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Grau en Enginyeria de Tecnologies Industrials

**Development of a sales system without
physical purchase receipts**

REPORT

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Summary

The aim of this project is to develop the approach of a sales system without physical purchase receipts, reaching an environmental improvement. This system will be designed for a particular company: Barcelona Tourism. Regarding the methodology used to develop this project, it has been fundamental the documentation on the current market situation regarding digital receipts in order to purpose the optimal solution. Furthermore, a survey of 72 potential users has been conducted and several external consultations have been carried out to complete the study.

The implementation of this project would imply the saving of 67.063,56 l of water, 390,21 l of oil, 16.207,5 kWh of electric energy, the cutting of four trees and 3342,64 kg of CO₂ emitted; furthermore, it would reduce the exposition to workers and users of Bisphenol A. The solution that bests prospects of success has is a mobile application. Such an application must provide quality content and it would even speed up the purchase process. Thanks to the survey carried out, it is likely that the application would have good acceptance.



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1. Introduction

It is still associated the growth of paper consumption as an indicator of development. It is actually a mere indicator of the current waste of natural resources. To illustrate this statement, let's look at some data. The 87% of paper used for writing and printing is consumed by only the 20% of the world's population (NOTE: See Greenpeace paper). As for the waste of resources, it's important to mention that between 30% and 40% of solid urban waste generated in Europe is paper and paperboard.

On a personal level I have always been bothered by the waste of resources, especially that of the paper used to print purchase receipts. I can not think of a better example of waste of paper: both for the unjustified length that many of them have, and for the little use they are given. However, they are very necessary to demonstrate the ownership of a specific product or service, and thus have guarantees, possibility of change or returns, or as a document of purchase for the company. In this meeting of inefficiency and necessity, this project was born. At first I tried to make an overly ambitious proposal in its objectives; my tutor made me rethink the idea to an achievable proposal.

The problem to be solved is to reduce paper waste, and from this project a modest contribution to that achievement is made. For this, a proposal will be made to a local company, so that, as we said, it is a practical and realistic project. To encourage other companies, an accomplished and viable experience is very useful. "Small changes are powerful."

1.1. The Project: objectives, methodology and structure

After defining the problem to be solved, the objectives of this Project can be raised. The desire is to develop the approach of a sales system without physical purchase receipts. This system will be designed for a particular company, in this case for Barcelona Tourism. This consortium is the official agency for the promotion and revitalization of tourism, cultural and shopping attractions of Barcelona and its surroundings. In this case, the proposal that best meets their needs, is a mobile application. This application will have its own objective: to improve the experience of the tourist in the city of Barcelona.

Regarding the methodology used to develop this project, documentation on the current market situation regarding digital receipts has been fundamental. Furthermore, a survey of 72 potential users has been conducted. Several external consultations have been carried out to complete the study. First, all the Barcelona Tourism information has been provided by David Leáñez, computer and new technologies manager in the same company. Secondly, Alex Pemán, programmer of the application 21 Buttons, product manager in the same company, and former student of ETSEIB. Finally, advice has been received from Maria del Mar Campanero, program responsible of the Barcelona's council Project "+ Sustainable City Council".

As for the structure of the project, it has been divided into several parts. In the first instance, concepts are defined and basic information is provided to understand the development of the study. Next, the process of selecting the company to be treated is discussed, and Barcelona Tourism is described. Then, a market study is carried out on digital receipts, to justify the proposal finally made. As it was previously mentioned, this proposal is an application, and therefore an entire block is dedicated to the creation of such an application, and to describe the new shopping process to be followed by the user. Finally, a general analysis and an environmental analysis is performed, presenting in last instance the results and

conclusions.

This project aims not only to make a proposal to Barcelona Tourism with the intention of reducing the issuance of paper receipts, but also aims to serve as a guide and referent if any company wants to become paperless.

1.2. Scope

As mentioned above, this project is limited to the proposal of Barcelona Tourism. Although at a general level it can serve as a guide for any company, at a particular level it responds to the unique needs of Barcelona Tourism, which being an entity that works with tourism, are very specific.

The main problem that has been had to deal with during the development of this project has been the small variety of alternatives available in the digital receipt market. It is a relatively new world, and most companies do not enter it; and those who do, do so in a very superficial way and with purely advertising goals. The great challenge of this project has been to find a proposal that was attractive to the customer, but also to the company, since it is them who have to make the investment of resources to implement it.

2. Deforestation

According to the UN, since 2000, the area of the world's primary forests has decreased by more than 40 million hectares, an area comparable to the size of Germany and Denmark combined. As Greenpeace¹ has stated, in order to combat climate change, global deforestation must be stopped before 2020.

Let's take a closer look at the causes of deforestation². In the first place, we find the change in land and water used for agricultural and livestock activities. The cultivated lands favor the commerce and provide food to the populations; And agriculture and livestock are the basis of settlements and prosperity of a community. However, the territory used for agriculture displaces the forests and with them, all the species of flora and fauna that are associated.

Another major cause of deforestation is uncontrolled fires. Most of the fires that take place around the world happen intentionally by the hand of the human being. Or by arsonists or by economic interests such as being able to build an urbanization on the land and profit. There are also diseases and forest pests that destroy much of the flora and fauna of the place, damaging the relationships between species and causing the ecosystem to die.

At present, massive logging of forests and forests is a major threat (approximately 10-15% of deforestation). Every year we lose 13 million hectares of native forest in the world, especially the tropical forests in Asia, Africa and America. The aim of this project is to prevent logging for papermaking. Below there is a chart of the causes of deforestation.

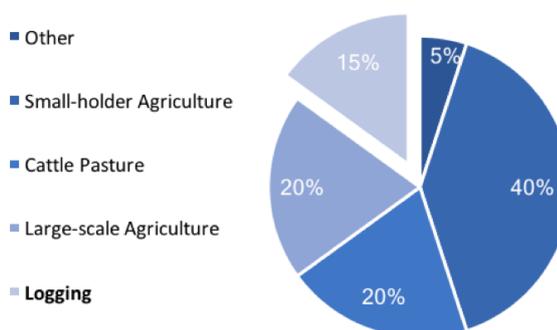


Figure 2. Causes of deforestation³

"Other" includes the development of urbanization infrastructures, forest fires (not for agriculture),

¹ For further information, go to page 58 "Bibliographic References" [22]

² For further information, go to page 58 "Bibliographic References" [46]

³ For further information, go to page 58 "Bibliographic References" [31]

hydroelectric projects and the collection of firewood.

Deforestation can have a negative impact on the environment. Let's take a look at the effects and consequences of this⁴. The most dramatic impact is the loss of habitat for millions of species. Eighty percent of Earth's land animals and plants live in forests, and many cannot survive the deforestation that destroys their habitats.

Deforestation also drives climate change. Forest soils are humid, but are not protected from the cover of trees that block the sun, and consequently dry quickly. Trees also help to perpetuate the water cycle by returning water to the atmosphere. Without trees to fill these roles, many former forest lands can quickly become dry deserts.

Removal of trees deprives the forest of portions of its canopy, which blocks the sun's rays during the day and stays warm at night. This interruption leads to more extreme temperature changes that can be detrimental to plants and animals. Trees also play a critical role in the uptake of greenhouse gases that fuel global warming. Less forests mean greater amounts of greenhouse gases entering the atmosphere and greater speed and severity of global warming. The most feasible solution to deforestation is to manage forest resources by eliminating logging to ensure that forest environments remain intact. The cut that must occur must be balanced by planting young trees to replace old felled trees.

Spain is the sixth most relevant producer of the EU⁵. Our country has 132 paper mills and 15 cellulose mills. The Spanish cellulose and paper industries consumed in 2003 a total of 5.858.000 m³ of wood as raw material for the production of 1.894.000 tons of cellulose. An important part of the Spanish paper industry, which is dedicated to the manufacture of paperboard for packaging, recycles about 4 million tons of recovered paper a year, preventing it from ending up in landfills. Thus, the paper sector uses as an average raw material 8 tons of recovered paper per 10 tons of new paper that is manufactured.

In line with avoiding deforestation, the alarming consumption of paper must be reduced. Specifically, each year 11 trillion receipts are printed, and only for US 9.6 million trees for the production of receipts are harvested⁶. This not only represents an enormous expenditure of natural resources but also economic; Each receipt is estimated to cost approximately \$ 0.01. Thus, each year, US \$ 110,000 million is spent on printing receipts worldwide. Despite this, only 10% of businesses offer digital receipts.

⁴ For further information, go to page 58 "Bibliographic References" [37]

⁵ For further information, go to page 58 "Bibliographic References" [23]

⁶ For further information, go to page 58 "Bibliographic References" [47]



3. Thermal paper

The paper that is usually used for receipt printing is called "thermal paper". It's a type of paper that is sensitive to heat and printed through a technology called "direct thermal", that is, print heat, not by ink⁷.

It has recently been discovered that exposure to thermal paper receipts issued by cash registers and similar appliances causes, through the skin of our hands, the absorption to our blood of significant amounts of *Bisphenol A (BPA)*⁸, according to a study published in a prestigious scientific journal⁹: *Journal of the American Medical Association (JAMA)*. In view of this study, *Vivo Sano Foundation* warns of the professional risk that people who work with cash tickets are exposed every day¹⁰.

BPA is not only found in receipts, but also in many plastics (eg *Polyvinyl Chloride, Low Density Polyethylene, Polystyrene*), and therefore many of the packages used for food¹¹. It is also found, among others, on recycled paper, in wines and beers fermented with *BPA* resin coated vats, and soda cans.

If a pregnant woman is exposed to *BPA*, it reaches her baby. At this stage of development, the *BPA* is suspected of producing the baby as serious damage such as infertility, kidney damage, breast cancer, behavioral disorders, immune system damage, obesity and diabetes, which can stay hidden until many years after birth.

From foundations such as *Vivo Sano*, it is being demanded that the restriction on *BPA* in thermal paper in Europe is extended, like the prohibition France did in 2015¹², with the aim of reducing exposure, in particular, of young women working in contact with these materials. For these workers the exposure is greater and the risk is bigger, for the possibility that they are pregnant.

⁷ For further information, go to page 58 "Bibliographic References" [48]

⁸ For further information, go to page 58 "Bibliographic References" [38]

⁹ For further information, go to page 58 "Bibliographic References" [49]

¹⁰ For further information, go to page 58 "Bibliographic References" [13]

¹¹ For further information, go to page 58 "Bibliographic References" [50]

¹² For further information, go to page 58 "Bibliographic References" [18]

4. Receipt's definition and legislation

In civil law a receipt is a written document delivered to the debtor in which the creditor acknowledges having received from him the amount of credit defined¹³.

Both invoices (a payment request) and receipts (proof of payment from the buyer) are legal documents. Two receipts must be made for each transaction: one for the customer and one for the seller. In many countries, such as Spain, a trader may have a legal obligation to provide a receipt to a customer showing the details of a transaction and other information so that the tax authority can verify that sales and related taxes¹⁴.

Under Spanish legislation¹⁵, "the granting of a payment receipt is, in principle, a non-formal legal act, which implies that the he who delivers it may choose any sort of natural written form, which constitutes the essence of the receipt, that is deemed appropriate, in accordance with the freedom of form principle."

On January first, 2013, a regulation came into force which establishes that invoices, both normal and simplified, may be issued by any means, in paper or electronic format, to guarantee the authenticity of its origin, the integrity of its content and readability from date of issue and throughout the shelf¹⁶.

It is common for receipts contain the following information¹⁷:

- Name of the company (personal name if the name of the company does not exist)
- Company's address
- Company's telephone number (or an alternative contact method)
- Transition date
- Detailed list of products or services (number of articles, name, description or a combination)
- Cost of each product or service
- Subtotal
- Taxes
- Final amount
- Payment method. If it's paid in cash, it includes the amount in cash and the money returned.

The document may also include merchant messages, warranty or return details, special offers, advertisements or coupons, but these are merely promotional and are not part of the formal receipt.

¹³ For further information, go to page 58 "Bibliographic References" [17]

¹⁴ For further information, go to page 58 "Bibliographic References" [15]

¹⁵ For further information, go to page 58 "Bibliographic References" [17]

¹⁶ For further information, go to page 58 "Bibliographic References" [41]

¹⁷ For further information, go to page 58 "Bibliographic References" [10]

5. E-Receipt

The alternative proposed by some companies to receipt printing, is the *e-receipt*. This is defined as an electronic receipt of goods or services that have been purchased, as opposed to a printed receipt, and are sent by email. The first company to offer *e-receipts* was *Apple* 12 years ago, and was joined by companies like *Wal-Mart* and *Home Depot*. Currently only 10% of companies offer *email receipts*, and most of them in the US. It is anticipated that in the next three years this percentage will increase to 70%¹⁸.

