent variable
- X1 (Frequency of the students of visiting a museum) as a dependent variable

Every factor found in the factor analysis has been calculated according to their representative items:

$$F1\_Interact = \frac{1}{7} (B12 + B14 + B15 + D5 + D6 + D11 + D12)$$

$$F2\_Mapps = \frac{1}{8} (B8 + B9 + B13 + B16 + C10 + D1 + D2 + D3)$$

$$F3\_Wsite = \frac{1}{3} (B10 + C1 + D7)$$

$$F4\_SocialApps = \frac{1}{7} (C5 + C11 + C12 + C13 + D8 + D9 + D10)$$

$$F5\_Behavior = \frac{1}{6} (A6 + A7 + A8 + A9 + A10 + A11)$$

$$F6\_Dmail = \frac{1}{2} (C8 + C9)$$

Factor X1 does not have to be transformed, as it contains only one item.

- Dependent variable *F5\_Behavior*

Multiple linear regression has been developed to evaluate if the identified independent variables exercise a significant influence on the behavior of students in terms of cultural institutions. The following table (table 19) shows the results of the regression analysis using *F5\_Behavior* as a dependent variable and the other five factors as independent ones.

**Table 19. Regression coefficients with *F5\_Behavior* as a dependent variable**

Modelo		Coeficientes no estandarizados		Coeficientes tipificados	t	Sig.
		B	Error típ.	Beta		
1	(Constante)	1,833	,468		3,914	,000
	F1_Interact	-,144	,126	-,169	-1,144	,256
	F2_MApps	,145	,129	,189	1,123	,265
	F3_Wsite	,106	,119	,126	,889	,377
	F4_SocialApps	-,013	,124	-,017	-,101	,920
	F6_DMail	,002	,099	,002	,016	,987
2	(Constante)	1,835	,430		4,272	,000
	F1_Interact	-,144	,124	-,169	-1,156	,251
	F2_MApps	,145	,128	,189	1,133	,261
	F3_Wsite	,106	,118	,126	,895	,374
	F4_SocialApps	-,012	,115	-,016	-,103	,918
3	(Constante)	1,835	,427		4,302	,000
	F1_Interact	-,147	,121	-,172	-1,214	,229
	F2_MApps	,139	,116	,182	1,199	,235
	F3_Wsite	,103	,115	,123	,899	,372
4	(Constante)	2,019	,374		5,398	,000
	F1_Interact	-,129	,119	-,152	-1,085	,281
	F2_MApps	,180	,107	,236	1,690	,095
5	(Constante)	1,778	,301		5,904	,000
	F2_MApps	,114	,088	,150	1,302	,197
6	(Constante)	2,154	,086		24,927	,000

As it is shown, this method starts with the full model, with all the five variables together and having *F5\_Behavior* as the dependent variable and they are eliminated according to their coefficients, starting with the lowest (*F6\_Dmail*). According to this method, there would be no predictor variables for the dependent variable, which is not surprising, as none of the independent variables are significant in the first model or the followings.

To analyze if the independent variables explain the dependent variable the coefficient of determination ( $R^2$ ) has to be presented and analyzed. Table 20 is showing the results.

**Table 20. Summary of results using *F5\_Behavior* as a dependent variable**

Coefficient of determination ( $R^2$ )	Std error of estimate
0.049	0.7603

The R square has a value of 0.049, which means that the explanation of the students' behavior relative to cultural institutions by the other 5 factors is almost insignificant.

- Dependent variable X1

Table 21 shows the results of this second analysis, using X1 as a dependent variable and the other 5 factors (the same as in the first analysis) as independent variables.

**Table 21. Regression coefficients with X1 as a dependent variable**

Modelo		Coeficientes no estandarizados		Coeficientes tipificados	t	Sig.
		B	Error típ.	Beta		
1	(Constante)	1,838	,453		4,058	,000
	F1_Interact	-,058	,122	-,070	-,477	,635
	F2_MApps	,156	,125	,209	1,253	,214
	F3_Wsite	,117	,115	,143	1,017	,313
	F4_SocialApps	-,081	,120	-,114	-,680	,499
	F6_DMail	,085	,096	,113	,880	,382
2	(Constante)	1,747	,408		4,277	,000
	F2_MApps	,137	,117	,183	1,168	,247
	F3_Wsite	,111	,114	,136	,977	,332
	F4_SocialApps	-,094	,116	-,132	-,811	,420
	F6_DMail	,088	,095	,117	,921	,360
	3	(Constante)	1,763	,407		4,332
F2_MApps		,093	,103	,124	,894	,374
F3_Wsite		,089	,110	,109	,810	,421
F6_DMail		,061	,089	,081	,682	,498
4	(Constante)	1,873	,372		5,036	,000
	F2_MApps	,108	,101	,144	1,075	,286
	F3_Wsite	,092	,110	,112	,834	,407
5	(Constante)	2,065	,292		7,085	,000
	F2_MApps	,152	,085	,204	1,791	,077

Following the same method as in the first analysis, it starts with all the 5 independent variables and eliminates the ones that are not predictor variables. The first variable to be eliminated is F1\_Interact, as it is the one that presents a lower coefficient. This results in a model with only one predictor variable, F2\_MApps, with a significance at 10% level and a coefficient of 0.204.

However, the  $R^2$  has to be presented and analyzed to see if the model shows any explanation of the dependent variables by the independent ones.

**Table 22. Summary of results using X1 as a dependent variable**

Coefficient of determination ( $R^2$ )	Std error of estimate
0.068	0.7357

Once again, the R square is very low (table 22), meaning that there is no significant explanation of the dependent variable X1 by the independent variables.

The correlation matrix (showed in the Appendix) explains that there is a high correlation between some independent variables, but there is only significance between F2 and X1 and an almost significant one between F3 and X1, for the second analysis at 5% level. For the first analysis, as it is

also perceptible in the correlation matrix, there is no significance correlation between any independent variable and F5\_behavior, but there are some significant ones between the independent variables.

These results of both analysis are not completely surprising, according to the sample used in this study. As it was said before, students showed that most of them did not visit museums frequently and they were not at the moment motivated to visit them, but they might in the future be motivated with the new technologies that they mentioned.

#### 4.2.2. Results from museums

##### i. General ideas

For the museums' surveys finally only 33 answers were obtained from the original list of 107 museums, so only a 31% of the museums were willing to collaborate with the study. The museums were from different countries, such as Portugal, Spain, USA, United Kingdom, North European countries and some Asian countries. The number of visitors of these museums is between 50.000 and 5.000 million, half of them around 500.000 and 1 million. The museum's fields are also very diverse; 12 museums of Contemporary Art, 8 of modern Art, 7 of History, 3 of Sciences and 3 of Archaeology. The complete list of the collaborating museums appears in the Appendix.

The first idea was to do a factor analysis for the museums' responses and make a comparison with the students' ones, but the sample is too small for a statistical test. Therefore, other analysis had to be considered in order to being able to compare both surveys and find interesting conclusions.

Starting with the open questions, some interesting ideas were extracted due to some unexpected answers (table 23).

**Table 23. Interesting answers for the first open question of the survey to museums**

<b>If you are planning to improve your technological devices or introduce new ones, could you explain which ones?</b>
Introduction of Apps to use during the visit
Position Sensor
Audio guides for visually impaired visitors
Touchscreens (tablets)
Kiosks
Smartphone rental service to use on the audio guides
Widen information in the website (it is cheaper and visitors don't have to download an App)
Install Wi-Fi
Improve website with the introduction of 3D.
QR codes
Install video games

As it can be seen in the table above, museums are really interested in acquire technological devices to make the museum more attractive. Different kinds of technologies are perceptible, from a Wi-Fi installation or a suitable website to Kiosks and position sensors.

From the 33 museums ten of them were not planning to improve or introduce new technological devices, but all of these presented important constraints on the third open question (basically budget and bad Wi-Fi connection).

For the second open question, there were two predominant answers which were that museums prefer to use technology to give more information about the exhibits and to both give information and let them interact with the exhibits. Most of the museums really think that it is important to give information to visitors so that they can understand the exhibits or can be more interested in them. Whereas only half of them really believe that the interaction between the visitor and the museum is important. Later on, in another part of the survey, this importance of giving information to visitors is also perceptible. Summarizing this aspect, most of the museums prefer to invest their money on technology to inform visitors rather than to strengthen their interaction (table 24).

