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AUGMENTED REALITY IN GROCERY RETAILING: STRATEGIC VALUE FOR COMPANIES?

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Abstract

Title: Augmented Reality in grocery retailing: strategic value for companies?

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The purpose of this dissertation is to shed a light on whether Augmented Reality (AR) can be a source of strategic value for grocery retailing companies. PromoPad, an AR-based device that provides context-sensitive shopping assistant as well as personalized advertising, was chosen to embody the functionalities AR can add to the grocery shopping experience.

To understand if PromoPad's functionalities were valued by customers, an online questionnaire was conducted as a way to collect empirical data. With the results of the questionnaire it was possible to understand the functionalities that were valued the most, and that privacy issues, user-friendly concerns and/or fashion concerns were not an impeditive for customers to use PromoPad. From this, it was concluded that customers value the extra functionalities AR can bring to the shopping experience in grocery retailing.

Finally, it was assessed if AR could be used strategically. In this regard, by applying RBV theory, it was concluded that the information PromoPad enables companies to gather was the needed "raw material" to derive valuable, unique, non-substitutable and inimitable customer knowledge, being therefore, a source of company's sustainable competitive advantage. Hence, the implementation of AR can indeed be strategic if properly integrated with a CRM strategy from which customer knowledge can be derived.

This dissertation concludes that the customer knowledge, derived from the information PromoPad collects and the use of CRM, can have a strategic relevance for companies. As so, this means that indeed AR can bring strategic value for grocery retailing companies.

Keywords: Augmented Reality, Grocery Retailing, PromoPad, Dynamic Contextualization, Persuasive Information Systems.

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I. Introduction

According to Wenmin et al (2010), we assist in many industries to the commoditization of products and services, which, together with the ever-increasing competition, force companies to find competitive edge in new areas. Specifically, in order to be successful, Pullman & Gross (2003) argue that companies must devote a large effort regarding the design and management of the customer experience.

Although customers engage in rational choices, they are often driven by fantasies, feelings, and fun (Holbrook & Hirschman, 1982). Hence, this transition from traditional to experiential marketing (Schmitt, 1999), entails a completely new logic regarding the way business as a whole is thought: "Welcome to the Experience Economy" (Pine II & Gilmore, 1998).

The shift of the customer's focus from the product itself to the experience associated with the consumption (Schmitt, 1999), has established the customer experience as the new competitive paradigm (Pine II & Gilmore, 1998). Today's customers perceive functional attributes as granted, and what they really want and value are *"products, communications, and marketing campaigns that dazzle their senses, touch their hearts, and stimulate their minds"* (Schmitt, 1999).

Grewal (2009) states that in order to achieve success in the current competitive retail industry, it is demanded more than low prices and innovative products. Indeed, to effectively compete, companies need to understand, provide and enhance customer's shopping experience. Schmitt (1999) reinforces this idea arguing that companies have to rely on new concepts and approaches in order to be able to take the most of the new opportunities experiential marketing has generated in these times of *"information, branding and communications revolution"*. Augmented reality (AR) is a form of experiential marketing and it can be a valuable tool to improve customer experience (Bulearca & Tamarjan, 2010), once it improves a user's perception of and its interaction with the real world (Carmigniani et al, 2010).

Regarding the technology itself, ABI Research has estimated an increasing value of AR market, and forecasted a boost of the total market for AR marketing applications from $6 million in 2008 to more than $350 million in 2014 (ABI Research, 2009) demonstrating the potential of this technology.

Despite all the potential of AR, do customers value what it adds in terms of their consumption experience? Is grocery retailing missing a strategic tool? The purpose of this paper is thus to assess if the use of AR can bring strategic value for grocery retailing companies.

Research Proposal:

Can the implementation of Augmented Reality in grocery retailing be strategic for companies?