This system offers many advantages over the traditional printed receipt. The first and most evident is the saving of paper, which in turn implies economic saving. As discussed above, it is estimated that the printing of each receipt costs about \$ 0.01.

Second, the *e-receipt* provides marketing opportunities. In fact, 83% of businesses that use it, declare it's for this reason¹⁹. With email address, a merchant can try to sell with personalized sales incentives. *E-Receipts* traders also provide a deeper understanding of consumer buying habits, which can lead to advertising more targeted, promotions and emails.

On the other hand, having the receipt in your email inbox makes it always available on your *smartphone* and it will not get lost or end up erasing the ink (with thermal paper, it is very common that the text gets erased before the end of the warranty of the product). In addition, such digitalization of the receipt allows a greater ease in terms of business acquisitions, which always require proof.

However, this system has some disadvantages. Providing your email address to the company in question, concerns certain users by the invasion of privacy²⁰. Not only is there evidence of your timely purchase, but also your purchase history.

Moreover, users who have given their email before have seen that the consequence of that fact is to receive advertising emails to which they did not subscribe. This means that in the future the same users reject the possibility of receiving *e-receipt*, to avoid such *spam* emails. A non - *spam* policy makes customers more likely to answer "yes" when asked if they would like a digital receipt²¹.

Finally, having all the receipts in the email is effective but not efficient; it's an unorganized solution. Although it is a digital option, it does not offer all the advantages it could provide, such as guarantee ends date detection system so that receipts are automatically deleted when they are not in effect; association of receipts with a program of expenses management, visualization of your consumption trends, etc. *E-receipts* provide many more advantages to the seller rather than the buyer, a fact that discourages the user to be in favor of this system.

¹⁸ For further information, go to page 58 "Bibliographic References" [47]

¹⁹ For further information, go to page 58 "Bibliographic References" [12]

²⁰ For further information, go to page 58 "Bibliographic References" [43]

²¹ For further information, go to page 58 "Bibliographic References" [12]

6. Company selection

To materialize the project, it is necessary to choose a business, and from its data, types of customer etc., choose the optimal solution for the elimination of physical receipts. This solution must have a frictionless experience for the customer. Any new digital receipt strategy must add value while offering greater simplicity. For example: the fact that the customer has to give his email every time he buys something is not efficient. The consequence of this is that the necessary data must be obtained from the customer on their first purchase, and automate the system thereafter.

This approach has as a counterpart that the client will not be interested in providing their data if they are not regular customers of the establishment in question. A possible solution to this counterpart is the merger of digital receipts with a loyalty program, which gives the customer two groups of advantages: those associated with the digitalization of receipts and those related to a loyalty program. Whether we opt for this proposal or not, what is established is that we are interested in choosing a business with a fixed clientele. Analyzing the typology of establishments, we can highlight those that usually have a higher level of fidelity:

- i. Supermarkets
- ii. Malls
- iii. Pharmacies
- iv. Markets
- v. Coffee shops
- vi. Kiosks
- vii. Clothes shops
- viii. Pet Stores

However, there are other types of establishments that enjoy short-term / medium-term loyalty. An example of this category would be:

- ix. Pre-mom / toy stores
- x. Tourism selling points

Is more interesting to digitize (and consequently make permanent) receipts that may be required for exchanges, returns, consumer inquiries and/or to submit to a third party. From the enumeration made above, (ii) presents a major problem, and that is that in many malls the stores that operate do so independently. Each has its own system of receipts where the mall in question can not intervene. The stores implement it with their plants and follow the system that they mark them. The shopping center, as a management team, only receives their sales, which are confidential, and gives them support in other actions: marketing, logistics, security, etc²². Therefore, it is discarded for our case.

For this particular project, a proposal to Barcelona Tourism will be done, because by selling products and services, they offer the possibility of eliminating not only the receipts, but also the shows or museums tickets.

²² For further information, go to page 58 "Bibliographic References" [32]

7. Barcelona Tourism

The Barcelona Tourism Consortium is the official entity for the promotion and dynamization of the tourist, cultural and commercial offer of Barcelona and its surroundings, created in 1993 by the Barcelona City Council, the Chamber of Commerce, Industry and Navigation of Barcelona and the Foundation for the Promotion of Barcelona²³. Tourism of Barcelona, as an entity, is sensitized with sustainability. In fact, it is one of its main lines of action, and as such, they work to minimize the impact of paper among others²⁴.

7.1. General performance

The consortium consists of twenty physical points of sale, plus online sales²⁵. They mainly sell services offered by the city, although in three offices they have a souvenir shop, and therefore physical product. In the online sales channel only services are offered²⁶.

In general, the impression of proof of purchase is required. In some cases, they already work with digital vouchers²⁷ without the need to print them, but the main problem is that not all facilities are ready to receive digital vouchers, and they ask them that customer has it on paper. Currently they have an ongoing project with the aim of responding to these facilities and allowing the customer to make use of a digital voucher everywhere. There are also other factors such as the Tour Operation²⁸ which in some cases ask for physical proof to validate the voucher in exchange for the service.

7.2. Costumer profile

It is important to know the customer's profile to make a proposal that suits their needs. During the year 2016, Barcelona received 11.790.941 tourists. Let 's look at these various classifications of tourists according to their profile²⁹.

²³ For further information, go to page 58 "Bibliographic References" [5]

²⁴ For further information, go to page 58 "Bibliographic References" [6]

²⁵ For further information, go to page 58 "Bibliographic References" [27]

²⁶ For further information, go to page 58 "Bibliographic References" [9]

²⁷ A piece of paper that can be used to pay for private goods or services or that allows to pay less than usual the price for them.

²⁸ Usually considered tour operator company that offers products or tourist services, usually hired by him, and made up more than one of the following items: transportation, accommodation, transfers, excursions, etc. It can be wholesale operator if you work exclusively with travel agents or wholesaler and retailer in order to extend its offer to the general public. This classification of wholesale / retail has been somewhat blurred since the advent of the Internet.

²⁹ For further information, go to page 58 "Bibliographic References" [7]

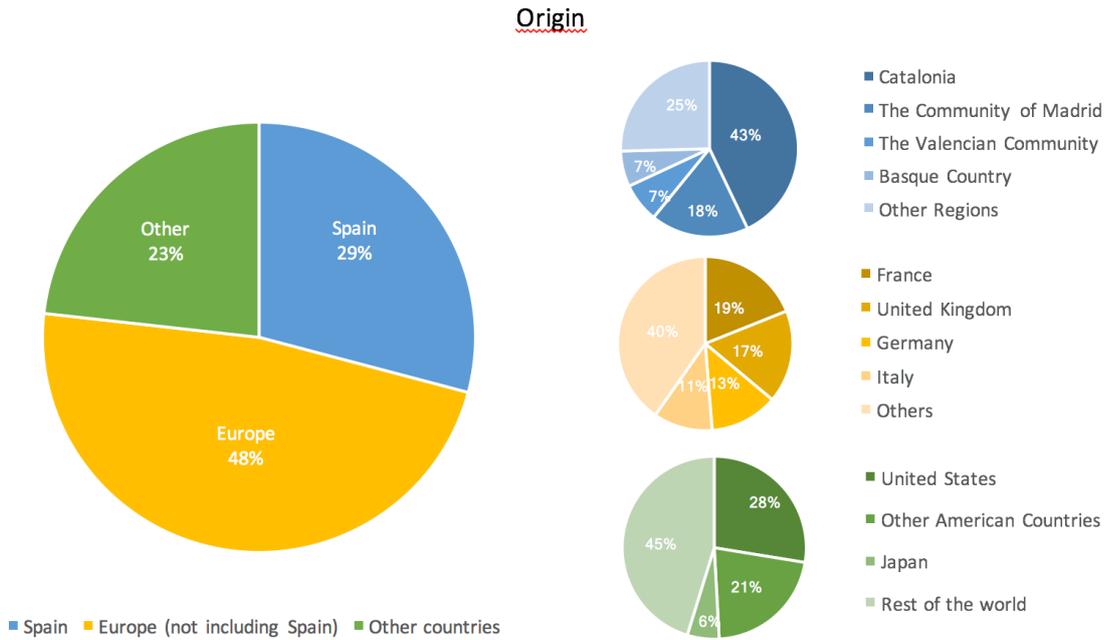


Figure 7.1. Barcelona’s tourists classified by origin

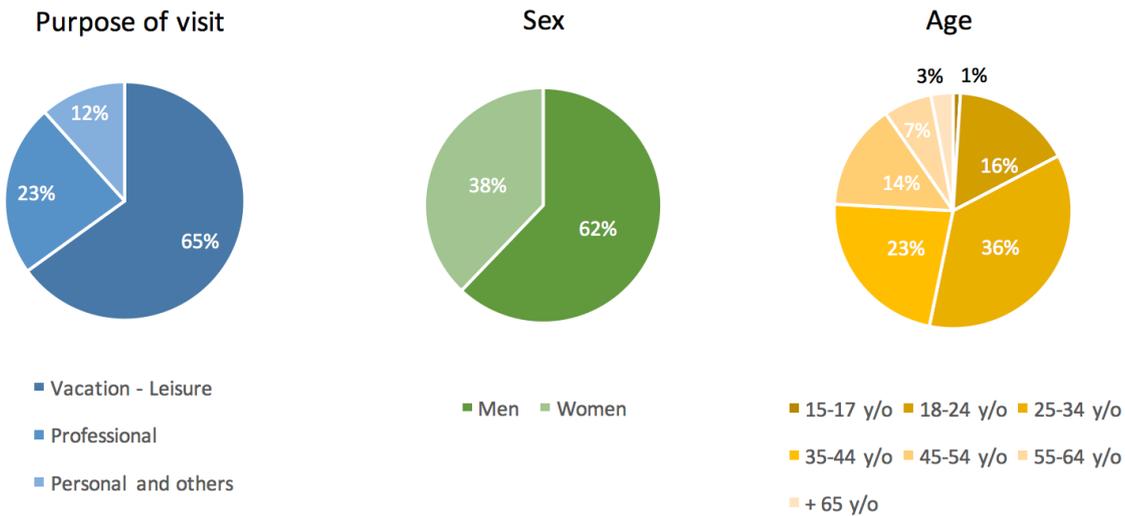


Figure 7.2. Barcelona’s tourists classified by purpose of visit, sex and age

For reasons of confidentiality, Barcelona Tourism is unable to provide specific statistics of the tourist’s profiles that buy products and/or services in their stores. However, the general data is consistent with the customer that Barcelona Tourism has. Consequently, the presented percentages will be considered for this study.

7.3. Customer Experience

Concerning the previously discussed loyalty concept, it is necessary to note that in this case, being the theme tourism, the possible loyalty is clearly short term. Its maximum duration is the time the tourist is in Barcelona. This does not imply that this concept becomes obsolete; Barcelona Tourism has a high degree of repetition. Consequently, although brief, we can consider that this consortium has a loyal customer, in the terms we have defined above.

7.4. Consumption

According to data provided by Barcelona Tourism³⁰, in 2016 services were sold for 46.720.000,00 €. Of this amount, 92.5% was acquired at physical points of sale, corresponding to an amount of 43.220.000,00. On average, a service offered by Barcelona Tourism costs 40 €/service, which means that in 2016 1.080.500 services were sold.

The sale of a service at a physical point of sale involves the printing of two types of paper. First, the voucher of the service, and secondly the receipt of purchase. If a group of people makes a joint purchase, each person will be given a different voucher/ticket but a single receipt. According to information provided by Barcelona Tourism³¹, people go to the average sales outlets in groups of 3 people. We can therefore consider that in 2016 Barcelona Tourism delivered 1.080.500 vouchers or tickets and 360.167 receipts.

³⁰ For further information, go to page 58 "Bibliographic References" [7]

³¹ For further information, go to page 58 "Bibliographic References" [27]

8. Comparison of E-Receipts

In order to provide Barcelona Tourism the best possible alternative to printing receipts, it is necessary to make a comparative study of the options currently offered by the market.

As discussed in previous sections, it is difficult to find a balance between customer satisfaction (having the traditional receipt but in a digital format) and merchant satisfaction (taking advantage of the receipt as an opportunity to increase sales). A comparison of different E-Receipts formats follows.

8.1. Mothercare

This company, originally from the United Kingdom but present throughout Europe, sells products related to the whole pregnancy process, and the early years of babies. Therefore, while it is true that only for a very determined period of time, they have a potentially loyal and recurrent clientele. In addition, they sell products that have guarantees, so the interest to keep the receipts increases. Environmental considerations are an integral part of their core business values, coupled with their commitments to social responsibility, quality, safety and value³².