**Table 24. Main answers for the second question of the museums’ survey**

<b>Do you prefer to use technology to give visitors more information or to let them interact with the exhibits?</b>	
To let them interact	3
Both	11
Give more information during the visit	12
Interacting when they are in the museum and inform them after their visit	1

The last open question talks about the constraints that the museums have which do not let them to have and use all the technological installations or devices that they would. More than a 50% of the museums regard budget as the main problem, as they can not invest all the money that they would like in technology, which was predictable. However, surprisingly, another common constraint is the fact of not wanting to lose the essence of having visitors appreciating the objects instead of being distracted with the technology. Nowadays, that technology has become increasingly ubiquitous and museums are aware of it and its importance, it was surprising to find that museums do not want to lose the charming of the museum’s main purpose, which is being totally focused and immersed in the pieces of art. This opinion might be expected from little museums, which still need some time to get used to technology, but surprisingly, this answers come from museums with a number of visitors per year that goes from 100.000 to 6.000.000, including important museums such as the National Gallery of London. Other common constraints among the museums are Staff resources, technical maintenance and Wi-Fi limitations.

To have a general idea about the attitude of museums towards technology, there were three questions related to it and they have been analyzed and they can be seen in the following figures.

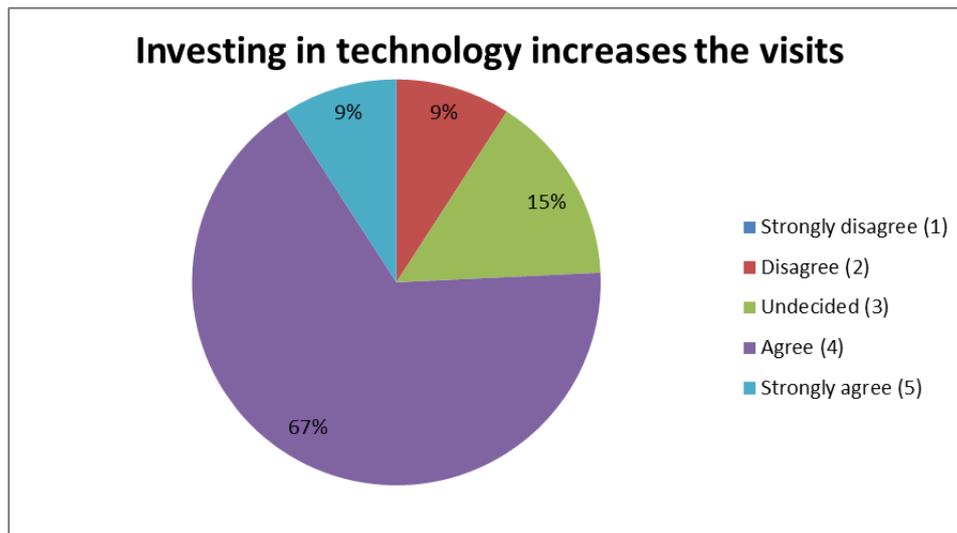


Figure 12. Opinion of museums about technology, measured with a Likert scale

In figure 12, it is perfectly perceptible that more than 75% of the museums believe on increasing the number of visits in a museum by the usage of technology. This figure depicts that technology and museums are really related and that they are completely aware of the technological change as well as the importance of technology in their field. This shows that their attitude towards technology is very positive and that they see technology as a way of helping them to have more visitors to their museum.

A second statement to be analyzed is the fact of increasing the number of visits due to technological devices in a museum (figure 13). The opinions in this issue are not as clear as in the one mentioned before. However, almost a 65% of the museums agree or strongly agree with this statement, showing that technology is not only useful for a good way of communication of the collections or for a better installation of Wi-Fi, but they focus a lot on employing technological devices, as they think they are really important to attract visitors.

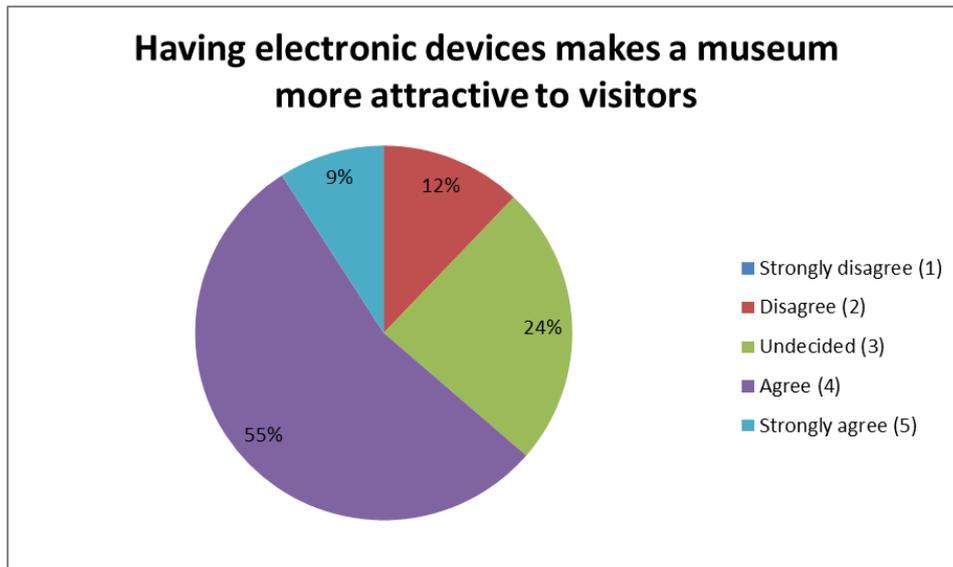


Figure 13. Museum’s opinion about technological devices, measured with a Likert scale

Finally, the last statement analyzed about the use of technologies and the attitude of museums towards technology is about giving more information to visitors. Usually there is a lack of understanding in some kind of objects in the museums and visitors need more information in order to understand them better. The museums’ opinion in this field concurs with the visitors’ one, as it is shown in figure 14.

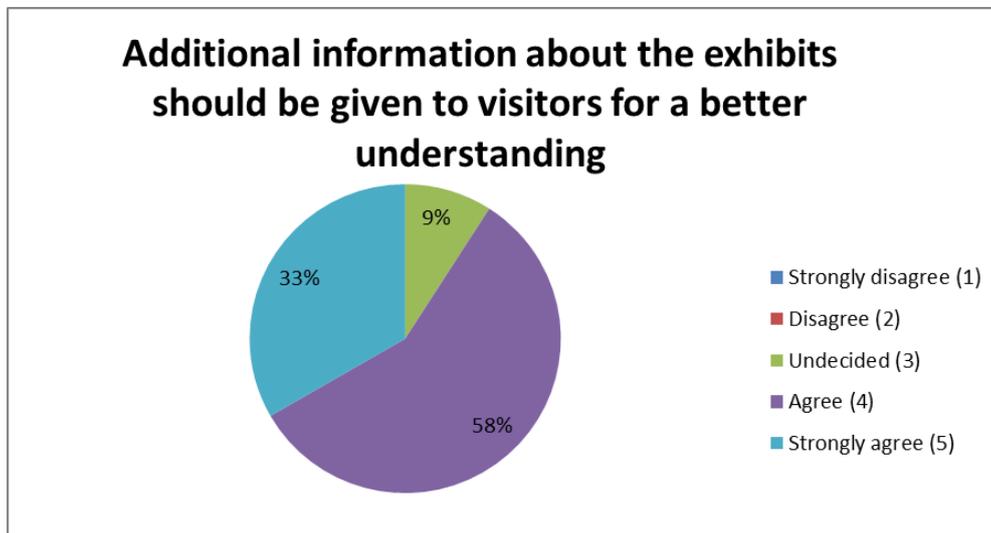


Figure 14. Museum’s opinion about the need of giving more information about the exhibits, measured with a Likert scale.

None of the museums disagree with this statement, almost all of them agree with it, which shows that they really want to add information in their exhibits, so that visitors can understand them. Although additional information is very general and it can refer to technologies or not, at least they are aware of the need that visitors have in this field and this will guide them to find the best way to do it, which will probably be using some type of technology.

ii. Interest in different ways of using technologies in the museum

There are different opinions in the preference to have and use one type of technology or another among the museums. As a general idea, the technologies in which museums are less interested are audio guides, QR codes and interactive games. These devices presented few opinions of agreement in terms of interest for their museum. In only 30% of the museums audio guides are useful and visitors ask for them and only 20% of them are really interested in interactive games and QR codes.