To effectively assess the problem statement, two different domains have to be evaluated. If on one hand it is necessary to (1) understand if there is value creation to the customers through a more interactive shopping experience, it is also fundamental to (2) grasp if the data companies are able to collect is strategically relevant. Both domains are critical given that as Porter (1996) refers without value creation there is no strategy, *"Strategy is the creation of a unique and valuable position, involving a different set of activities"*, and in the same line of reasoning, if there is no strategic potential concerning the data it is worthless for companies to collect it.

From the above mentioned, two research questions, meant to help answering the research proposal, need to be answered in order to shed a light on the research proposal in a structured and systematic way.

Research Questions:

1. **Do customers value the extra functionalities AR can bring to the shopping experience in grocery retailing?**
2. **Can the information collected through the consumers' use of AR be strategic to grocery retailing companies?**

1.1 - Methodology

With the final purpose of getting insight about the research proposal in a structured way the two research questions have to be answered. To answer the first research question, an AR shopping assistant device is proposed, called PromoPad[1], aiming to illustrate the functionalities customers can experience. According to Zhu et al (2004), PromoPad is a system that through AR provides shopping assistance as well as personalized advertising. The

[1] PromoPad is further developed in the "PromoPad section"

in-store e-commerce system is able to delineate customers' profiles based on customers' data collection, like purchases' historical, which it continuously gathers.

After enumerating the functionalities customers may benefit from by using PromoPad, these are presented and described in a questionnaire so that, with the customers' responses, it is appraised which functionalities they value, and ultimately if the PromoPad is indeed a source of value to their shopping experience. Still regarding the questionnaire, and based on the existent theory, privacy issues are also addressed with the intention of knowing if customers are able to forgo part of their privacy, allowing the recording of their shopping data, in order to benefit from a customized shopping experience.

Having the answers to the above said it is evaluated if the information collected can be used in a strategic way, i.e. the strategic potential of the customers' information is assessed. To do so, Resource-Based Value theory is applied answering, this way, to the second research question.

To achieve the main objective of this dissertation seven chapters are developed. In the next chapter, background knowledge about AR (Azuma, 1997), CRM (Reinartz et al, 2004), RBV (Barney, 1991), and Permission Marketing (Seth Godin, 1999) is needed, and as so the Literature Review presents relevant literature around these main themes.

In the third chapter, the PromoPad is explained thoroughly the AR-based shopping assistance that is proposed presenting its concept and functionalities.

In the "Research Model & Questionnaire" chapter, the assumptions made and hypotheses intended to be tested are explained. Moreover, the association between the hypotheses postulated and the questions of the questionnaire conducted is presented. Ultimately, the structure and some general data of the questionnaire conducted.

Following, the consumers' responses are described, analyzed and synthesized, and from them intermediate conclusions are drawn in the "Results & Discussion" chapter.

The sixth chapter - "Discussion" - is where the matching of the preliminary questions and the hypotheses previously developed is made. Based on this, the two research questions are answered, and some insights relevant for this dissertation's purposes are also discussed.

Lastly, and to achieve the purpose of this dissertation, in the "Conclusion" a final response regarding the strategic value of Augmented Reality in grocery retailing is drawn.

II. Literature Review

With the aim of providing a background overview that allows a better understanding of this work, four subjects are addressed and developed:

- **Augmented Reality** - the core of this dissertation relies on the use of this technology as a mean to provide a better customer experience in grocery retailing while collecting relevant data at the same time;

- **Customer Relationship Management (CRM)** – a business strategy that often represents a way of creating a sustainable competitive advantage by creating long-term customer-company relationships (Torggler, 2009);

- **Resource-Based View (RBV)** – a business management tool that allows us to understand and analyze which functionalities effectively have strategic potential to the grocery retailing companies;

- **Permission Marketing (PM)** - coined by Seth Godin (1999) PM portrays a logic of customers giving their permission to be presented to promotional messages.

As it can be seen these four subjects represent the backbone of this dissertation, and therefore it is important to shed a light on them. As previously said, the first part of this section is dedicated to AR. Firstly, it is explained what AR is all about; then, some successful applications of this technology in other industries are depicted; and finally, possible challenges and limitations are described.