In the first purchase of a client in their establishments, they send an *e-Receipt* by email, if it is preferred to the printed one. In the email, in addition to the receipt in an attachment in PDF, they promote their app³³. Specifically, they promote the option that the app offers to manage receipts. By having an account in this store, you can access the receipts from your smartphone, tablet and the web. Thanks to this system, currently 48% of the receipts provided by Mothercare are digital³⁴.

This app has been designed by *NN4M*³⁵, a company that is dedicated to designing and selling apps, in collaboration with *yReceipts*³⁶, a company with the main objective of linking in-store transactions to shoppers and campaigns on any *POS* (point of sale) device.

The process for obtaining the digital receipt at the *POS* is very simple³⁷. The customer only scans a QR code presented in the app on the customer's device, and the digital receipt is automatically stored in the customer's account. These receipts include product images that allow the client to quickly access product details in the same app. Sales staff also have the ability to scan the customer's email address instead of having to manually enter it, eliminating the margin of error per human factor.

YReceipts integration adds another layer of comfort to the app Mothercare, enabling customers to access all your purchase history in the store, instead of having to search through your inbox email.

³² For further information, go to page 58 "Bibliographic References" [35]

³³ For further information, go to page 58 "Bibliographic References" [34]

³⁴ For further information, go to page 58 "Bibliographic References" [36]

³⁵ For further information, go to page 58 "Bibliographic References" [40]

³⁶ For further information, go to page 58 "Bibliographic References" [55]

³⁷ For further information, go to page 58 "Bibliographic References" [39]

8.2. Evans Cycles

Evans Cycles is a bike shop and accessories for the same from UK. This company follows an active policy³⁸ to reduce their environmental impact (they have won several awards for it), while encouraging its customers to reduce their footprint on the planet.

In this case, when a purchase is made, an email address must be provided. Consequently 100% of customers receive an *E-Receipt*. The store also provides an in-store physical receipt to all customers, even though the digital works as warranty.

Concerning the *E-Receipt* format, the receipt is sent as an attached PDF, and in the email's body there are links giving the customer the opportunity of providing feedback, product reviews and there are also useful links, that is, policy return / exchange.

8.3. Philz Coffee

Philz Coffee is an American coffee and coffee chain based company based in San Francisco, California. It is defined as that company as environmentally-friendly as possible³⁹.

In this case, the receipt is in the email's body. The only supplementary information provided, in addition to the regulatory listing of consumed products, is a "Is this not your receipt?" link and another link to a specific preference receipt centre, which provides a great experience for the customer, providing the flexibility that is lost when providing your personal email. Finally, they encourage the client to leave opinions of the place, simply by responding to the email.

Currently less than 5% of Philz Coffee customers request an e-receipt⁴⁰.

8.4. Macy's

Macy's is a department store in the United States. Its main store is located in Herald Square, New York City. It currently has stores throughout the United States. Macy's pledge to reduce their impact on the environment, from reducing energy use to recycling more waste generated by its own operations⁴¹. By 2016, about 23 percent of all Macy's receipts were digital⁴².

In this case, to benefit from the *E-Receipt*, it is necessary to have an account at the store, associated with an email. Once the account is active, the customer can choose between:

- i. Only receipts by e-mail
- ii. Only paper receipts
- iii. Both physical and digital receipts

³⁸ For further information, go to page 58 "Bibliographic References" [19]

³⁹ For further information, go to page 58 "Bibliographic References" [44]

⁴⁰ For further information, go to page 58 "Bibliographic References" [45]

⁴¹ For further information, go to page 58 "Bibliographic References" [30]

⁴² For further information, go to page 58 "Bibliographic References" [29]

The format of the *E-Receipt* is a traditional receipt, in the same email body. It has a bar code, very suitable for both security and fraud prevention. As additional information, it can only be found a promotion of their rewards program. Although a copy of the *E-Receipt* can be requested if lost⁴³, receipts will only be available on the email inbox, not in the customer's profile on the website.

8.5. Halfords

Halfords Group is a UK retailer of auto parts, car equipment, camping and touring equipment and bicycles operating in the UK and Ireland. In their environmental policy⁴⁴ they expose that their work has an impact on the environment and that they have the duty to handle that impact in a responsible and ethical way.

They introduced the *E-Receipts* in January 2016⁴⁵, and since then, 15% of its customers have chosen the digital receipt. Regarding the *E-Receipt's* format, the receipt is in the body of the email. The only additional information is a link to rate your purchase and store.

8.6. Miss Selfridge

Miss Selfridge is a women's clothing company originally from the UK and currently present throughout the world. Miss Selfridge is part of Arcadia Group Ltd⁴⁶. Fashion Footprint is the Arcadia Group program that plans, monitors and manages the social and environmental impact of their business. They aim to produce fashionable products in an ethical way and demonstrate responsible attitude towards people and the environment.

Currently, 20% of their receipts are expended in digital format, at the request of its customers⁴⁷. In this case, the receipt is also part of the email body itself. It contains a bar code for safety, along with the date of the last refund of the products. As for additional information, it only gives the possibility review the purchase.

What this company provides, is the fact that through its website, and thanks to the bar code present in the physical receipt provided in the store, you can instantaneously create a digital receipt.

8.7. Argus

Argos is a British retailer operating in the United Kingdom and Ireland, and a subsidiary of Sainsbury's. Company policy expresses a clear desire to reduce their environmental impact.

This company is a client of Yocuda⁴⁸, a leading provider of *E-Receipts*. Concerning the *E-Receipt's*

⁴³For further information, go to page 58 "Bibliographic References" [28]

⁴⁴For further information, go to page 58 "Bibliographic References" [24]

⁴⁵For further information, go to page 58 "Bibliographic References" [53]

⁴⁶For further information, go to page 58 "Bibliographic References" [3]

⁴⁷For further information, go to page 58 "Bibliographic References" [2]

⁴⁸For further information, go to page 58 "Bibliographic References" [54]

format, the receipt forms the heart of the message. As additional information, promotional and review links are given. Links to support content such as manuals and videos specific to the items purchased are also provided; A good way to give the customer useful and relevant information after the purchase. According to the latest statistics, 22% of customers ask for the digital receipt⁴⁹.

8.8. Comparison

Once presented the different types of e-receipt on the market, it is necessary to establish interesting categories to study and do a comparative analysis between them.

First it is interesting to see if the company in question has an environmental policy, and consequently whether the fact of providing an e-receipt it is interesting for them to reduce their environmental impact. It is also important to see the degree of their customer's fidelity considering both the intensity level (high, medium, low) and longevity (short-term, long-term). This data will show us the relationship between offering an e-receipt with the type of customer that the company in question has.

Previously it has been established⁵⁰ that it is important, as far as possible, that the process of providing an e-receipt can not be tedious for the client, which we call frictionless experience. To measure this level of customer involvement, we discuss the need to provide an email address and/or creating an account.

Then we analyze the characteristics of their e-receipt. The possibility of digitalizing a receipt that previously was given in paper, from which platform the e-receipt can be seen (e-mail, web, app), in what format is sent the e-receipt (with an attachment or in the body of the email), if it has a bar code, and finally the additional information provided by these receipts (reviews, publicity, descriptions of the products purchased, and if the platform allows you to view the entire history of receipts).

The relevance of this information is captured in the most important fact of the table: the percentage of consumers who receive an e-receipt to total consumers. With this data we can analyze whether the methodology used by the company is effective or not.

⁴⁹ For further information, go to page 58 "Bibliographic References" [25]

⁵⁰ For further information, go to page 11 "E-Receipt"

Company	Green policy	Fidelity	Account needed	Email address needed at POS	Transform paper to digital receipt	Visualization of the e-receipt			% Of e-receipt Given
						E-mail	Web	App	
Mothercare	x	H - ST	x			x	x	x	48 %
Evans Cycles	x	M - LG		x		x			(100%) ⁵¹
Philz Coffee	x	H - LG		x		x			<5%
Macy's	x	H - LG	x			x			2.3%
Halfords	x	M - LG		x		x			15%
Miss Selfridge	x	M - LG		x		x			20%
Argus	x	M - LG		x	x	x	x		22%

Company	Receipt 's format			Additional information			
	PDF attached	Email's body	bar code	reviews	publicity	On the Purchased products	Purchase history
Mothercare	x		x	x	x	x	x
Evans Cycles	x			x			
philz Coffee		x		x			
Macy's		x	x		x		
Halfords		x		x			
miss Selfridge		x	x	x			
Argus		x		x	x		x

Figure 8.1. Comparative table of the different E-Receipts studied

Legend of the table:

x = Yes

Blank = No

H = high; M = medium; L = low;

ST = short-term; LT = long-term;

⁵¹ It will not be considered the percentage of Evans Cycles, because they force all customers to receive a digital receipt, but in turn provides a physical receipt. What we study is the will of the client receive an e-receipt as opposed to a paper receipt.

Once exposed this information, it is necessary to analyze it to draw conclusions about what makes an e-receipt have more or less customer acceptance. For starters, it should be noted that all these companies have an environmental policy, and all of them have a level of customer fidelity medium-high. Therefore, this information does not affect the success rate, and consequently it is not considered relevant.

In the case of Macy's, it is necessary to have an account to receive e-receipts. At Mothercare you have two options: either provide your email at the POS and they will send you the e-receipt by email, or create an account and access all your receipts from the web or app. Although a priori it might seem that the fact that more effort is required from the customer to create an account implies that this option receives less acceptance, the result is the opposite. The advantage of having an account is that the process can be automated; the customer has to spend time creating the account, but it's an investment. Other companies ask for the email address each time a purchase is made, what ends up in more time of the customer consumed. The result of this is that the two companies that present greater acceptance are Mothercare and Macy's.

However, the percentage of Macy's is not significantly different from companies that send receipts by email. Then, it is important to see what Mothercare differs from the others. There are primarily three characteristics. The first is that receipts can be displayed on the app or web. Argos also offers the possibility of viewing the receipt on the web, yet customers are not allowed to view the history of all purchases; Mothercare's second particular characteristic. By last, from links on the bill, additional information on the products purchased can be seen. This feature is also shared with Argos. It can therefore be concluded that what gives more value to the Mothercare e-receipts, and what consequently translates into success is viewing the e-receipt on the app, and the ability to store all receipts.

It is very important to note, moreover, that the Mothercare APP offers much more than the ability to store purchase receipts. This application provides the customer with a shopping channel, tools and tips to help parents who are in the process of having and raising a baby, wish lists, and a function called 'Baby Tunes' which is nothing more than a collection of lullabies and appropriate songs for parents to put their children⁵². All these features make the APP very attractive for the customer, and therefore makes it easy for consumers to get an account to access all this content, and in the end, this is just translating into a higher percentage of e-receipts. We can then assume that to increase this percentage, it should be offered more quality content to make the proposal attractive and beneficial to consumers.

⁵² For further information, go to page 58 "Bibliographic References" [4]

9. Proposal to Barcelona Tourism

After analyzing the market, we can propose a solution to Barcelona Tourism to remove physical receipts, or at least reduce their numbers significantly. As we concluded in the previous section, the solution that works best is one that provides the customer quality content, as well as provides the receipts digitized. The platform that best allows both things, is a mobile application.

In this case, the additional information that this application will offer include: city maps, recommended routes, information about museums, gastronomic proposals ... In fact, an application of this kind already exists; created by the same Barcelona Tourism. The added value proposed in this paper, is to create an app that integrates information currently provided and a new part consisting of:

- i. Sales channel for the services already offered online and POS.
- ii. Storage section of the tickets purchased either through the app itself or in a retail store.
- iii. Receipts of the services/products purchased online or at a retail store.

Let's look at some statistics on mobile applications that justify and reaffirm this election. A study by Google⁵³, 63% of consumers download an APP to facilitate their life. TripAdvisor conducted a study in 2015⁵⁴ that gives very important information:

- i. The 42% of tourists in the world use smartphones to plan or book their trip
- ii. 45% of Connected Travelers⁵⁵ usually book activities for their trip with their smartphone
- iii. 72% of Connected Travelers use their smartphone to browse restaurants while on vacation

It also provides a ranking of the regions with the highest number of Connected Travelers. From this ranking, those places that also have information on the percentage of annual tourists in Barcelona were selected.

Origin	% of connected travelers	% of tourists in Barcelona ⁵⁶
America (without US)	57 %	4.9 %
Spain	52 %	29, 0 %
Italy	49 %	5.3 %
japan	49 %	1.4 %
US	48 %	6.4 %

Figure 9.1. Table of comparison between % of connected travelers and % of tourists in Barcelona of a particular region

⁵³ For further information, go to page 58 "Bibliographic References" [21]

⁵⁴ For further information, go to page 58 "Bibliographic References" [51]

⁵⁵ The report defines "Connected Travelers" as Those Who Have Used a Smartphone to plan or book a trip and offers an in-depth insight into Their habits and behaviors

⁵⁶ For further information, go to page 13 "Barcelona Tourism"

It can be seen that of the 47 % of tourists annually received in Barcelona, the average of Connected Travelers is 51 %, a very significant percentage.