For the analysis of the other types of technologies that were considered in the survey (Interactive technologies such as videos displayed in touchable screens or tablets or kiosks, Apps with guided tours or information and free Wi-Fi for visitors) a division of countries was considered.

The groups of countries are: Portugal, Spain, USA and Canada, UK and Ireland, North European countries (Norway, Sweden and Denmark) and Asiatic countries. The group of museums of each country has similar opinions about their interest on the different types of technologies (table 25).

**Table 25. Types of technologies focused in museums of each country**

Country	Type of technology focused	Number of museums
Spain	Apps	7
	Videos displayed in electronic screens	
Portugal	Apps	5
	Kiosks	
	Free Wi-Fi	
USA	Free Wi-Fi	3
UK	Free Wi-Fi	6
North of Europe	Free Wi-Fi	6
Asia	Videos displayed in electronic screens	3
	Apps	

Most of the museums prefer to invest in free Wi-Fi for their visitors. It is a cheap way to let visitors be informed and look for additional information of the exhibits. They also do not have to download any Application and they can look for whatever they want. Free Wi-Fi installation means relying on the personal autonomy of visitors, letting them be independent rather than dependent. However, as some museums pointed out in the open questions, letting them to use free Wi-Fi can distract them from the exhibits and they can use the internet for other purposes.

### iii. The different channels of communication

Museums have different preferences when communicating about their collections or exhibits. Nowadays it is easier to get to people using technology, especially young students, who are completely immersed in the technological world. It is also a cheaper and easier way to address to people.

Different channels of communication were studied in this questionnaire, being the website the most important one for mostly all of the museums. A website can be more or less completed but it is always essential for a museum, as it is the main way visitors use to get informed about a museum in a specific country and it seems that museums realize it and consider it the most important way to communicate new arrivals or collections.

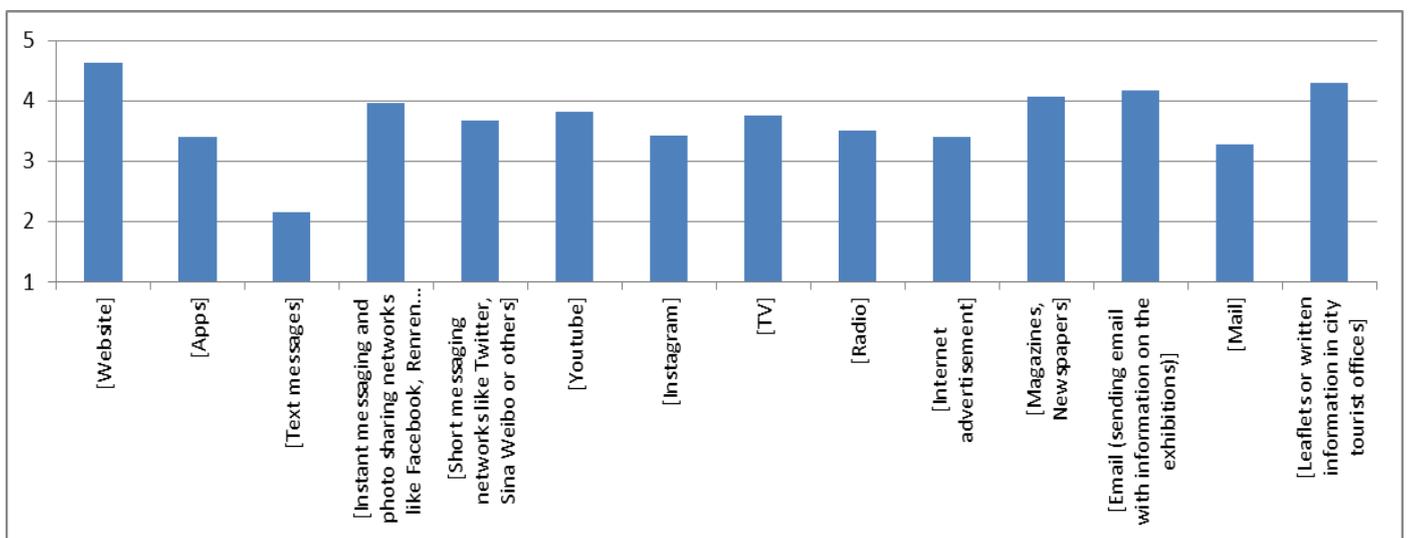


Figure 15. Different ways of communication about new collections in a museum, measured by a five-point important scale

Figure 15 shows the means for each way of diffusing information. It is also perceptible that the usage of mail and text messages is not very important among museums. As it was mentioned before, cheaper and easier ways are replacing the old methods such as (post) mail that is clearly being replaced by email, as shown in figure 13. This also happens due to the situation that is currently taking place, which makes museums to reduce their budget and spend as less money as possible in advertisement and communication. Communication via (post) mail is much more expensive than email and this is one of the reasons for this substitution. Social networks such as Facebook, Twitter, Youtube and Instagram seem to be very similar in terms of importance, but later on it will be broken down by countries to see the differences in terms of their preferences.

Dividing it into countries, some differences are perceptible and it seems that the museums for each country have similar preferences and the importance they give to one channel of communication or another are alike.

In the UK group, which includes Ireland and the United Kingdom, there is a distinction between social networks, as they consider particularly important to transmit their information using Twitter and Youtube and in fourth place (the website is considered the most important way of communication in all countries) using the email. The other social networks and the traditional ways of communication are not as important as the ones mentioned before for this group.

In Spain their interests are different, as they consider more important to diffuse information using the traditional ways, like leaving leaflets in city tour offices, using magazines and radio and also they think the email is an important way to communicate. Surprisingly, the Spanish museums are the only ones that also believe on the mail. These museums regard social networks as less important (all at the same level except Instagram, which they do not consider as important as the others).

But Facebook, Twitter and Youtube have exactly the same answers for each museum, which shows that they do not make any distinction between them and the museums use them equally.

Portuguese museums also consider leaflets in city tour offices an important way for communication but they also concentrate on email, magazines and Facebook to inform about their collections. In this case the social networks do present different behaviors, as Facebook is considered the most important one to give the information, followed by Youtube and Internet advertisement, leaving with little importance Twitter and Instagram.

For the group formed by USA and Canada, there are not many differences. On the top, the most important for them in terms of communication is the website (as all the other countries) but then every museum present the same answers for leaflets, Facebook, Twitter, Instagram, email and magazines. This means that they strongly believe that the website is essential for the museum's diffusion but then the other ways of communication (leaving the ones that are not significant for them such as text messages, mail, TV, radio and youtube) are equally important. In this case, the social networks exactly in the same level, all of them important equally.

The Asian group is the most different one, as it is the only one whose most important way of communication is not the website, but the email. The website also appears in the most important ways of communication, but in the third position. Facebook and magazines are equally occupying the second most important way to inform about the museums' collections. Here again appears a distinction between social networks, Facebook the only important one for information diffusion.

Facebook is considered the most important way of communication (after the website) for the North European countries, followed by the email and leaflets in city tour offices. Also other social networks like Youtube and Instagram are important for them and present exactly the same answers for each museum of this group. Finally, magazines are the last important way of communication according to these museums.

The last group, formed by other countries such as Italy, Greece and Germany consider leaflets an important way for communication and, surprisingly, is the only group that considers more important

to inform using TV and magazines than the other ways. From the rest of the options, only the email and Youtube are also important for them, being the only technological ways to differ information.

As a general idea, traditional ways such as leaflets in city tour offices and magazines are still important for museums to differ their information. Also, Facebook seems to be the most significant social network for all the countries in terms of communication, with the others more or less important depending on each country. Instagram is the social network considered less important for almost all the museums. The ways of communication that most of the countries do not believe are important at all are text messages, mail, radio, TV, Apps and internet advertisement.

Even though it was only possible to analyze a small sample, some perceptible differences between the countries could be seen, like the ways of informing and the technologies they are interested in.