2.1 - Augmented Reality: concept and main features

To start with, it is important to present and contextualize AR conceptually. AR is a technology that enables the user to observe the real world objects overlaid and/or complemented with computer-generated virtual objects (Azuma, 1997). Azuma continues stating that rather than completely replacing the real world AR makes it possible the coexistence of real and virtual objects in the same space, that is, AR supplements instead of replacing reality. It means the possibility to the user to see the real world enhanced/augmented by virtual information (Milgram & Kishino, 1994).

Milgram & Kishino (1994) defined the "Virtuality Continuum" (figure 1): the span that goes from the real to the virtual environment. The authors argue that AR is part of the mixed reality once it is a combination of real and virtual world objects presented in a single display. Although placed in between, AR is closer to the real environment as the surrounding environment is real and to it virtual objects are added or, in other words, the virtual augments the real (Azuma et al, 2001).

Figure 1 – Virtuality Continuum (Source: Milgram & Kishino (1994). A Taxonomy of Mixed Reality Visual Displays)

As Azuma et al (2001) pointed out AR is not confined to a specific type of sense, it can not only be applied to sight as it can also be to smell, touch and hearing. Moreover, the same authors considered the existence of a subset of AR consisting on removing real objects from the environment which is the same as covering the real object with virtual information so that it seems that the object is not there - mediated or diminished reality.

After understanding the concept of AR it is important to grasp the technologies that underlie and enable the use of AR. Several specific technologies, together, make it possible to build persuasive AR environments. Only the more important ones are addressed in this section: displays, input devices, tracking and user interfaces. Ultimately, their description is intended to be succinct and not a thorough explanation of technical issues.

2.1.1 - Underlying Technologies: exploring AR

<u>Displays</u>

Displays have a crucial role on an AR system once without it the user cannot see virtual and real environments merged (Speager, 2012). Moreover, according to Eitoku et al (2006), displays should obey four main characteristics: be able to dispose virtual information in the real world; support collaborative work; do not overload users with major equipment; and be able to naturally display 3D images. They can be grouped in three main categories:

Figure 2 - HMD (source: Carmigniani et al (2011). Augmented reality technologies, systems and applications)

head mounted, handheld and projective (Azuma et al, 2001).

Zhou et al (2008) explain the first category, head mounted displays (HMD), which are devices worn on the user's head that allow him to see real and virtual objects superimposed. Ultimately, HMD allow the user to be hands-free to perform tasks while benefiting from the augmentation of its vision (Speager, 2012).

Figure 3 – Handheld displays (source: Carmigniani et al (2011). Augmented reality technologies, systems and applications)

On the other hand, handheld devices consist in small devices with a display and a camera attached allowing video-see-through-based augmentations; currently there are three different types: smart-phones, PDAs and Tablet PCs (Carmigniani et al, 2010).

Lastly, the spatial or projection displays consist on a single room-mounted projector that project directly on the physical objects that are intended to be augmented (Azuma et al, 2001). This type of projection separates the technology itself from the consumer and incorporates it in the environment (Carmigniani et al, 2010).

All the different types of displays entail advantages and disadvantages which are summarized in the table 1 (Appendices).

Input Devices

Many different input devices can be used for AR systems (Speager, 2012). Carmigniani et al (2010) refer some examples such as: gloves, wireless wristbands and even smart-phones which can be regarded as pointing devices. The same authors stress that the choice of the input device will depend on the application of the AR system, i.e. if the user needs to perform a task its hands will have to be free.

Tracking

In order to perfectly overlay computer-generated information in the real environment a very accurate position is needed and for that a good tracking system is required (Carmigniani et al, 2010). Thus, tracking is a crucial enabling technology for AR and it has been one of the most popular topics of research in this field (Zhou et al, 2008).