On the other hand, the average monthly hours that all users use mobile applications, is 68,2 h⁵⁷. Millennials⁵⁸ use mobile applications 86,6 h/month, significantly above the average. As previously seen, 52% of tourists annually received in Barcelona are millennials⁵⁹, a fact that underlines the viability to create an APP .

Finally, both the Trip Advisor Study⁶⁰ and other consulted sources, highlighted the growing trend of Connected Traveler. In fact, from 2014 to 2015, time spent by users in travel applications increased by 28%⁶¹.

Therefore, it can be concluded that for both the current trend and the forecasting of the future is not only consistent but also recommendable to use an APP to solve the problem before us.

⁵⁷ For further information, go to page 58 "Bibliographic References" [1]

⁵⁸ There are no sets dates for When This cohort starts or ends; Demographers and Researchers Typically use the early 1980s as starting birth years and the mid-1990s to early 2000s as ending birth years. In this paper we will consider millennials to group currently between 18 and 34

⁵⁹ For further information, go to page 13 "Barcelona Tourism"

⁶⁰ For further information, go to page 58 "Bibliographic References" [51]

⁶¹ For further information, go to page 58 "Bibliographic References" [20]

10. Creation of the application

10.1. Outline of the process

Once the proposal that will be done for Barcelona Tourism has been detailed, it is necessary to establish the methodology to be followed to develop the project. In this case we have chosen to follow the methodology proposed by Javier Cuello and José Vittone in his book and manual "Designing mobile apps"⁶². Creation stages outlined in this manual are five: conceptualization, definition, design, development and publishing. In this particular project, being a proposal to a company, stages of conceptualization, design and information architecture design will be developed; for being the ones that structure the needs of Barcelona Tourism and that reflect the application's requirements.

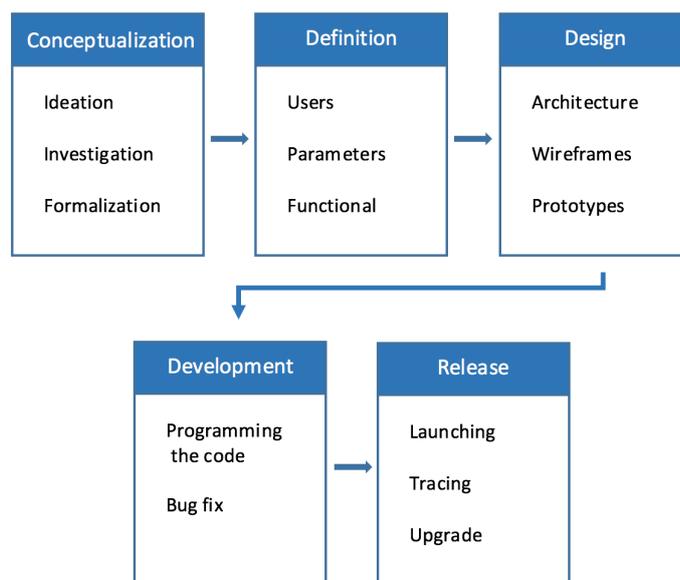


Figure 10.1. Outline of the process proposed by Javier Cuello and José Vittone

The manual makes a clear distinction between the roles of two characters: the designer and the developer. We can see below an outline provided in the same manual of the amount of work both of them have on each stage.

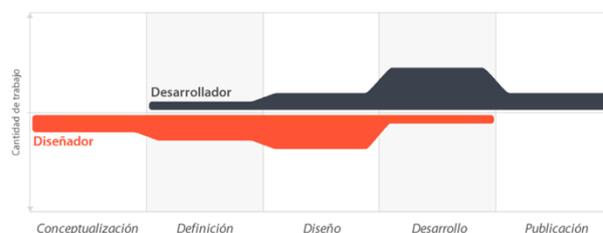


Figura 10.2. Amount of work of the designer vs. developer in the whole process

⁶² For further information, go to page 58 "Bibliographic References" [14]

10.2. Conceptualization

Regarding the conceptualization, it consists of three distinct processes:

- Ideation
- Investigation
- Formalization of the idea

10.2.1. Ideation

In Proposal to Barcelona Tourism⁶³, a first approach to the features that will have the APP has been made. Now we shall structure more compact and clearly, but still in a simplistic way, the features that this application will have:

- City Information (practical information, art, museums, leisure etc.)
- City maps with transportation alternatives
- Suggested itineraries
- Gastronomic proposals
- Sales channel
- Passbook⁶⁴
- Purchase receipts

Once the idea has been conceived, it must be differentiated from other applications by contributing with something meaningful and valuable to the user. The way to get started is based on three pillars:

1. To have a goal

Anything that is included in the app must respond to this objective, although it will not always be a direct relationship. This objective is directly linked to user needs and how the application helps resolve them. The greater the need is, and the better the app solves it, the more successful it will be.

The objective of this APP is to improve the tourist experience in the city of Barcelona, providing basic information, recommendations, maps, and a sales channel with its corresponding passbook to achieve it.

⁶³ For further information, go to page 22 "Proposal to Barcelona Tourism"

⁶⁴ Storage tickets purchased either through the app itself or in a retail outlet

2. Thinking about the user

It is vital to know the user, and this knowledge can be used to make design decisions focused on him, so that the application is intuitive and therefore easier to use.

In this case we have two types of very important information. First we have very specific profile of the tourists that Barcelona has, provided by Tourism Barcelona⁶⁵. These data gives information on gender, origin, age, and the reason for visiting the city. On the other hand, as will be seen later in Defining Users⁶⁶ a survey to 72 people has been conducted, and it will help define personality traits of this user: life goals, personal situation and professional or aptitude for technology among others. This information will be essential to design the application in line with the user. The user must be taken into consideration throughout the entire process, being a product designed exclusively for him.

3. Determine the context

The context of use has into account where users are interacting with the app: places the user in a given physical space that affects and conditions the way he has to interact with the screen. The context also takes into account factors such as the general atmosphere of the place, the people there and the punctual actions made therein.

The geographical context of this application is very clear: Barcelona. However, the geographical context is not everything; you need to analyze when and how the user will use this APP. In this case, each functionality of the APP will be used in a different situational context. This will cause each function to be independently designed considering the use that will be given.

Two different situations are defined: planning and on-going. As for planning it is understood for features that help plan the trip and consequently are consulted in a relaxed situation, whether a hotel, apartment or cafe. Consequently, users have more time, you can enter more written information, and a more complex interface.

As for on-going, it is defined as a situation in which the tourist is moving or stopped briefly, like a bus, walking or queue of a museum. The interface of these functions should be very simple and intuitive, the user does not have time and will probably be in a "chaotic" situation. Of course there will be functions to be used in both situations, and for the, a compromise should be reached that meets both needs.

⁶⁵ For further information, go to page 13 "Barcelona Tourism"

⁶⁶ For further information, go to page 32 "Creation of the application / Definition / Users"

Let's take a look on how each function will be used:

Function	Planning	On-going
City information	X	
City maps, and transport information	X	X
Recommended routes	X	X
Gastronomic Proposals	X	X
Sales Point	X	
Passbook		X
Purchase receipts	X	

Figure 10.3. Table of the functions classified in “planning” and “on-going”.

After finishing this ideation step, it is time to investigate.

10.2.2. Investigation

Now we differentiate two distinct processes, benchmarking and viability of the idea:

1. Benchmarking

With the idea already defined, it is necessary to see if that idea already exists, if it was previously developed by others and how. This is defined as benchmarking. With the amount of applications on the market today, it is highly likely that a similar idea is found. It's important analyze and evaluate alternatives to see how they can be improved, completed or offer something to add some value to your proposals can help the differentiation discussed earlier, and consequently increase the chances of success. Both the strengths and the weaknesses of competition will help stand out.

In this case, being a tourist APP, a comparison will be made between other official tourism entities in the world: Barcelona, Berlin, London, Amsterdam and Madrid (NOTE: We have selected these cities on the recommendation of Tourism Barcelona), as they all have a policy of active tourism promotion.

	Amsterdam	Barcelona	Berlin	London	Madrid	
Content	Accommodation		X			
	Activities		X	X	X	
	Culture		X	X	X	
	Eat & drink		X		X	
	Events		X	X	X	
	Free				X	
	Kids		X		X	
	LGTB		X		X	
	Maps	X	X	X	X	
	Must see		X		X	
	Near me				X	
	Neighborhoods		X	X		
	Offers		X		X	
	Pictures		X			
	Routes / Itineraries	X	X		X	
	Shopping		X		X	
	Transport				X	
	Useful information		X		X	
	offline	By choice	X		X	X
		Partial		X		
Languages	German		X	X		
	Spanish		X		X	
	English	X	X	X	X	
	French		X			
	Italian		X			
Account needed	X					
Tickets store		link				
Search engine					X	

Figure 10.4. Table comparing the apps offered by different cities

From the table above we can draw positive and negative points of each application. First, it is important to point out that the application format Amsterdam has is very different from the others: it only provides itineraries and different routes, and yet it is the only one that requires creating an account. It has the same objective as the other applications, improving the tourist experience in their city, but his approach is diametrically different. Consequently, it will not help us to make comparisons.

In terms of content, Barcelona and Madrid provide greater variety and quantity⁶⁷ without doubt. Although a priori it may seem a plus, it makes it slow to find the content wanted, there is too much information. In the case of the Barcelona application, some content is repeated in various sections, and that translates into confusion, inefficiency and complexity of the APP. It will be essential to choose very carefully what information you wish to provide and find a balance of quality and simplicity.

⁶⁷ For further information go to Annex, page 1, “Comparison APPs” [1]

The only content that the four cities agree to provide is: activities, culture and maps. Chosen by three of the four cities, categories are: events, activities to do with children, shopping and must see.

In a survey done with 72 people, it has been asked users to order by priority functions that provide the application⁶⁸. The order chosen is as follows:

1. City Information
2. City maps
3. Sales channel
4. Passbook
5. Gastronomic proposals
6. Purchase Receipts

The gastronomic recommendations have many variable parameters (type of food, price, localization, local type) that hinder you can provide all user types a site that meets their tastes and needs without having to have a too extensive data base, complicating the structure of the application. Seeing that users that have conducted the survey do not prioritize this option, and that Barcelona and Madrid are the only ones who opt for this content, no astronomical proposals options will be offered in the implementation of this project. Following the same criteria of complexity, it is discarded to provide hotel/apartment proposals.

The same survey has collected the concerns of users regarding content. They feel the app should count on the explanations of transport, both motorbike/car rental and public transport. On the other hand, the sales channel is among the favorites among users and no city offers in its application. The Barcelona app provides a link to the website, but is not integrated into the application.

As to dispose of the application without internet, all cities except Barcelona offer the possibility to download some content at will of the user, to access it without an internet connection. The 15% of respondents⁶⁹ believe that offline content is the most important thing for this type of APPS. The 47,50% precedence simplicity of the APP, a fact that reiterates the need to optimize the amount of information provided. On the other hand, 22,50% would prefer a good search system, which currently only offers the application of Madrid.

⁶⁸ For further information, go to Annex, page 9, "Survey's results" [2]

⁶⁹ For further information, go to Annex, page 9, "Survey's results" [2]

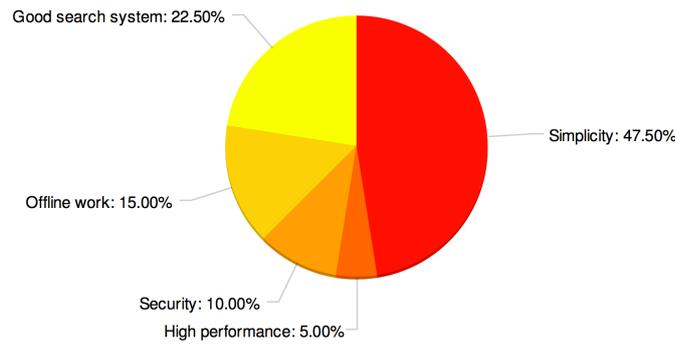


Figure 10.5. Result of the survey to the question: What do you feel is most important in this kind of APP?

Finally, it can be seen that except for Barcelona, other applications only offer the APP in the languages of their city. Being an APP designed for tourists, it makes no sense to not offer it in the most common languages of Barcelona’s tourist⁷⁰: German, Spanish, English, Italian and French.

2. Viability of the idea

Of course, one must ask whether the idea will work. For this purpose, behavioral studies, observation or surveys can be used. In this case, it has been chosen to do a survey, asking the user if they would download an APP of the mentioned characteristics. The answer is affirmative, a fact that reaffirms the viability of the application.