#### 4.2.3. Discussion: comparison between museums and students

Although students do not visit a museum frequently, according to the results obtained on the survey, they do have motivations and preferences of some types of technology or others. These opinions and preferences are the ones that might lead them to go to museums later on. Museums are aware of technology and its benefits and know that to satisfy their visitors and widen their audiences in a future, students' interests and preferences about technology must be analyzed.

Concentrating on specific technologies, meaning specific electronic devices used in museums, some differences and similarities can also be perceptible between these two groups. To have an idea of the students' general opinion of technologies, the means for the different devices that motivate them to visit a museum have been extracted.

**Table 26. Comparison between the different technologies of a museum according to students' opinion**

<b>Types of technologies</b>	<b>Mean</b>	<b>Standard Deviation</b>
Interactive technologies: videos (touchable screens)	3,63	1,09
Interactive technologies: games (touchable screens)	3,51	1,04
Audios as part of the exhibit	3,49	1,08
Videos as part of the exhibit	3,47	1,09
Classic audio guides	3,20	0,98
Apps for smartphones with more information about the exhibits (explanations, comments from the artist...)	3,12	1,21
Apps for smartphones with guided tours	3,03	1,26
QR codes (codes that can be read from your smartphone, that gives more information of the exhibit)	3,03	1,26

All different types of technologies present a low standard deviation and the means between 3.03 and 3.63, which means that there are not many differences from them between one or another. However, it is perceptible in table 26 that they are more motivated by interactive technologies such as videos, audios, games and touchable screens. On the other hand, it seems that audio guides, Apps and QR codes are not motivating at all for students.

**Table 27. Comparison between the different types of technologies that museums prefer to have**

<b>Types of technologies</b>	<b>Mean</b>	<b>Standard deviation</b>
Wi-Fi	4,091	,8790
Videos displayed in electronic screens	3,576	,9024
Apps	3,485	1,0038
Interactive games	3,424	1,0009
Kiosks or interactive screens	3,152	,8337
QR codes	2,909	1,0417
Audio guides	2,848	1,2278

In the museums' survey there were not exactly the same items to choose from, as some interesting ideas (like the free Wi-Fi) were taken from the students' analysis and were added to the questionnaire for museums. However, it is shown in table 27 that museums also prefer to invest in interactive technologies such as videos, games or kiosks. They also agree with students that QR codes and audio guides are not the most important ways to use technology in a museum to make it attractive. However, as students suggested on their survey, it would be interesting to have different degrees on the details in audio guides to be able to listen to more or less information according to the visitors' interests. Almost 70% of the museums agree with this idea and only 3 museums disagree, which means that it could be an interesting idea to develop and strengthen the usage of audio guides. The only type of technology that presents differences between museums and students are the Apps, as students do not find them attractive whereas museums do, as it is the third type of technology that they agree to be attractive to visitors in a museum.

A second aspect to be compared is the way of providing information. For a perfect communication between visitors and the museum, students and museums should consider important the same ways of differing information. The best way to show if they agree or not with the same channels of communication is a graphical comparison. However, there might be some differences, as students are not the only type of visitors that go to museums. This is why, even though the results might differ between them, it has to be considered that other visitors could really prefer the same ways as the museums do.

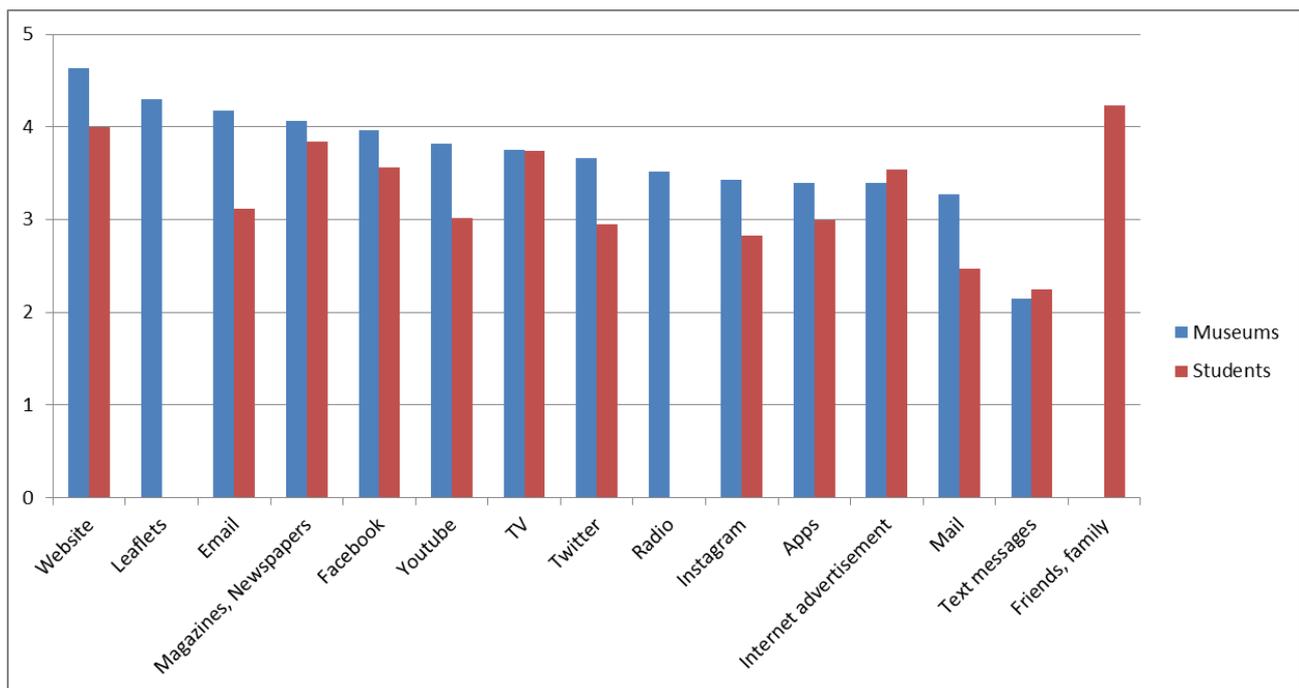


Figure 16. Comparison between the ways of communication from the point of view of students and museums

Not all the channels of communication can be compared, as some of them only appear in one of the surveys (figure 16). This happens to leaflets in city tour offices and radio, which only appear on the museums' questionnaire, because both of them were ideas taken from the comments that students made on their survey. Also, the variable friends and family was only evaluated in the students' survey, as it is something that museums cannot easily and cheaply control, the word-to-mouth is used for visitors and it was shown, as expected, that students really rely on the recommendations given by friends or family or what they hear in the street, as it is the most important way of being informed for them.

Both students and museums agree that the most important way of communicating new collections or exhibits is by using the webpage. This means that museums really try to make the website as attractive and complete as possible and students do really visit them to look for any information they need about the museum. Nowadays, with the Internet, it is the easiest way to look for information, so it was predictable that websites would be really important for both.

Students, as well as museums, also think it is important to diffuse the museums' information using magazines and newspapers. It is surprising from both parts that they believe in the effectiveness of newspapers and magazines more than the social networks. Nowadays, it is most common to believe that students would rather get information easily by connecting to the internet than by looking at a newspaper or magazine, but surprisingly they do not think like that yet. However, there are not many visible differences between magazines and newspapers and Facebook or internet

advertisement, but at least these traditional ways of communicating are still in the same position as some of the new ones that are coming due to the Internet generation.

It is shown in the graphic above that for both students and museums the most important social network for communication is Facebook. Especially for students, as there is a significant difference between Facebook and the others. On the other hand, Instagram is the less important social network for both sides, especially for students, who do not consider it important at all for communication.

Another surprising result to take into consideration is the email. For museums it is a really important way to diffuse their information, whereas for students it is not important at all. This could be due to the amount of advertisement emails that are delivered nowadays, which makes the email less reliable as it used to be some time ago. Also, as it was mentioned in the museums' analysis, to receive an email from a museum you first need to have visited it, in order to give your contact details and be informed later on. Probably students that visit a museum do not plan to visit it again, at least not in a short time. This might be why they do not think email is as important as other ways of communication.

To conclude this comparison, the less important ways of communication that both museums and students consider are text messages, (post) mail and Apps. Text messages and (post) mail are ways of information diffusion that are less and less used every day, so it was perfectly predictable that they would not be considered as the most important ones. With Apps the situation is different, as they are a new technology which is emerging from a new segment. Probably they are not considered as a way of communication but a way of interaction when visiting a museum.