The tracking techniques can be sensor-based (based on sensors), vision-based (based on fiducial markets) and hybrid that combine the strengths and the flaws of individual tracking techniques (Azuma, 1997). Although there is much to be done in terms of *"sensing the entire environment, operating in unprepared environments, minimizing latency, and reducing calibration requirements"*, current AR systems already show robust and convincing registration in prepared indoor environments (Azuma et al, 2001).

User Interfaces

The biggest benefit of AR is that it allows users to interact with the virtual content of AR applications which means that the way this interaction is made plays a decisive role on the success and effectiveness of the technology (Carmigniani et al, 2010). In fact, building appropriate interaction techniques that transform the user experience into something intuitive is a critical aspect (Zhou et al, 2008). However, Azuma et al (2001) emphasize that only recently the concern regarding the way users would interact with AR systems arose. The authors continue explaining that in the beginning the primarily focus was on the displaying information that overlays the real world rather than the interface of this information with the user. In fact, recently, we assisted to a change on the research emphasis from exploring the fundamental technologies that underlie AR systems to the real world applications of the technology itself (Zhou et al, 2008).

There are four main AR interfaces: tangible AR interfaces, collaborative AR interfaces, hybrid AR interfaces and multimodal AR interfaces.

Azuma et al (2001) pointed out that a trend in the interaction research was exactly the integration with the physical world namely through tangible interfaces. Following the same reasoning Zhou et al (2008) highlighted that the manipulation of physical and tangible objects makes the interaction with the virtual content as something very easy and intuitive for users.
According to Zhou et al (2008) the second type of interaction, collaborative AR, only appeared in the mid-nineties once until then only single user AR applications were studied. In 2001, Azuma et al defended that several AR applications could be more advantageous if there were multiple people using it whether viewing, discussing or interacting with the virtual content.

Regarding the hybrid AR interfaces they are nothing but a combination of different, and complementary interfaces which makes possible the user's interaction through a variety of interaction devices (Zhou et al, 2008). This type of interfaces constitute a flexible platform for those unplanned interactions where it cannot be known in advance what kind of interaction display or devices are going to be utilized (Carmigniani et al, 2010).

Nevertheless, augmentation can be extended to the other human senses resorting to multimodal AR interfaces (Speager, 2012). According to Carmigniani et al (2010) this is an emerging style of interaction that allows people to interact without requiring any intermediate device. Multimodal interfaces combine real objects input with natural types of language and behaviors, namely: speech, touch, gestures, or even gaze.

2.1.2 – AR applications

The increasingly accuracy and reliability of AR's underlying technologies (Azuma et al, 2001), in addition to the shift of the research focus from technical issues to user's interaction (Zhou et al (2008); Carmigniani et al (2010), Speager (2012)) generate the possibility to implement AR in more innovative ways (Speager, 2012). Carmigniani et al (2010) complements stating that AR can represent a better solution in some industries, a cheaper one in others or simply create a completely new service. Nevertheless, and even though the considerable development and innovation, AR applications are mostly grouped into four main categories or industries: advertising and commercial, entertainment and education, medical, and mobile applications (Carmigniani et al (2010), Speager, (2012)).

<u>Advertising and commercial</u>

AR's potential to embellish ads and promote new products is enormous (Azuma et al, 2001). Using AR in advertising (whether magazines, websites or software) allows consumers to have more interactive experiences and even benefit from more information (Carmigniani et al, 2010). Besides being a compelling advertising tool, AR also represents a credible solution to the usually expensive process of prototyping since it eliminates the necessity to actually manufacture the product in order to get feedback on possible modifications (Speager, 2012).

According to Carmigniani et al (2010), in commercial applications AR also has proven to be a valuable option. The same authors highlight examples such as Magic Mirror, which allows consumers to virtually try on footwear before ordering or purchase, showing that AR's future application in this sort of activities is promising.

<u>Entertainment and education</u>

In what concerns entertainment and education the more illustrative examples are cultural and gaming applications (Speager, 2012). According to Carmigniani et al (2010), sightseeing and museum guidance are examples of the first and they can be an effective help guiding and showing complementary information and/or past representations of the places users are

visiting. One type of AR gaming applications are those that run on top of traditional games and make it possible to include animations to make the game more appealing.