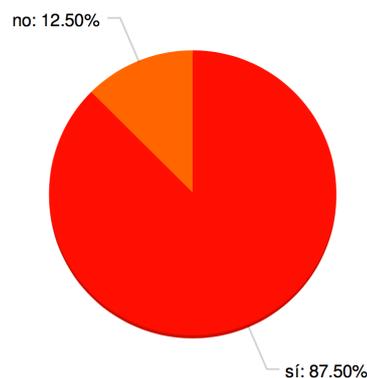


Figure 10.6. Results of the survey to the question: Would you download an APP of such characteristics if you visited that city?

⁷⁰ For further information, go to page 13 “Barcelona Tourism”

Once the investigation is completed, the idea can be formalized, adding to the initial ideation proposals and differential values of the acquired market analysis.

10.2.3. Formalization of the idea

Once the sub-stages of ideation and research completed, it can be proceeded to formalize the idea, specifying those aspects that were previously unclear. First, the previously established functions are modified, eliminating the culinary offerings. The final functions are shown below:

- City Information
- City maps
- Sales channel
- Passbook
- Purchase Receipts

The application can be used without an account, but in order to access the functions of passbook and purchase receipts, the user must have an account by providing their name and email. In case they want to buy, not also they need to have an account, but also provide data on the credit card. If purchased in a physical point of sale, they can access the ticket and the receipt in the APP with the account. In this case, as in the case of Mothercare⁷¹ the seller will scan a QR code⁷² to be found in the client APP, containing the information of the email with which the user created his account, and tickets and purchase receipts are then transferred to the customer's account and therefore the APP.

As for the information of the city, which is the category that contains more content, it must be decided which themes will be offered. Through the benchmarking and survey analysis conducted above, one can choose:

- Useful information
- Must see
- Culture
- Events
- Activities
- Activities with kids
- Routes / Itineraries
- Transport

This selection of content intends to meet the user's wishes and simplify the application. In addition, the application will have a search system, in order to reduce the time the user takes to

⁷¹ For further information, go to page 16, "Comparison of e-receipts"

⁷² QR Codes can trigger various actions on the smartphone Where They are read: website, business card, Wireless network, send SMS or email, call a phone number, add an event to a calendar, geolocation, plain text between others. For further information, go to page 58 "Bibliographic References" [14]

find the content they are looking for, useful especially for those functions used in the context of on-going⁷³.

On the other hand, the application will have the option to download content at will, to access it when internet is not available. This content can be accessed from an option called "Saved." Finally, as discussed above, the APP will be available in five languages: German, Spanish, English, Italian and French.

10.3. Definition

In this process step, as the name suggests, the following categories are described in detail:

- Users
- Parameters
- Functional

10.3.1. Users

Let's start with the definition of users. Knowing the users is essential to design an application that takes into account their motivations, needs and problems, as an axis from which to build a proposal. This knowledge is based on studies that help determine the profile of users of the application. The methodology generally used to achieve that is "Personas"⁷⁴.

To create Personas is necessary to do research analyzing as many users as possible and by identifying which patterns of behavior and thought they have in common with each other, avoiding falling into their individual characteristics, focusing only on what they share. For this we conducted a survey⁷⁵ with potential users of the application to create our Persona on which we will work. The end result of this research is a visual representation where the user is modeled from the data obtained: the person will have a face, a name, a story, ambitions and goals.

Following this methodology and the information provided by respondents, it has been reached Jean-Pierre's profile, shown below. From now on the application will be designed thinking in his needs, concerns and ambitions.

⁷³ For further information, go to page 25, "Creation of the application / Conceptualization / Ideation"

⁷⁴ The concept of "Personas" was coined by Cooper, a design company and strategy located in San Francisco, and is a design strategy centered on the user and marketing, where Personas are imaginary characters created to represent different types of users who could use a website, a brand or a product similarly. Vendors should use people along with market segmentation, where qualitative people are built to represent specific segments. Different types of people can be determined for an application, but for this exercise has real value should not be more than three. Ideally, the project should focus on one primary person. Personas viewed individually may serve to meet a user model, but also need to know how that model behaves and feels

⁷⁵ For further information, go to Annex, page 9, "Survey's results" [2]

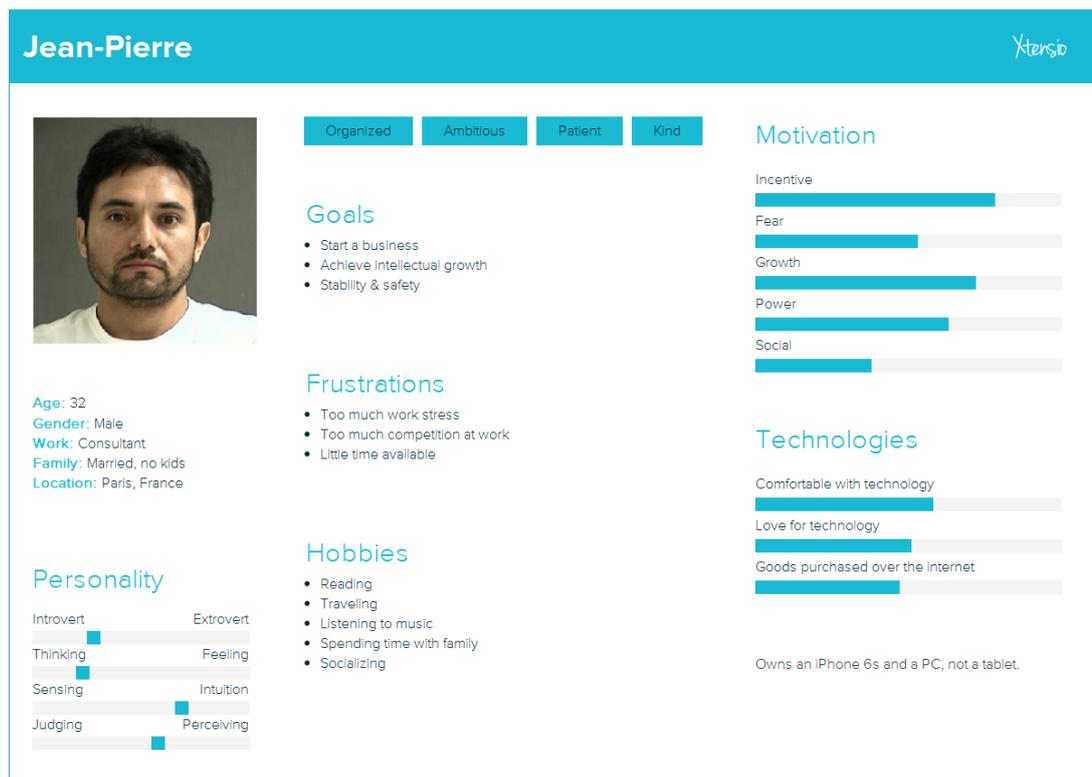


Figure 10.7. Jean-Pierre Persona

10.3.2. Parameters

Once users are studied, it is necessary to define a set of parameters. For this, a division of applications in various groups will be made in order to analyze the implications each classification will have.

Category

The first parameter to be considered is the type of application, according to the type of content that gives users. We'll call category and it will condition, in a design level, the kind of detail that the interface will have, and in turn influence the monetization possibilities of the application⁷⁶.

⁷⁶ The different categories are:

- Entertainment: they propose fun to the user. Graphics, animations and sound effects try to maintain constant and uninterrupted user attention.
- Social: they focus on communication between people, in building networking and interaction between users.
- Utilitarian and productivity: they provide tools to solve specific problems and are based on the implementation of specific, short and quick tasks.
- Educational and information: they are transmitters of knowledge and news.
- Creation: they provide tools to enhance the user's creativity.

Considering the content of this project, it is an informative application. In these apps access to content is privileged. For this reason, the readability, ease of navigation and search tools are fundamental, as discussed above in formalizing the idea⁷⁷.

Price

The next decision is regarding the price of the APP: free, paid or *freemium*⁷⁸. In order to make an informed decision, it must be established whether the objective of the APP is to make money or serve as a communication channel with users, or as a way to extend the reach of the brand⁷⁹.

In this case, the purpose of the application described in Conceptualization / Ideation⁸⁰, is to improve the tourist a greater experience in Barcelona. It is therefore essential the promotion of Barcelona, and therefore this application it is merely a way to extend the reach of brand. On the other hand, compared to other applications⁸¹, offered by other cities, they are all free. For these two reasons, the application will be free.

⁷⁷ For further information, go to page 31, "Creation of the application / Conceptualization / Formalization of the idea.

⁷⁸ Combination of the previous two mix of English words *free* and *Premium* is to download the application for free, allowing the user a basic and limited, with the possibility of more advanced functions use prepaid

⁷⁹ The different advantages and disadvantages of each system are the following:

	Advantages	Drawbacks
Free	<ul style="list-style-type: none"> - Scope or amount of potential users - Lowers expectations about the product - It can serve as promotion for a paid version of herself or other applications from the same developer 	<ul style="list-style-type: none"> - Difficulty in obtaining visibility in the rankings of the different stores due to great competition - Most downloads require the payment to reach the top of the rankings
Paid	<ul style="list-style-type: none"> - iPhone users are more accustomed to paying for a quality APP - It allows us to offer advanced services 	<ul style="list-style-type: none"> - They require a large number of downloads to be profitable - Lesser extent, the user does not usually want to risk paying for something not yet known - Free tend to have similar alternatives - Price conditioned by the market and competition - By commissions of different shops (Google Play, App Store or Windows Phone Store), the developer gets 70% of download
Freemium	Advantages of the previous two	<ul style="list-style-type: none"> - Difficulty in determining which parts of the application to offer free and which do pay

Figure 10.8. Comparative table of the advantages and drawbacks of each type of app

⁸⁰ For further information, go to page 25, "Creation of the application / Conceptualization"

⁸¹ For further information, go to page 25, "Creation of the application / Conceptualization / Investigation"



Monetization

In relation to the above classification, it is necessary to define monetization models, ie, the various alternatives to obtain money through the application. There are three alternatives: in-app purchase, payment for the full version and advertising⁸².

As discussed in the previous section, the purpose of this application is not making money directly, but indirectly by the consumption of tourists in the city of Barcelona. While it is true that evidently the user who wants to purchase tickets for a museum / event / etc proposed in the online shop Tourism Barcelona, will be required to pay through the platform. This function does not convert the app into freemium, but it does provide Tourism Barcelona a new and more accessible source of income than those currently available.

Development

Here it is important to define what type of application will be programmed according to their development. There are three possibilities: native applications, web or hybrid. The chosen system will condition the visual design and interaction⁸³.

⁸² Different alternatives:

- In-app purchase. They allow you to pay small amounts of money by buying separate items that improve application performance. This form of monetization is associated with the model *freemium*.
- Pay for the full version. In this case the developer creates two versions, free with basic features, and the most comprehensive payment. This model is losing weight by the disadvantages. It is not always easy to transfer the user settings from one version to the other defined, and user ratings and position in the rankings are independent for the two versions.
- Advertising. Usually it occurs in the form of small messages, which when pressed will move to the advertiser's website. The gain depends on the number of people entering the ads.

⁸³ Each operating system provides developers with specialized software to develop applications, known generically as *Software Development Kit* (SDK). Applications written with that SDK, are called native. Consequently, to put the application on sale in the specific application store of each operating system, the application will have to be programmed for each of them. This represents a greater workload, and a rethinking of the application for each operating system, but in turn has several advantages:

- They can make use of notifications operating system to gives relevant information to the user.
- Internet is not required for the application to work, it is truly integrated into the phone.
- For the same reason, it allows the app to use all the features of the terminal hardware (camera, sensors, GPS etc.)
- Design specifically designed for each operating system, favoring usability.

The second possibility is to program a web application, also called *webapp*. The programming of these applications is made with HTML, JavaScript and CSS. By not using an SDK as in the previous case, this application is programmed once and serves all operating systems. On the other hand, this type of application does not require installation, as displayed using the phone's browser. This however, has some negative implications, such as not being distributed in an application store, and therefore they must market and promote independently. They also require Internet connection to operate.

Finally, you can opt for a hybrid application. This type of application is a combination of the two. It develops similarly to the web (HTML, JavaScript and CSS), but once the code of the application is complete, is compiled in such a way that the end result is very similar to a native application. This format allows, with the same code, programming an application and distribute it in each of the stores of different operating systems. In return, the

As seen above, this APP will require to have some offline content, and the GPS will be needed for the maps function to work correctly. Therefore, this application will be native.