## CHAPTER V: CONCLUSIONS

This study was focused on the attitude of museums towards technology, to identify their preferences and contrast them with the visitors' beliefs and opinions to reach a high degree of customers' satisfaction.

The first noticeable conclusion taken from the surveys' analysis is that the sample from the students' survey was difficult to analyze, as the results may reflect the fact that most of the students who answer it do not visit museums frequently. However, they stated their preferences, which should highlight strategies for the museums to attract these new audiences in the future.

After the factor analysis, 6 factors were extracted and selected to comprise the dimensions of the students' study, being: interactive technologies, museum applications, website informing, social Apps (other ways of internet informing), behavior (students' behavior in terms of cultural institutions) and direct mailing.

These factors were supposed to explain the students' behavior when going to a museum (based on the frequency of their visits). The results of this part were not as expected, as none of the factors was significant enough to explain the dependent variable and their correlations were not high enough. However, it was not a completely surprising result, as there was a sampling limitation (mentioned before). Nowadays the sampled students may not visit a museum frequently, but they do have preferences and motivations about the technologies that a museum may employ. As museums are currently starting to contemplate these technological preferences, but there are still a lot of museums which are not using them, there might have been a time lag (delay) in the analysis. Students' behavior shows their current situation, whereas the rest of the factors that should explain it refer to what they would like in a future, as they still have not seen much about these technological advances and electronic devices.

Museums strongly believe investing in technology makes a museum more interesting to visitors and this will increase their number of visits. As a general idea, most of the museums have also the same idea about having additional information in the exhibits, which they think it is essential for visitors for a better understanding of the objects and students also agree with this issue.

The sampled museums present different preferences for the diffusion of information about their collections and the types of technologies depending on the country where they are set. In terms of information diffusion there are also perceptible differences depending on the country of the museum, the website being the most important one. There are differences about the importance of the social networks for the diffusion of museum information, depending on the country where the museum is set.

This is exactly what the interviewed museums mentioned, that new technologies are very useful nowadays to diffuse the information and to get to all the different targets and the other more

traditional ways are being substituted by the new ones. These interviews show that they are really working on technology, not only to use it for the information diffusion but also to use it during the visit, inside the museum, to make it more attractive, as they are aware that new technologies are becoming more and more demanding. The Gulbenkian museum also mentioned the importance of finding a balance with technology, so that visitors do not get distracted from the objects because of it, which other museums also corroborated later on in the questionnaire. However, with the interviews it was perceptible their need to reach this audience and this new generation that they believe that can only be achieved with technologies. For this reason, as museums are really aware of it and are starting to deal with this situation it is essential for them to know and study the students' preferences to adapt the museum according to them and make it as attractive as possible for them.

Comparisons with the students' opinions and preferences show that both studied groups present a higher motivation and interest for interactive technologies such as videos and audios displayed in the exhibits and kiosks. This means that museums know students' preferences in a museum and are working on satisfy them. On the other hand, they also both find of little interest QR codes and audio guides, with Apps the only type of technology in which they disagree, as students do not find them interesting. Museums should try to focus on making Apps more motivating and interesting, as students are going to be the future public to their institutions. This opinion about Apps was also reflected on the specific question for Apps that the students' survey had, where it was shown that they almost never or rarely download and use an App of a museum.

To conclude, in terms of information diffusion, museums and students have similar opinions. The most important ones for both are website, magazines and newspapers and Facebook. For students it is also very important the recommendations and word of mouth, which means that the museum should achieve a high degree of satisfaction on customers, so that they can, later on, recommend it to their colleagues. They do not agree with the email, which museums consider of a higher importance whereas students do not. The less important ways of communication for both are text messages, mail and Apps. It has just been presented that Apps are not considered a way of communicating information but a way to interact with during the museum's visit. Text messages and mail have been substituted by the new technologies, especially because of their higher cost compared to the new ones.

According to the results found in this study, museums should focus on improving and implementing interactive technologies, which are more attractive to new generations and not spending much time on the other technologies that both museums and students found less motivating. It is important that their information about collections, offers and qualities of a museum arrive to all publics, specially to students, to make the museum attractive for them, as a lot of times they do not visit a museum due to lack of information.

# LIMITATIONS AND FUTURE WORK

As future work, a bigger sample of the students' survey should be collected in order to achieve a more completed statistical analysis and maybe a linear regression could be used in this case, with a higher R square that explained the dependent variable. It would also be interesting to add some statements about the students' satisfaction in the museum, to study the correlation with the rest of factors and try to achieve a higher R square with a linear regression. The usage of Facebook as the channel of communication of the survey was a limitation to a specific profile of students, so it would also be interesting to use other social networks to get to different students' profile.

Instead of having studied students' behavior, which are the future generations of museums, it would have also been interesting to study the current generations that are going often there. In other words, to know the visitors' behavior and their preferences it could have been interesting to deliver the survey among the usual visitors of museums, by going to different museums, physically, and obtaining the answers from the people who visit them.

From the museums' side it would have been interesting to get more answers from the survey, in order to elaborate a depth analysis. However, as they do receive many inquiries and surveys, it is difficult to get a great number of responses.

# REFERENCES

- Allemandi, U. (2014): Visitor figures 2013, *The Art Newspaper*, 23 (256): 1 – 15
- Angelova, B. & Zekiri, J. (2011): Measuring Customer Satisfaction with Service Quality Using American Customer Satisfaction Model (ACSI Model), *International Journal of Academic Research in Business and Social Sciences*, 1(3), 232-258.
- Bailey, J. & Pearson, S. (1983): Development of a tool for measuring and analysing computer user satisfaction, *Management Sciences* 29(5): 530 – 545
- Bautista, S. & Wallis, C. (2012): Mobile experiences in art museums, *Digital media and learning*
- Berry, L. (1986): Big Ideas in Service Marketing, *Journal of Consumer Marketing*, Spring: 47 – 51
- Bloch, M., Upah, G. D. & Zeithaml, V. A. (1985): *Services Marketing in a Changing Environment*, Chicago: American Marketing Association.
- Bonniface, P. & Fowler, P. J. (1993): *Heritage and Tourism in “the Global Village”*, London: Routledge.
- Boyle, T. (2013): QR codes enhance museum experience, *Qfuse*, January
- Cacioppo, K. (2000): Measuring and Managing Customer Satisfaction, *Quality Digest*, September from <https://www.qualitydigest.com/magazine/2000/sep/article/measuring-and-managing-customer-satisfaction.html>
- Carrozzino, M. & Bergamasco, M. (2010): Beyond virtual museums: experiencing immersive virtual reality in real museums, *Journal of Cultural Heritage*, 11: 452 – 458.
- Chang, K., Hou, H., Sung, Y., Chao, H. & Lee, C. (2014): Development and behavioral pattern analysis for a mobile guide system with augmented reality for painting appreciation instruction in an art museum, *Computers & Education*, 71: 185 – 197
- Cheney, P., Mann, R. & Amoroso, D. (1986): Organizational factors affecting the success of end-user computing, *Journal of Management Information Systems*, 3(1): 65 – 80.
- Churchill, A. Gilbert (1995): *Marketing Research: Methodological Foundations*, Orlando: Dryden
- Cochran, W. & Cox, G. (1965): *Diseños experimentales*, México D.F.: Editorial F. Trillas
- Colbert, F., & Cuadrado, M. (2003): *Marketing de las artes y la cultura*, Barcelona: Ariel
- Conybeare, C. (1991): *Museum Visitor Surveys: A practical guide*, Tauton: Area Museum Council for the South West.
- Cronin, J. J., and Taylor, S. A. (1992). Measuring Service Quality: A Reexamination and Extension. *Journal of Marketing*, 56(3), 55–68.
- Davies, S. (1994): *By Popular Demand: A strategic analysis of the marketing potential for museums and art galleries in UK*, London: Museums and Galleries Commission.
- Davis, F. (1989): Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology, *MIS Quarterly*, 13(3): 319 – 340