Medical applications

The use of AR in this field is mainly related to image guided and robot-assisted surgeries (Speager, 2012). Medical AR applications range from techniques to help on laparoscopic surgery to help treat symptoms of Parkinson's disease (Azuma et al, 2001). However, Bichlmeier et al (2007) states that as surgeons have to interact with supplementary virtual information and cues it somehow limited doctor's natural and direct view of the human body. As so, the same authors developed an AR system that allows direct and real time visualization on the body/skin of the patient.

Figure 4 – System that allows viewing through the skin (source: Bichlmeier et al (2007). Contextual anatomic mimesis: hybrid in-situ visualization method for improving multi-sensory depth perception in medical augmented reality)

Mobile applications

Azuma et al (2001) wrote at the time that advances in tracking and increased computing power were leading to developments in mobile AR systems. Although mobile applications were firstly developed to smart-phones, once the first generation of tablets (iPad) had not camera incorporated, it is now enlarged to all kind of handheld devices (Speager, 2012). The majority of these mobile applications are of entertainment, education, informative or navigational nature (Carmigniani et al, 2010). If on one hand, this type of AR applications is the one that shows greatest potential of growth, it is also true that some constraints regarding imprecise tracking still need to be overcome (Speager, 2012).

AR is still in its early stages, and it is a fact that its future potential applications are inestimable (Carmigniani et al, 2010). Ultimately, according to Speager (2012), as technology enhances and becomes more reliable, more AR uses will be found and more industries will benefit from the potential of this technology: *"Currently, with the advances in technology, a huge increase in augmented reality applications is seen".*

2.1.3 - Limitations of AR: challenges to be overcome

Due to its early stage AR still has to overcome some challenges, namely social and privacy challenges, in order to fully confirm its potential (Zhou et al, 2008). Of critical importance for a success is for AR to be able to reach user's acceptance (Azuma et al, 2001). This acceptance can be mainly split into two different domains: social acceptance and privacy issues (Azuma et al, 2001; Carmigniani et al, 2010; Speager, 2012).

Given the fact that the interaction is a critical issue when using AR, it has to be something intuitive – *easy to use* -, and viewed as part of a user's everyday life – *fashion concerns* (Azuma et al, 2001). On one hand, if the use of devices, which enable AR interactions, require complex training it is most likely that users will refuse it (Speager, 2012). On the other hand, interactions have to be natural, discrete and smooth so that users are willing engage on them without feeling uncomfortable (Carmigniani et al, 2010). According to Speager (2012) if these premises are not met it is difficult for the general public to adopt AR.

Privacy issues are something that are also at stake when referring to AR (Azuma et al, 2001; Carmigniani et al, 2010). Carmigniani et al (2010) even argues *that "Augmented reality mobile systems need to be personal, meaning that the displayed information should only be viewed by others if the user allows it"*. This privacy domain is a fundamental issue that has to be carefully addressed for the sake of AR's success (Azuma, 2001).

With all the important subjects regarding AR addressed, as it was previously mentioned, it is important to approach a business theory, Customer Relationship Management, which can be important in future sections of this dissertation.

2.2 – Customer Relationship Management (CRM)

CRM has been, in several cases, a way to create value and to develop a sustained competitive edge, essentially through the creation of profitable long-term relationships between the customer and the company (Torggler, 2009). It is assessed if in this dissertation it can be also the case which makes it important to present the existent literature regarding this theme. Thus, it is reviewed the importance of CRM in companies' strategies, its potential when integrated with technology, its advantages, and lastly the classification of the diverse CRM functionalities.