Platform

Related to the previous category, it is necessary to establish for which platform/s the application will be designed. To make this decision is essential to take into account the resources, complexity, and type of user that the application is directed. Currently, the most present operating systems entities in the market are Android with 81.7%, iOS with 17.9% and finally Windows Phone with a minor 0.3%⁸⁴. Besides their presence in the market, it is important to differentiate each operating system for the features that their users have, whether geographic, demographic, psychographic or behavioral⁸⁵.

Once taking into account the presence in the market of the different operating systems, and their users profiles, it has been chosen to program this application for Android and iOS. On the one hand, being a free app, the Android user will not be a problem downloading, and it is very important to be present in the Android app store, because of their majority presence in the market. On the other hand, users of iOS, having usually higher socioeconomic status are more likely to travel, and therefore it is very important to offer them the application.

10.3.3. Functional

In this sub-section, the bases regarding functionality will be set, which will determine the project scope and complexity of design and programming of the APP. All actions and interactions that are necessary for a user to achieve its objective, translate into functions that the application must have.

design is not as adapted to the operating system in question as it would be in a native APP and has a worse performance.

⁸⁴ For further information, go to page 58 "Bibliographic References" [33]

⁸⁵ Designing for Android is a good strategy given the high number of users you have, it becomes potential customers; It has a broader scope. The downside is that the wide variety of models, screen resolutions and different operating system versions available, it becomes difficult to design and programming. The Android operating system is open, a fact that makes their applications very different from each other. This defines a system more open to new ideas, different user structures, which sometimes results in chaotic applications. This implies that the quality of the applications is not always what the user expects, and therefore not usually willing to pay for a APP they do not know.

On the other hand, designing for iOS means focusing on a smaller market, and in turn more exclusive. Apple brings simplicity to the design process, being more consistent with screen resolutions in the operating system versions and have few models. As for users, giving greater value to the experience, they are interested in the details and have a higher socioeconomic profile than users of other platforms. As discussed above, they are more willing to pay for applications if it means having quality content.

Windows Phone, despite being at a disadvantage compared to the previous two, is growing. Windows Phone interface is flat, is based on simplicity. Practicality over aesthetics preempts, and therefore attracts users who prefer a good experience through simple navigation.

Every time a new feature that complements the main objective is added, it's important to be aware of the value it represents for the user and their real utility, taking into account the person and the context of use. Each added function represents also increased development time and complexity, hence the importance of carefully deciding in each case whether or not it will be included in the application, to avoid ending up with a saturated product. The visual simplicity is directly related to usability. Mobile devices are not designed to show too much information, as it must be displayed on the screen; one should handle the visual economy and have good judgment to determine what to include and what not in the design.

On the other hand, it is necessary that the app is programmed consistently to each operating system. Android users and iOS are accustomed to different forms of use and must be programmed accordingly. While the information structure will be the same for both applications to be designed, how one accesses it may vary to respect the knowledge and customs of the user.

In addition, the mobile application design must take into account how users hold their devices. One of the most common ways is to hold the device with one hand, which implies that there will be areas of the screen that will be achieved with less comfort⁸⁶.

Finally, the interaction patterns are proven solutions to address common design problems that often occur. While it should not be used as a law, it should be followed as a guide. These interaction patterns vary for Android or iOS.

To properly define each of the functions, like the explanation will structure the application into six categories:

1. Home Screen
2. Information about Barcelona
3. Maps and transport
4. Sales channel
5. Passbook and receipts
6. Saved

Each of these categories (unless home screen) will be the theme of a different tab. The tabs are always present in an application, to switch back and forth comfortably.

Apple tabs are always at the bottom of the screen, while in the case of Android are on top. In the latter they can be fixed or sliding; This project has chosen them fixed. It has also followed Google's recommendation not to use more than seven tabs.

⁸⁶ The "Law of thumb" refers to the surface of the screen that the finger used is easily accessible, and that will directly affect how to organize the elements in the interface.



Figure 10.9. Arrangement of tabs in Android and iOS⁸⁷

At the top of each tab (except on maps) the user will see a magnifying glass icon, which when pressed will convert the entire top in a search engine that will let the user search for content in the entire application. Within this search engine will be two options to search, "the name of the tab" or "all the content" to speed up the search if you're looking in the right place, or to avoid losing content if not. Android makes the option to search accessible from the action bar.

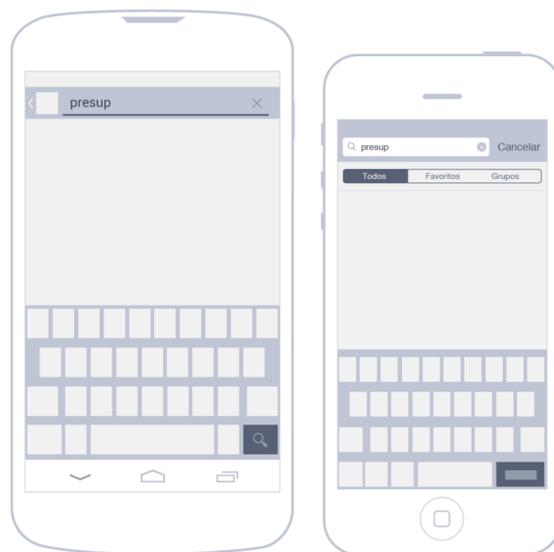


Figure 10.10. Example of a search engine in Android and iOS⁸⁸

⁸⁷ For further information, go to page 58 "Bibliographic References" [14]

⁸⁸ For further information, go to page 58 "Bibliographic References" [14]

In the upper right part of each tab, there will be an icon of a gear which will open a settings menu where you can change the language and account data.

Finally, on every screen, one can access the immediately preceding content by pressing an arrow return, that Android will be in the lower left, and iOS in the upper left, as the user is accustomed to find it.

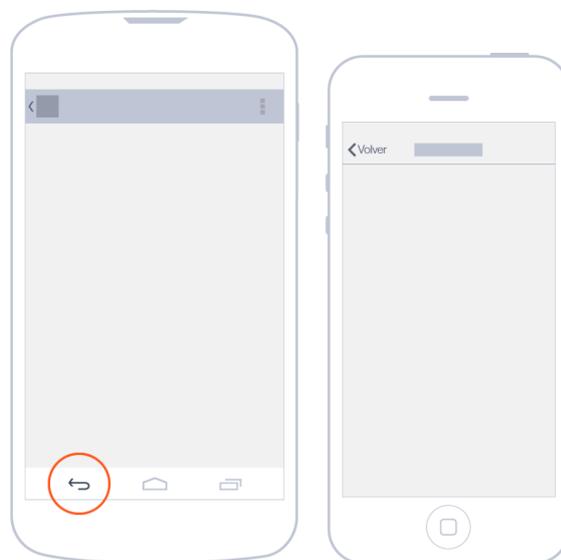


Figure 10.11. Example of the location of the “go back” button in Android and iOS⁸⁹

1. Home Screen

When the application first opens, the first thing that appears is a list where you must choose the language in which you want to use the APP. This selection can be modified later from the Settings menu. Once selected, another screen (in the language selected) will offer the possibility for the user to create an account to access the sales channel and the passbook. This screen will have a cross on the top right if the user wants to skip that step and go directly to the content. Once the account or skipped step is chosen, the Information about Barcelona will be opened by default.

2. Information Barcelona

As its name suggests, in this tab the user will find the selected information about Barcelona will be. This information will be listed in a way that will occupy the entire width of the screen. This list will have the following items⁹⁰:

⁸⁹ For further information, go to page 58 “Bibliographic References” [14]

⁹⁰ For further information, go to page 25, “Conceptualization / Ideation”

- Useful information
- Must see
- Culture
- Events
- Activities
- Routes / Itineraries
- Private transport

By selecting each of these categories a new screen with a new list will open. The contents specific to each of these screens will be specified later in Architecture⁹¹.

Functionally, in all lists, slipping an item left an icon of a heart (standardized for the saved content), that lets you download that content and access it from the last tab. In turn, in a final display (eg: Must see - Sagrada Familia) there will also be a heart that lets you download that content. If that heart is deselected the content is removed from the Saved tab.

As an additional functional detail, when one reaches a final screen, on the top half will appear a map labeled with the destination, and in the lower half practical and useful information about it. If one presses the map, the tab changes the category Maps and transport, from which one can see useful transport options.

3. Maps and transport

The first time the application is opened, a pop-up will show asking the user for permission to allow the app to access location. If it is not accepted, the mapping function may also be used, but then the user should always write correctly origin and destination, with no option to put "current location" to reduce the search time.

When one opens the app, there's a point marking the current location on the map. At the top one can find, as in conventional transportation applications, a bar where insert the origin, and another immediately below to enter the destination. Next of both, there will be a button with the message "Go!" to start the search for alternative routes. The result will be divided into three options at the bottom of the screen: walking, public transport, car/taxi. Underneath each of the options it will be written the approximate travel time. When pressing an option will appear in full screen detail of it. In the upper right there will be the heart icon, which will save the route to consult when internet connection is not available.

In addition, on the map with full screen, the main attractions explained in the same application will be marked. This will allow the user to modify the proposed route stopping at their points of interest.

⁹¹ For further information, go to page 43, "Creation of the Application / Design / Architecture of information"

4. Sales channel

Pressing the sales channel tab, a list will appear again. This list will show the categories of activities following the classification of the Barcelona Tourism web:

- Highlights
- Culture
- Gaudí and modernisme
- Sea and beaches
- Concerts and shows
- Food and wine tourism
- Sports and Nature

By selecting one of them, the activities proposed with a photograph and the price of each one will appear. When pressing an activity, it's product description will appear, and the option to buy. When the user clicks this option, the screen that appears next depends on whether the user has an account or not.

If the user does not have an account, he will need to create it then time to proceed with the purchase. In order to create an account, one is asked for the following information: name, email address, and password. After validating the email address with a confirmation email, one can then access the account from the same sales channel and buy the product he wanted.

If the user has an account and has not logged into the application, he can do so at that time and pay for the product. If the user already signed up, the option of entering data credit card or pay by Paypal to expedite the process will appear directly. When paying, the user will be asked if he wants to save the data from the credit card to avoid having to enter them in a next purchase, just confirm them. Once this is done, the customer has purchased the product and the corresponding tickets and receipts are automatically uploaded on the tab Tickets and receipts.

This tab will not have at any time the option of saving content as to purchase a product internet connection is indispensable.

5. Passbook and receipts

Within this tab they are stored all purchased tickets and receipts for such purchases. It is divided into the two options mentioned, with top menu similar to the Figure X with the names: "Tickets" and "Receipts".

In the top right, there will be a button that when pressed, the QR code where data from the user's

account is stored will show. Thanks that code, in a physical point of sale, the person who sells the service can scan to transfer tickets and receipts to the APP.



Figure 10.12. Example of top menu in iOS⁹²

By default, the tab will open in the Ticket option, in which they are listed in chronological order by date of activity, because as explained in paragraph Conceptualization - determine the context, this function will be used in situations on-going, particularly in entries of establishments mostly. It is therefore necessary to have a fast access to the ticket. In addition, when this tab is opened, the screen brightness will increase, so there are no problems of light when the establishment worker asks for the ticket.

Concerning receipts, each of them will have the option of being exported, either Dropbox or applications alike, or to send by mail, in order to facilitate control of travel costs and justify expenditures to companies if necessary.

6. Saved

Finally, the tab saved. This also will have a top menu with the following options: "All", "Info", "Routes". By default, this APP will open in the category "All", in which all the content chosen to be offline will appear. In the "Info" list, there will be exclusively downloaded information of Barcelona, and in the "Routes" list, only routes chosen in the tab "Maps and transport". In all tabs above, if the heart is deselected the offline content of the Saved tab is cleared.

The content on this tab will always be listed in alphabetical order. The content is downloaded to the language in which the application was at the time of download. If the content language is changed later, the category of "Saved" will not be updated and must be done manually.

⁹² For further information, go to page 58 "Bibliographic References" [14]

10.4. Design

The design stage has three distinct processes:

- Architecture of information
- wireframes
- Prototypes

10.4.1. Architecture of information

Architecture of information is a way to organize content and functions of the entire application, so they can be quickly found by the user. In a global sense, the architecture of information considers the relationship between the contents of different screens and particular level, content organization within the same screen.

A good way to understand the information architecture of an application, is from a block diagram. On the next page you can see the block diagram that corresponds to the design of the implementation of this project.

10.4.2. Wireframes

A *wireframe* is a simplified representation of a single screen, which allows an initial idea of the organization of the elements that contain information identifying and removing those interactive. The wireframes are drawn linearly and the same color, allowing separating the aesthetics of the structure or skeleton of a screen. These wireframes can be drawn both pen (in more preliminary stages especially) or templates in computer software programmed for this purpose.