- Davis, F., Bagozzi, R. and Warshaw, P.(1989): User Acceptance of Computer Technology: A Comparison of Two Theoretical Models, *Management Science*, 35(8): 982 – 1003
- Denzin, N. & Lincoln, Y. (1994): *Handbook of Qualitative Research*, California: Sage Publications
- Dibb, S., Ferrell, O. C., Pride W. M. & Simkin, L. (1991): *Marketing: Concepts and strategies*, Boston: Houghton Mifflin Company.
- Diggles, K. (1986): *Guide to Arts Marketing: The Principles and Practice of Marketing as They Apply to Arts*, London: Rhinegold
- Drucker, P. (1954): *The practice of Management*, Oxford: Butterworth Heinemann.
- Esbensen, K (2002): *Multivariate Data Analysis: An Introduction to Multivariate Data Analysis and Experimental Design*, Oslo: CAMO Process AS
- Falk, J. H. & Dierking, L. D. (1992): *The museum Experience*, Washington, D.C.: Whales-back books.
- Fishbein, M. & Ajzen, I. (1975): *Belief, attitude, intention and behavior: An introduction to theory and research*, Massachusetts: Addison-Wesley
- Fitzpatrick, R. (1991): Surveys of patient satisfaction: Designing a questionnaire and conducting a survey, *British Medical Journal*, 302: 1129 – 1132
- Flipo, J. P. (1988): "On the Intangibility of Services", *Services Industries Journal*, 8(3), 286-98.
- Gaskin, C. & Happell, B. (2014): On exploratory factor analysis: A review of recent evidence, an assessment of current practice and recommendations for future use, *International Journal of Nursing Studies*, 51: 511 – 521
- Goulding, C. (1999): Contemporary Museum Culture and Consumer Behaviour, *Journal of Marketing Management*, 15 : 647-671
- Grigoroudis, E. & Siskos, Y. (2010): *Customer Satisfaction Evaluation: Methods for Measuring and Implementing Service Quality*, New York: Springer.
- Grinter, R., Aoki, P. & Hurst, A. (2002): Sotto Voce: Exploring the Interplay of Conversation and Mobile Audio Spaces, *ACM-Press*, November: 16 – 20
- Grönroos C. (1983): *Strategic management and marketing in the service sector*, Boston: Marketing Science Institute
- Hair, J., Bush, R. & Ortinau, D. (2006): *Marketing Research: within a changing environment*, New York: McGraw-Hill
- Hair, J., Anderson, R., Tatham, R. & Black, W. (1999): *Análisis Multivariante*, Madrid: Prentice Hall Iberia
- Haley, R. I. (1968): Benefit Segmentation: A decision-oriented research tool, *Journal of Marketing*, July: 5 – 30
- Heim, M. (1993): *The Metaphysics of Virtual Reality*, Oxford: Oxford University Press
- Hernon, P. & Nitecki, D. (2000): Measuring service quality at Yale university's libraries. *Journal of Academic Librarianship*, 26(4), 259-273.

- Hill N. (1996): *Handbook of customer satisfaction measurement*, Hampshire: Gower Publishing Limited
- Hoffman, D. & Bateson, J. (1997): *Essentials of services marketing*, Texas: The Dryden Press
- Hokanson, S. (1995): The Deeper you Analyze The More You Satisfy Customers, *Marketing News*, January 2, p.16.
- Holman, R. H. & Wilson, R. D. (1982): Temporal Equilibrium as a Basis for Retail Shopping Behavior, *Journal of Retailing*, 58 (1): 58 – 81
- Ibrahim, H. (2014): Technology Acceptance Model: Extension to Sport Consumption, *Procedia Engineering*, 69: 1534 – 1540
- Jamieson, S. (2004): Likert scales: How to (ab) use them, *Medical Education*, 38: 1212 – 1218
- Johnson, R. & Wichern, D. (2007): *Applied Multivariate Statistical Analysis*, New Jersey: Pearson International Edition
- Khee, C, Wei Wei, G. & Jamaluddin, S. (2014): Students' perception towards lecture capture based on the Technology Acceptance Model, *Procedia: Social and Behavioral Sciences*, 123: 461 – 469
- Kotler, P. (1967): *Marketing Management: Análisis, Planning and Control*, Englewood Cliffs, New Jersey: Prentice-Hall.
- Kotler, P. (2000): *Marketing Management, Millenium Edition*, New Jersey: Prentice-Hall.
- Kotler, N. & Kotler, P. (1998): *Museum Strategy and Marketing*, San Francisco: Jossey-Bass.
- Kotler, P., Armstrong, G., Saunders, J. & Wong, V. (1999): *Principles of Marketing*, London: Prentice-Hall/Financial Times
- Lankford, S., Bitgood, S., & Cota, A. (1995): Special issue: Orientation and circulation, *Visitor behavior*, 10(2): 1 - 200
- Lee, Y., Kozar, K. & Larsen, K. (2003): The Technology Acceptance Model: Past, present and future, *Communications of the Association for Information Systems*, 12: 752 – 780
- Lehn, D. & Heath, C. (2005): Accounting for New Technology in Museum Exhibitions, *Internation Journal of Arts Management*, 7(3): 11 – 21
- Lehn, D., Heath, C., Hindmarsh, J., & Luff, P. (2007): Engaging constable: Revealing art with new technology, *Computer Human Interaction 2007*, Abril 28 – May 3: 1485 – 1494
- Lewin, K. (1951): *Field Theory in and Social Sciences*, New York: Harper and Row
- Lewis, R.C. & Klein, D.M. (1985): Personal constructs: Their use in marketing of intangible services. *Psychology and Marketing*, 2 (3): 201 – 216
- Lim, W. & Ting, D. (2012). E-shopping: an Analysis of the Technology Acceptance Model, *Modern Applied Science*, 6(4): 49 – 62
- Lovelock, C. H. & Weinberg, C. B. (1988): *Public and Nonprofit Marketing*, Danvers: Boyd & Fraser
- Lovelock, C. H. & Wirtz, J. (2010): *Services Marketing: People, technology, strategy*, New Jersey: Prentice Hall

- Malhotra, N. (2007): *Marketing Research: An applied orientation*, New Jersey: Pearson Prentice Hall
- Malraux, A. (1996): *La Musée imaginaire*, Paris: Gallimard.
- Martin, D. (2000): Audio Guides, *Museum Practice*, 5 (1): 71 – 81
- McDonald, M. and Dunbar, I. (1995): *Market Segmentation: A step-by-step approach to creating profitable market segments*, Basingstoke: Macmillan.
- McGoldrik, P. J. (1990): *Retail Marketing*, Berks: McGraw-Hill
- McLean, F. (1997): *Marketing the Museum*, London: Routledge
- McLean, F. (1992): Museum Policy and Marketing Strategies, unpublished PhD thesis, Newcastle-upon-Tyne Polytechnic.
- Middleton, V. T. C. (1985): "Visitor Expectations of Museums" in Scottish Museums Council, *Museums Are for People*, Edinburgh: HMSO.
- Miles, M. & Huberman, A. (1994): *Qualitative Data Analysis*, California: Sage Publications
- Mokwa, M. P., Dawson, W. M. & Prieve, E. A. (1980): *Marketing the Arts*, New York: Praeger.
- Montgomery, D. (2005): *Design and analysis of experiments*, New Jersey: John Wiley & Sons
- Murillo, J. (2009): *Cuestionarios y escalas de actitudes*. Not published manuscript, Universidad autónoma de Madrid.
- Murray D. (1904): *Museums: Their history and their use*, Edinburgh: James MacLehose & Sons
- Museums Association (1984) Definition of a "Museum". Agreed at the Annual General Meeting. See Museums Association: *Code of practice for Museum Authorities*, London: Museums Association.
- Neter, J., Kutner, M., Nachtsheim, C. & Wasserman, W. (1990): *Applied Linear Statistical Models*, Boston: Irwin
- Nunnally, J. (1979): *Psychometric Theory*, New York: McGraw-Hill
- Othman, M., Petrie, H. & Power, C. (2013): Measuring the usability of a smartphone delivered museum guide, *Procedia-Social and behavioral sciences*, 97: 629 – 637
- Parasuraman, A., Zeithaml, V.A. & Berry, L.L. (1985): A conceptual Model of Service Quality and its Implications for Future Research. *Journal of Marketing*, 49 (Fall), 41-50.
- Parasuraman, A., Zeithaml, V. A. & Berry, L. (1990): *Delivering Quality Service: Balancing Customer Perceptions and Expectations*, New York: The Free Press.
- Payne, A. (1993): *The essence of Services Marketing*, Hemel Hempstead: Prentice-Hall.
- Pope, C. & Mays, N. (2002): *Qualitative Research in Health Care*, London: British Medical Journal Bookshop
- Rathmell, J. M. (1974): *Marketing in the Service Sector*, Cambridge: Winthrop.
- Reichheld, F. & Sasser, WE (1990): Zero Defections: Quality comes to Services, *Harvard Business Review*, September-October, 105-111.

- Schultz, M. (2013): A case study on the appropriateness of using quick response (QR) codes in libraries and museums, *Library and information science research*, 35: 207 – 215
- Sechrest, L. & Sidani, S. (1995): Quantitative and qualitative methods: is there an alternative?, *Evaluation and Program planning*, 18(1): 77 – 87
- Shostack, G. L. (1977): Breaking Free from Product Marketing, *Journal of Marketing*, 41(2): 73-80.
- Spearman, C. (1904): General intelligence, objectively determined and measured, *American Journal of Psychology*, 15: 201 – 292
- Styliani, S., Fotis, L., Kostas, K. & Petros, P. (2009): Virtual museums, a survey and some issues for consideration, *Journal of Cultural Heritage*, 10: 520 – 528
- Thomas, S. & Mintz, A. (1999): The virtual and the real: media in the museum, *The curator: the museum journal*, 42: 55 – 58
- Verdaasdonk, H., Van Rees, C., Stokmans, M., Van Eijck, K. & Verboord, M. (1996): The impact of experiential variables on patterns of museum attendance: The case of the Noord-Brabant museum, *Poetics*, 24 (2-4): 181 – 202
- Vavoula, GN., Sharples, M., Rudman, P., Meek, J. & Lonsdale, P. (2009): Myartspace: Design and evaluation of support for learning with multimedia phones between classrooms and museums, *Computers and Education*, 53 (2): 286 – 299
- Walter, T. (1996): From museum to morgue? Electronic guides in Roman Bath, *Tourist management*, 17 (4): 241 – 245
- Zhang, J., Hou, H. T., & Chang, K. E. (2012): Designing a streamlined viewport strategy system to enhance performance in context awareness in mobile learning environments. *Proceedings of the 1st IIAI international conference on learning technologies and learning environments (IIAI LTLE 2012)*, 72–76

Websites:

<http://pt.museuberardo.pt/>

<http://www.gulbenkian.pt/Institucional/pt/Homepage>

# APPENDIX

## Message posted on Facebook asking students to collaborate with the thesis

“Hi everybody! I am working on my thesis about technologies in museums and I need students to answer this survey. If you could fill in the survey, it would be awesome for me!! It will only take you a couple of minutes to complete it! Thanks a lot!”

[https://docs.google.com/forms/d/1yzc5HfaL8X4CBRBJ\\_p3\\_LQCUvgUf\\_RAnjJh6KkEfD0/closedform](https://docs.google.com/forms/d/1yzc5HfaL8X4CBRBJ_p3_LQCUvgUf_RAnjJh6KkEfD0/closedform)

## Questionnaire for students

What do you do in terms of culture?

For the following statements choose according to your degree of frequency:

	Very frequently	Frequently	Occasionally	Rarely	Never
I go to concerts					
I read books					
I go to the theatre					
I go to the cinema					
I go to the opera					
I go to art galleries					
I go to temporary exhibitions in museums					
I go to modern art museums					
I go to history museums					
I go to art museums					
I go to science museums					

For the following questions choose according to your degree of frequency:

	Very frequently	Frequently	Occasionally	Rarely	Never
How often do you go to museums?					
How often do you download an App of a museum?					
How often do you use the App of a museum?					

For the following statements choose your degree of agreement:

	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
I Access the webpage of a museum before visiting it					
I access the webpage of a museum after visiting it					
I access the webpage of a museum during my visit					
Technology really motivates me to visit a museum					
I always look for museums that have more technologies and devices					
If I would have to choose between two museums of the same field, I would go to one that has more technological devices					
I don't care about technologies in a museum, I just go there to see art					
A museum would be more attractive to me if it had Apps with information about the exhibit					
A museum would be more attractive to me if it had audio guides to support the exhibit with additional information					
A museum would be more attractive to me if it had additional information about the exhibits in its website					
A museum would be more attractive to me if it had additional information about the exhibits in its networks (Facebook, Twitter, Instagram...)					
A museum would be more attractive to me if it had videos presented in fixed electronic displays					
A museum would be more attractive to me if it had an App to download on the phone during my visit with a guided tour					
A museum would be more attractive to me if it had audios or videos as part of the exhibit					
A museum would be more attractive to me if it had interactive games about its content					
A museum would be more attractive to me if it had audio guides to download on the phone during my visit					
Technology does not make a museum more attractive to me					

How important are the following in terms of being informed of new collections?

	Very important	Important	Moderately important	Of little importance	Unimportant
Website					
Text message (SMS)					
Facebook					
TV					
Internet advertisement					
Friends, family					
Magazines, newspapers					
Email					
Mail					
Apps					
Twitter					
Youtube					
Instagram					

How important do you think the following are in order to motivate you to visit a museum?

	Very important	Important	Moderately important	Of little importance	Unimportant
Apps for smartphones with guided tours					
Apps for smartphones with more information about the exhibits (explanations, comments from the artist, similar exhibits to visit and others)					
QR codes (codes that can be read from the smartphone, that give more information of the exhibit)					
Classic audio guides					
Interactive technologies: videos (touchable screens)					
Interactive technologies: games (touchable screens)					
Webpage of the museum with information					
Facebook (as a way to inform about new collections)					
Twitter (as a way to inform about new collections)					
Instagram (as a way to inform about new collections)					
Audios as part of the exhibit					
Videos as part of the exhibit					

When you go to a museum, do you understand the exhibits or would you prefer to know more information and details about them, by using any device? Which one would you choose to use?

If you were the manager of a museum and you had money to invest in technology, how would you use it to attract visitors? To give them more information, to communicate with visitors, for publicity, to be modern enough to compete with other museums, etc?

---

How old are you?

- 18 – 20
- 21 – 25
- 26 – 30
- 31 – 35

What are you currently studying?

- Primary School
- Secondary School
- University
- Master
- Postgraduate University

If you are studying a career or a master, in which area?

---

### Message sent to museums by email

“Good morning,

I am Carolina Charques, a student of Engineering from Barcelona. I am working on my thesis in the engineering school of the University of Lisbon (Instituto Superior Tecnico; <http://tecnico.ulisboa.pt/>). The thesis is about Art, culture and marketing, concentrating especially in museums and the way they use technology. This is why I would be really grateful if you could help me by answering this survey about the “Example Museum”, which will only take you ten minutes to complete:

[https://docs.google.com/forms/d/1O0UGU1t1cc4deCBFbDYS2gszGCs2kSN7WvxAE9qHmgo/viewform?usp=send\\_form](https://docs.google.com/forms/d/1O0UGU1t1cc4deCBFbDYS2gszGCs2kSN7WvxAE9qHmgo/viewform?usp=send_form)

Thank you very much for your time and effort.

Best regards, Carolina Charques”.