10.4.3. Prototypes

Prototypes are representations of the application used to test it internally or through test with users, to detect usability errors in early stages of development. There's no need to create the entire architecture of the APP with a prototype, only the functions that are different from each other to make sure they work and are comfortable. Prototypes are usually presented in navigable documents, web versions or programs specialized for it.

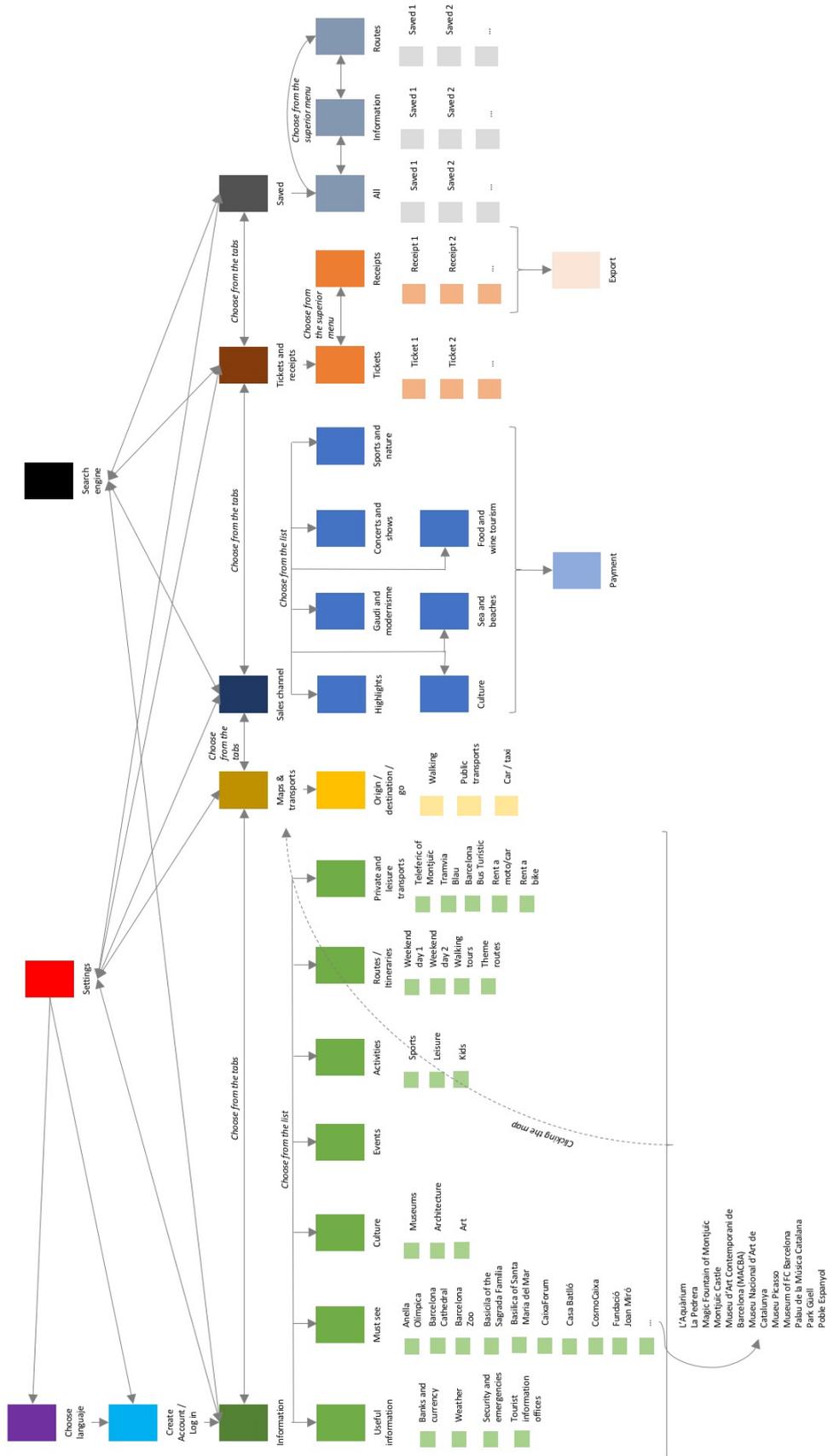


Figure 10.13. New architecture of information proposed to Barcelona Tourism

10.5. Development

The development of the application includes all the programming code and bug fixes. As discussed above, the programming of the application will not be made in this project, but the fundamental aspects of this programming that will help us structure and organize the workload will be discussed.

To develop an app two type of programmers are needed: FrontEnd and BackEnd⁹³. Usually the FrontEnd programmer works on stylizing the page so that the application remains comfortable for the person who uses it: they program the visible part of the application. Therefore, the programmer must know both User Experience techniques to provide a comfortable experience of use to the user, and Interaction Design to place the functions and information in the position that optimizes use and user interaction with the application. This programming is mainly based on three languages: HTML, CSS and JavaScript⁹⁴

On the other hand, the programmer BackEnd is not always necessary; only when the application requires to store databases on a server. In our project therefore it will be necessary as storing user data is required. This programmer, programs languages like PHP, Python, .Net or Java. He is responsible of interacting with databases, verify the proper management of the sessions of the users, install the application on a server, and from this serve all that the FrontEnd creates. It also ensures that all data arriving from the FrontEnd reaches a database. Therefore, the programmer must know BackEnd security, he must create a server that is not vulnerable.

Barcelona Tourism's website already has a functional BackEnd system. How purchases can already be done in the web, the BackEnd information this requires is already programmed, and can be reused for the sales channel of the APP. It is only necessary to develop it in a FrontEnd level for Android and iOS. However, to create storage functionality for tickets and receipts, a new BackEnd technology will be necessary to store all the data and be able to show it within the APP for each user.

⁹³ For further information, go to page 58 "Bibliographic References" [42]

⁹⁴ There are many technologies related to these three languages used in the FrontEnd. For example for JavaScript exists angular.js and backbone.js. Moreover, the programmer must know information transfer languages like XML and JSON, and Ajax to make requests without the need to refresh the application.

10.6. Publication

The application is finally made available to users in stores. From that moment, a tracking process begins through analytics, statistics and user feedback to assess the behavior and performance of the app, correct mistakes, make improvements and update it in future releases.

Before publishing the application, it is necessary to ensure that it complies with the stores publication policies to avoid being rejected or blocked in the approval process. The process in Google Play, the Android store, is very open: most applications are published. By contrast, in the App Store, the Apple store, approval is especially strict, with a policy designed to ensure a quality standard.

It is important to know that publishing is not free. Both Google Play and the App Store have to assume a cost to start the process that varies in each case. In Google Play, you need to pay 25 € once. In the case of App Store, payment is 99 €/year.

11. Purchase process

Once completed the process of creating the APP, the customer shopping experience changes substantially. Let's see how this contribution affects to that process.

Currently, the customer has two alternatives for shopping in Barcelona Tourism. Evidently, the first one is a sales point. The process of shopping there follows a traditional standardized format: when purchasing, a ticket or voucher and a purchase receipt is received; both printed. It is asked to the customer to provide a name and contact method, either by phone or email, just in case he should be informed of any changes. The second way is buying through the web of Barcelona Tourism. The customer also receives the voucher/ticket and a receipt, but this time through email. When a transaction is made on-line, the user is required to have an account. The data needed for the creation of that account is: name, email and nationality.

So, as we have seen above, every Barcelona Tourism client provides personal data, regardless of the system he chooses to make that purchase. This benefits our project because it minimizes the change experienced by the customer to make a purchase.

That seen, let's analyze what implies the use of the application in the purchase process. First it will be discussed the purchase in the point of sale. Many companies that issue e-receipts, choose to put a tablet on the counter (for example Uniqlo and Urban Outfitters), which the customer has easy access to. In this tablet the client finds the space provided to write their email, and when they enter it, the receipt is automatically sent to that address. The proposal is that Barcelona Tourism incorporate tablets in their POS, but this project it requires a plus of sophistication: the customer must be able to create an account in that tablet. The difference to the customers of the companies mentioned is that they must create an in-situ password, and select their nationality. Once the account is created, the purchases are automatically transferred to the APP, which must be downloaded. Barcelona Tourism always offers Wi-Fi in its stores, a fact that will facilitate the user to download it right there and continue their tour of the city, accompanied by this APP. Of course if the customer does not want to create an account, it will not be binding, but he must also provide his data as mentioned above.

If the user already has an account and application, when he goes to make a purchase, he must go to the tab "tickets and receipts" on his Smartphone, and at top right there is a button that when pressed the QR code will be displayed on the screen. The seller will scan Barcelona Tourism and purchases will automatically be transferred to the client application. In the event that the customer does not have battery on their device or he doesn't have the application but has an account, he must provide the e-mail address of the account, and when he has access to a smartphone with the application, the information will already be updated.

As for purchases through the web process is the same as currently. The customer can view the entire offer provided by Tourism Barcelona (282 activities), but if he makes a purchase, he must create an account or access the account he already has to make the payment.

The purchase process of the application is identical to the web. The user can look at the services offered, but when he wants to buy one is asked to sign in or create the account. Once the account is created the user will be redirected to the product he wanted to purchase and passed to the corresponding payment screen where he must enter data from his credit card or Paypal, as currently on the web.

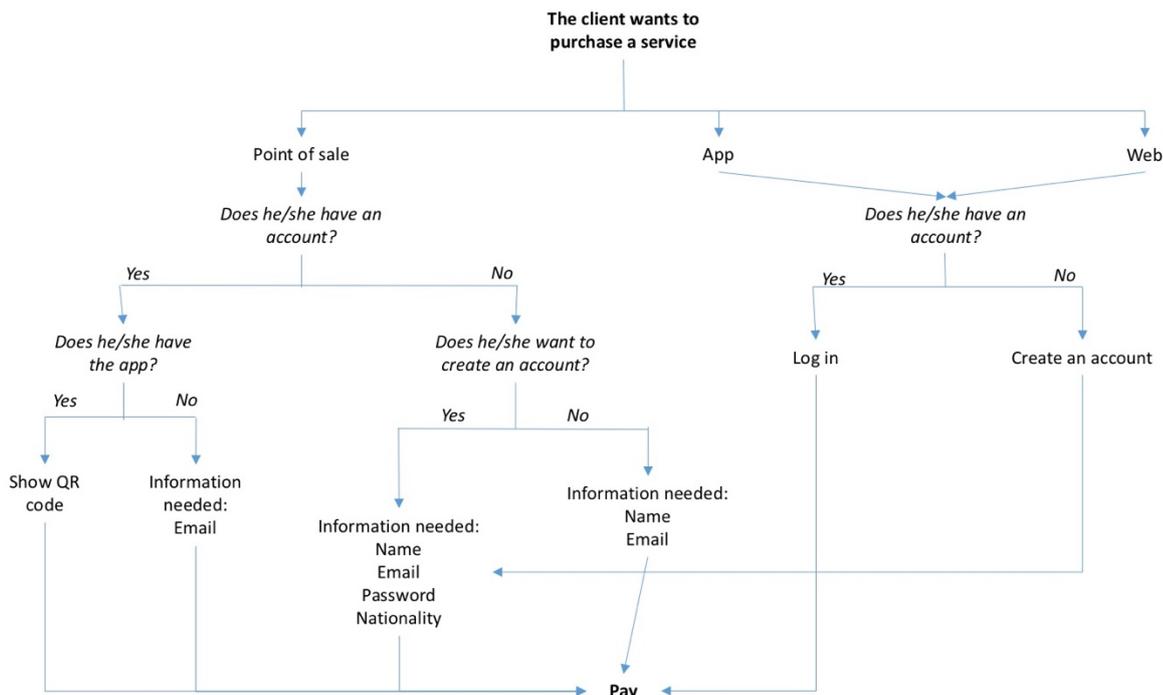


Figure 11.1. Outlining the new purchasing process

Thanks to this outlining it can be seen that if the recommended option is used, ie create an account on the APP from the beginning, the buying process is streamlined, saving the user having to provide their data each time and allowing him to make purchases comfortably from anywhere through the sales channel of the application.

Once seen the purchasing process, it is important to see how it will affect the digitalization of tickets/vouchers at the time of service. According to data provided by Barcelona Tourism, the vast majority of businesses accept receipts in digital format (estimate that approximately the 85% of them). However, some of them still do not accept them because their facilities are not ready to receive vouchers/digital tickets. There are also other factors such as the Tour Operation, who in some cases ask for physical proof to validate the voucher in exchange for the service. In that case, the ticket will have to be printed on the point of sale, and if the purchase is made online or by the application, the customer will be advised to print the ticket/voucher.

As set forth⁹⁵, according to David Leánez, Barcelona Tourism currently has a project in order to respond to these facilities and allow the customer can make use of a voucher/digital ticket in every establishment.