## List of the museums

Museum	Country
Berardo museu	Portugal
Museu Soares dos Reis	Portugal
Fundação Gulbenkian	Portugal
Museu Nacional de Arte contemporânea do chiado	Portugal
Museu de ciência da universidade de Coimbra	Portugal
Museu de arte contemporânea de Oporto (Serralves)	Portugal
Cosmo Caixa	Spain
Museu Egipci de Barcelona	Spain
MUNCYT coruña	Spain
Museo nacional Reina Sofia	Spain
Museo Naval de Ferrol	Spain
Museo Dalí	Spain
Centro Gallego de Arte Contemporáneo	Spain
Museo Provincial de Lugo	Spain
Museu d'Historia de Barcelona	Spain
Museu Picasso de Barcelona	Spain
Museu Europeu d'Art Modern	Spain
Museu Nacional d'Art de Catalunya	Spain
Museo Nacional del Prado	Spain
Museo Thyssen-Bornemisza	Spain
Guggenheim Bilbao	Spain
CCCB	Spain
Musée du quai branly	France
Louvre	France
Orsay Museum	France
Centre Pompidou	France
Cité des Sciences et de l'Industrie	France

Museum	Country
The Metropolitan Museum of Art	United States
Museum of Modern Art (MOMA)	United States
Denver Art Museum	United States
San Jose Museum of Art	United States
Museum of Fine Arts	United States
American Museum of Natural History	United States
Seattle Art Museum	United States
Philadelphia Museum of Art	United States
National Air and Space Museum	United States
Getty Center	United States
Guggenheim NY	United States
Art Institute Chicago	United States
Brooklyn Museum	United States
The British Museum	England
National Portrait Gallery	England
National Museum of Scotland	England
Somerset house	England
Tate Britain	England
Natural History Museum	England
Science museum	England
The National Gallery	England
Victoria and Albert Museum	England
National Gallery of Ireland	Ireland
Moscow Kremlin Museum	Russia
The State Hermitage	Russia
Tretyakov Gallery	Russia

Museum	Country
Museo Bardini	Italy
The Vatican Museums	Italy
Uffizi Gallery	Italy
Guggenheim Venice	Italy
Pinacoteca di Brera	Italy
National Archaeology Museum	Greece
Acropolis Museum	Greece
Rijksmuseum	Holland
Van Gogh Museum	Holland
Kunsthistorisches Museum	Austria
Museum of Cairo	Egypt
Pergamon Museum	Germany
National Palace Museum	Taiwan
National Museum of China	China
Geological museum of China	China
Railway museum of Hong Kong	China
Art museum of Chinese University in Hong Kong	China
Hong Kong Science Museum	China
Hong Kong Space Museum	China
Macao Science Center	China
Museu de Macau	China
National Museum of Korea	Korea
Mori Art Museum	Japan
The National Museum of Western Art	Japan
Centro cultural banco do Brasil (Rio)	Brasil
Museo Soumaya	Mexico

Museum	Country
Queensland art gallery	
Art Gallery New South Wales	
Museum of Contemporary Art Australia	
Museum of Inuit Art	
Royal Ontario museum	
National Museum	
Vasa Museet	
Goteborgs Konstmuseum	
Louisiana Museum of Modern Art	
SMK National Gallery of Art	
Experimentarium City	
Natural History Museum of Denmark	
Arken Museum of Modern Art	
Kunsten	
Museum of Cultural History	
Munch Museet	
Norsk FolkeMuseum	
Asian Civilisation Museum	
Philatelic Museum	
Peranakan Museum	
Singapore Art Museum	
National Museum of singapore	

### List of the collaborating museums

<b>Museum</b>	<b>Country</b>
Berardo museu	Portugal
Museu Soares dos Reis	Portugal
Fundação Gulbenkian	Portugal
Museu Nacional de Arte contemporânea do chiado	Portugal
Museu de arte contemporânea de Oporto (Serralves)	Portugal
Museo nacional Reina Sofia	Spain
Museo Dalí	Spain
Museo Provincial de Lugo	Spain
Museu d'Historia de Barcelona	Spain
Museu Europeu d'Art Modern	Spain
Guggenheim Bilbao	Spain
CCCB	Spain
Museum of Fine Arts	United States
Seattle Art Museum	United States
The British Museum	England
National Museum of Scotland	England
Natural History Museum	England
Science museum	England
The National Gallery	England
National Gallery of Ireland	Ireland
Pinacoteca di Brera	Italy
National Archaeology Museum	Greece
Pergamon Museum	Germany
Hong Kong Science Museum	China
Mori Art Museum	Japan
Museum of Inuit Art	Canada
National Museum	Sweden
Vasa Museet	Sweden
Experimentarium City	Denmark
Natural History Museum of Denmark	Denmark
Arken Museum of Modern Art	Denmark
Munch Museet	Norway
National Museum of singapore	Singapore

## Questionnaire to museums

### TECHNOLOGY IN MUSEUMS

This is a study for an engineering thesis of a student from IST (Instituto Superior Tecnico) in Lisbon about art, culture and marketing, concentrating on the behavior of museums towards technology. The data collected in this study will be aggregated for further analysis.

In which country is the museum placed?

\_\_\_\_\_

How many temporary exhibitions have you had during the last year approximately?

\_\_\_\_\_

Which is the museum's field (for instance: Modern Art, History, Science, Classic Art...)?

\_\_\_\_\_

Do you have any App (to use it in tablets and smartphones) of the museum?

\_\_\_\_\_

For the following statements related to the attitude towards technology in the museum choose depending on your degree of agreement:

	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
Investing in technology increases the visits.					
Having electronic devices makes a museum more attractive to visitors					
Most of the visitors ask for audio guides					
Audio guides should have different degrees of detail for each exhibit, to accommodate the different interests of visitors					
QR codes are useful to give more information of the exhibits					
More technology than we have at the moment can distract the visitor from appreciating the exhibit they have in front of them					
Additional information about the exhibits should be given to visitors for a better understanding					
It is essential to have Wi-Fi in the museum, free for visitors					
We prefer to have free Wi-Fi restricted to internal webpages on the exhibits					

To spread information about we think it is important to use (choose depending on your degree of importance):

	Very important	Important	Moderately important	Of little importance	Unimportant
Website					
Apps					
Text messages (SMS)					
Instant messaging and photo sharing networks like Facebook, Renren or others					
Short messaging networks like Twitter, Sina Weibo or others					
Youtube					
Instagram					
TV					
Radio					
Internet advertisement					
Magazines, newspaper					
Email (sending email with information on the exhibitions)					
Mail					
Leaflets or written information in city tourist offices					

For the following statements related to Apps and the interaction with the museum choose depending on your degree of agreement:

	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
It is important to have an App of the museum for visitors to use it during their visit					
It is important to have an App of the museum for visitors to use it before their visit					
It is important to have an App of the museum for visitors to use it after their visit					
Having an App of the museum makes it more attractive to visitors					
Having an App of the museum helps visitors to understand the exhibits					
Having interactive games within the museum makes it more attractive to visitors					
Having videos displayed in fixed electronic screens makes it more attractive to visitors					
The museum plans to have new technological devices physically in the museum (such as touchable screens, tablets, kiosks, audio guides...) in the next 3 months					
Having kiosks or interactive screens in the entrance of the museum makes it attractive to visitors					

If you are planning to improve your technological devices or introduce new ones, could you explain which ones?

---

Do you prefer to use technology to give visitors more information or to let them interact with the exhibits?

---

What constraints do you have towards technology in your museum?

---

How many visitors did you have last year approximately? (optional)

---

How many objects do you have at the moment in the museum approximately? (optional)

---

Name of the museum (optional)

---

## Correlations matrix

	X1	F1_Interact	F2_MApps	F3_Wsite	F4_SocialApps	F5_Behavior	F6_DMail
X1	1	,069	,204*	,189	,101	,727**	,134
Correlación de Pearson		,277	,039	,051	,193	,000	,125
Sig. (unilateral)		76	76	76	76	76	76
N							
F1_Interact	,069	1	,569**	,413**	,514**	-,017	,168
Correlación de Pearson		,277	,000	,000	,000	,441	,074
Sig. (unilateral)		76	76	76	76	76	76
N							
F2_MApps	,204*	,569**	1	,529**	,632**	,150	,275**
Correlación de Pearson		,039	,000	,000	,000	,098	,008
Sig. (unilateral)		76	76	76	76	76	76
N							
F3_Wsite	,189	,413**	,529**	1	,487**	,149	,170
Correlación de Pearson		,051	,000	,000	,000	,100	,070
Sig. (unilateral)		76	76	76	76	76	76
N							
F4_SocialApps	,101	,514**	,632**	,487**	1	,078	,432**
Correlación de Pearson		,193	,000	,000	,000	,251	,000
Sig. (unilateral)		76	76	76	76	76	76
N							
F5_Behavior	,727**	-,017	,150	,149	,078	1	,040
Correlación de Pearson		,000	,098	,100	,251	,040	,366
Sig. (unilateral)		76	76	76	76	76	76
N							
F6_DMail	,134	,168	,275**	,170	,432**	,040	1
Correlación de Pearson		,125	,008	,070	,000	,366	,000
Sig. (unilateral)		76	76	76	76	76	76
N							

\*. La correlación es significativa al nivel 0,05 (unilateral).

\*\* . La correlación es significativa al nivel 0,01 (unilateral).