⁹⁵ For further information, go to page 13, “Barcelona Tourism / General performance”

12. Analysis

This whole process of digitizing receipts and tickets/vouchers has certain implications to consider. First, it will affect to a technological level, since new equipment will have to be acquired for the POS. Concerning the hardware necessary, as mentioned above, tablets will be incorporated. These tablets will also function as QR codes scanner, eliminating unnecessary spending in also acquiring independent QR code readers. In reference to software, Barcelona Tourism will have to acquire a similar one to the one offered by yReceipts, which connects the tablet information with the computer vendor and the client application. In addition, as discussed in detail above, an application programmed according to the needs explained previously must be created.

On the other hand, it should be considered the requiring of staff training. By incorporating new equipment in retail outlets, it should be explained to workers how customer and his own experience is transformed. Two hours a day of training and supervision at each retail outlet to solve the problems that may arise during a day will be sufficient to ensure proper use of this new technology. Part of this training should include strategies to promote this system to engage the maximum number of users. Of course, workers will spend a period of adaptation in which efficiency won't be optimal. It is therefore advisable to implement this system in a less touristy season of the year. Both the incorporation of new hardware and software, and the staff training necessary for the implementation of this new system of receipts, represent an outlay of money to consider. This will be analyzed in detail on a budget.

Once exposed the implications of incorporating digital receipts, it's important to see what benefits are involved. The first and clearer, it considerably reduces the use of recycled paper and thermal paper⁹⁶. Moreover, as explained above, both recycled paper and thermal paper have a contaminant called Bisphenol A (BPA) very harmful to human health, which enters the body through fingerprints. This pollution is especially harmful to pregnant women and their fetus⁹⁷. By reducing the consumption of both types of paper, contaminant exposure to users is reduced, but more importantly, the exposure is reduced to all sales workers in Barcelona Tourism, who are now in permanent contact.

Secondly, it is remarkable the improvement of the user experience in the city of Barcelona. First, downloading the application provides a lot of quality content on the city, which could alternatively be found in Barcelona guides or less reliable web pages. Having that content in an application with the possibility to access it offline in-situ, is a great advantage for the user. As for shopping, having an account and the application speeds up the process, as it avoids providing personal data on every purchase in a physical point of sale. In addition, tickets available in the application at the touch of a button, can speed up the process of admission to the attraction. As for receipts, it is very convenient to have them digitized to send them by email if you need to justify the expenses to the company, or to keep better track of travel expenses and to dispose of it in case you have to do some claim or change.

Last but not least, improving the tourist experience translates into a promotion of the Barcelona brand, a key objective of Barcelona Tourism. In turn, it is a very coherent implementation with this sustainable policy consortium⁹⁸, in its commitment to the environment and reducing paper consumption, as its commitment to workers to fight for their well-being.

⁹⁶ For further information, go to page 50, "Environmental impact"

⁹⁷ For further information, go to page 10, "Thermal Paper"

⁹⁸ For further information, go to page 58 "Bibliographic References" [6]

13. Environmental impact

The aim of this project is to eliminate physical paper receipts, and subsequently removing print tickets or vouchers was considered. This implies a positive environmental impact. Let's look at how the reduction of paper consumption affects in Barcelona Tourism.

First we shall make an approximation of how much paper is consumed annually. As we have seen earlier in Tourism Barcelona - consumption in 2016 were entered 43.220.000 € for purchases of services in physical outlets. The average price of services offered by Barcelona Tourism is 40 €/service. Thus, we can estimate that in 2016, 1.080.500 services were sold in Barcelona Tourism stores.

Let us first examine what was the thermal paper consumption of Barcelona Tourism in 2016. Each time a purchase is made, the customer receives a voucher or ticket and a receipt. If the purchase is carried out by a group of people, each person receives a ticket, but only one person a receipt. For this reason, it has been asked to Barcelona Tourism the average size of group who buy in physical outlets. They believe that this average is three people. Consequently, for the 1.080.500 services sold in 2016, only 360.167 receipts were issued.

Receipts, as explained above, are printed on thermal paper. This thermal paper has a width of 8 cm and is sold in rolls 80 meters. The average measured length of a receipt is 16 cm. We can see then that every roll of thermal paper allows printing 500 receipts. Therefore, in 2016, 721 thermal paper rolls were used. Each batch of 30 rolls weighs 11 kg, ie 366.7 g/roll. Finally, we conclude that that year 264.37 kg of thermal paper were consumed in Barcelona Tourism stores.

	Quantity	Toilet	Oil	Looging	CO ₂
Thermal paper	1 ton	72207 l	1476 l	15 trees	1200 kg
	264.37 kg	19089.36 l	390.21 l	4 trees	317.24 kg

Figure 13.1. Table of the wasted resources to fabricate thermal paper⁹⁹

Then let's look at that amount of paper consumed for printing vouchers or tickets. Printing a ticket medium occupies 1/3 of an A4 sheet, but the rest of paper is not used, and therefore for the 1.080.500 services that were sold, 1.080.500 folios were spent. Barcelona Tourism uses recycled paper of 80 gsm; it weighs 5 g/sheet. Therefore, in 2016 they were consumed 5.402,5 kg of paper just to print tickets and vouchers. A4 packages have 500 pages each, making a total of 2161 packets consumed.

⁹⁹ For further information, go to page 58 "Bibliographic References" [26]



	Quantity	Toilet	Energy	Logging	CO ₂
Recycled paper	1 pack (2.5 kg)	22,2 l	7.5 kWh	0 trees	1.4 kg
	2,161 packs (5402.5 kg)	147974.2	16,207.5 kWh	0 trees	3025.4 kg

Figure 13.2. Table of the wasted resources to fabricate recycled paper¹⁰⁰

We can therefore see that if we removed 100% the use of paper receipts and tickets, Barcelona Tourism would save annually:

	Quantity	Toilet	Oil	Energy	Logging	CO ₂
Thermal paper	264.37 kg	19089.36 l	390.21 l	-	4 trees	317.24 kg
Recycled paper	5402.5 kg	47974.20 l	-	16,207.5 kWh	0 trees	3025.40 kg
Saving	5666.87 kg	67063.56 l	390.21 l	16,207.5 kWh	4 trees	3342.64 kg

Figure 13.3. Table of the wasted resources to fabricate thermal paper and recycled paper

¹⁰⁰ For further information, go to page 58 "Bibliographic References" [11]

Conclusions

Once finished the project, it is necessary to see if what has been done meets the initial objective and how. To do this, let's remember that the aim of this study was to develop the approach of a sales system without physical purchase receipts. Barcelona Tourism consumed 264.37 kg of thermal paper and 5,402.5 kg of recycled paper last year. The environmental impact involved in the consumption of both types of paper is of 67063,56 l of water, 390,21 l of oil, 16.207,5 kWh of energy, the logging of four trees and 3342,64 kg of CO₂ emitted. Saving the paper, resources and contaminants equivalent to the 100% of tickets and receipts is very considerable, a fact that reaffirms the viability of this project.

In addition, the removal of the contaminant Bisphenol A (BPA) on stationery Barcelona Tourism has a positive effect on the quality of workers and tourists. On the other hand, Barcelona Tourism has an explicit policy for sustainability. A project such as the one defended here would be an asset to their goals.

After a market study, it was concluded that the solution that has better prospects of success, is an application. Such application must offer quality content to make it attractive to the user, including an extensive range of information and the company services. Thus the functionality of e-receipt becomes one of many that contains the APP.

Creating a good application is essential for this study because of its use will depend the fulfillment of the project's objective. If a quality application is not created, users will hardly use it, and therefore the amount of sufficient receipts to the reduction of wasted paper would not be remarkable. Therefore, it has been given a great importance to the application design, defining all the parameters necessary before the start of the programming.

Once completed the tasks above, the purchase process was defined. It is very important that the fact of making purchases using APP as a tool, either through it or in a physical point of sale, does not slow down the process. We have seen that not only does not slow it down, but if used optimally (creating an account from the beginning), the process is speeded up, making it more efficient and less tedious for the user, thus avoiding having to provide their data every time, and having the option to make purchases from anywhere. One again, the success of the application results in compliance with the initial objective.

A survey was made to 72 potential users to determine whether an application of these features would have a good acceptance. Of these 72 respondents, 40 answered the question: would you download this app? In order to avoid that the fact that the app was from Barcelona affected the answer, the city was left unknown. 87,5% of respondents said that they would download it, a fact that supports the interest of creating a quality application. Thus we can see that this whole process is necessary to fulfill the objective of this project.

Finally, the implementation of this proposal requires the acquisition of new hardware, software and staff training at both technological and promotional strategies of this system. All these contributions imply financial and resource investment by Barcelona Tourism.

The table below is a summary of the conclusions of this project, referenced to the section where they have been analyzed.

Conclusion	Source
Barcelona Tourism consumed 264,37 kg of thermal paper and 5.402,5 kg of recycled paper last year. The environmental impact of the consumption of the two types of paper is 67.063,56 l of water, 390,21 l of oil, 16207,5 kWh of energy, the cutting of 4 trees and 3342,64 kg of CO ₂ emitted.	Environmental Impact
The elimination of the pollutant Bisphenol A (BPA) in Barcelona Tourism has a positive effect on the wellbeing of workers and tourists.	Thermal Paper
Barcelona Tourism has an explicit policy in behalf of sustainability. A project like the one defended here would be an asset for their objectives.	Analysis
The solution that best prospects of success has, is a mobile application.	E-Receipts Comparison
This application must offer quality content.	E-Receipts Comparison
Such an application must provide extensive information and the company services. This way the functionality of the e-receipt becomes one of the many that the APP contains.	Survey
An application of these characteristics would speed up the purchase process.	Purchase Process
Such an application could have good acceptance.	Survey
The implementation of this proposal requires the acquisition of new hardware, software and personnel training. All these contributions imply an economic investment and of resources by Barcelona Tourism .	Analysis

Figure 14.1. Table of the conclusions of this project along with the origins of such conclusions

Budget

Once the proposal is finished, it is essential to provide a detailed budget to Barcelona Tourism budget so that they can consider whether they want to accept it or not. It is necessary to provide too the money that they would save by implementing this system.

In Barcelona Tourism they buy the thermal paper 80x80 in boxes of 48 units, with a cost of 47,64 €/box. As seen in Environmental Impact, in 2016, 721 rolls of thermal paper were consumed. Therefore 16 boxes are needed, which corresponds to a disbursement of 762,24 €/year per year. Regarding the consumption of fiber paper, Barcelona Tourism uses recycled paper. This currently costs approximately 9.35 €/box. Each box has 5 packages of 500 pages each, meaning that in 2016, 2.161 packages were consumed corresponding to 433 boxes. Therefore, this last year 4.048,55 € have been spent on the purchase of paper only for vouchers and tickets. The total payout for both is 4,810.79 €/year.

Having seen the annual savings that would eliminate paper, we see that disbursement requires the creation of the APP. First it would need to hire a UI designer (NOTE: Interface Design) / UX (NOTE: User Experience) for a month to design the screens and the prototype. This involves an expenditure of about 750 €. On the other hand, they must hire two programmers, one FrontEnd and other BackEnd. The APP programming itself requires approximately three months but it requires maintenance, improvement and elimination of bugs. There are two options: hire two programmers in-house with an approximate salary of 33 k € per year, or outsource a company that always charges depending on the complexity of the project. In this case subcontracting would cost about 15k € per year approximately.

The first alternative:

	Concept	Cost
Expenditure	Designer UI / UX	<i>First year</i> 750 €
	FrontEnd programmer	33.000 €/year
	BackEnd programmer	33.000 €/year
	Computer software	2.000 €/year
	Tablets	<i>40 units</i> 10.000 €
	Personnel formation	<i>20 days</i> 200 €
	Release Google Play	<i>First year</i> 25 €
	App Store Release	99 €/year
Saving	Thermal paper	762.24 €/year
	Recycled paper	4.048,55 €/year
Total (1st year)		74.263,21 €
Total (after the 1st year)		63.288,21 €/year

Figure 15.1. Budget of the project, first alternative

Outsourcing, the total would be detailed as follows:

	Concept		Cost
Expenditure	Designer UI / UX	<i>First year</i>	750 €
	Outsourcer		15.000 €/year
	Computer software		2.000 €/year
	Tablets	<i>40 units</i>	10.000 €
	Personnel formation	<i>20 days</i>	200 €
	Release Google Play	<i>First year</i>	25 €
	App Store Release		99 €/year
Saving	Thermal paper		762,24 €/year
	Recycled paper		4.048,55 €/year
Total (1st year)			23.263,21 €
Total (after the 1st year)			12.288,21 €/year

Figure 15.1. Budget of the project, second alternative

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