2.2.1 - CRM concept

It has been long advocated that striving for long-term customer relationships instead of transaction-oriented behaviors is more profitable for firms (Morgan & Hunt, 1994). The recognition that customers have different economic value for companies unveiled the necessity to adapt companies' offers and communications according to customer's characteristics and/or profiles (Reinartz et al, 2004). According to Mithas et al (2005) companies have moved from a product or brand-centric marketing towards a customer-centric approach. The authors continue stating that there is increasing recognition that managing customer relationships is crucial for companies' long-term success, emphasizing CRM as a critical strategy.

Boulding et al (2005) define CRM as: "*Specifically, CRM relates to strategy, managing the dual-creation or value, the intelligent use of data and technology, the acquisition of customer knowledge and the diffusion of this knowledge to the appropriate stakeholders, the development of appropriate (long-term) relationships with specific customers and/or customer groups, and the integration of process across the many areas of the firm and across the network of firms that collaborate to generate customer value".*

2.2.2 - CRM potential and the role of technology

CRM empowers companies with customers' information and consequently customers' knowledge which allows them to establish sustainable positions of competitive advantage (Henneberg, 2005). In fact, this ability to collect, manage and model customer information is essential to ensure a sustainable competitive edge for companies (Hogan et al, 2002; Rust et al, 2002).

Moreover, advances in technology and the resulting possibility to collect, process, and interpret enormous amount of data easily, increased even more CRM's potential (Jayachandran et al, 2005). Day (2003) refers that the integration of technology in CRM improves the company's ability to sustain profitable customer relationships since it enables information integration and the dissemination which in turn results in efficient company-customer interactions, comprehensive analysis of customer data and personalization of responses.

Nonetheless, Reinartz et al (2004) warn that it is not just about implementing technology and CRM practices. The authors point out that in order to have a successful CRM programs it takes

more than just technology; it also demands a companywide customer focus and not the limitation of this idea to the marketing department. The authors conclude stating that this misconception, of what it takes to have successful CRM programs, is the major cause of some disappointing CRM results. Thus, it becomes clear that successful CRM requires a cross-functional approach, involving the whole company (Ryals & Knox, 2001), or as Jayachandran et al (2005) defend "*organization's actions should be driven by customer needs and not by the internal concerns of functional areas".*

Ultimately, as Reinartz et al (2004) conclude, CRM is an organizational systematic process of the company's relationship with the customer:

"*CRM process entails the systematic and proactive management of relationships as they move from beginning (initiation) to end (termination), with execution across the various customer-facing contact channels. This necessitates both information generation through the analysis of customer and prospect needs and behavior and action on this information, contingent on the customer's value and life-cycle stage."*

2.2.3 - CRM advantages

Mukerjee & Singh (2009) describe three main issues that are regarded as CRM advantages:

- Identify customer's profitability: with CRM companies are able to differentiate profitable from unprofitable customers, identifying the key customers and being able to treat them according to the importance and/or value they bring to the company (Jayachandran et al, 2005). Companies strive to avoid the mistake of not recognizing a good customer, and as a consequence not treat the customer accordingly (Reinartz et al, 2004). Bull (2003) quoting Clemonds stresses that a tenfold difference exists between the profits coming from the more profitable customers and the less profitable ones.

- Behavior prediction and segmentation: to be able to indentify profitable customers, companies need to gain customer knowledge (Parvatiyar & Sheth, 2001). CRM is a valuable tool to make it possible to segment and recognize the profitable customers based on their purchase behavior (Newell, 2000). Furthermore, by analyzing customer's purchases, and therefore segment them, based on their purchase behavior, firms can better predict other products/services they might be more likely to buy (Jayachandran et al, 2005).

- Personalization: CRM applications allow the collection of relevant customer's data which, in turn, enable companies to customize products and/or services according to customer's preferences (Mukerjee & Singh, 2009).

Overall, as Wood (2003) emphasizes, the customer itself, company's databases together with knowledge derived from interactions company-customer become valuable corporate assets. The data collected from all points of customer contact enables companies to gain customer insights that can be critical to improve the quality of customer experience (Payne & Frow, 2006). Indeed, the use of this data makes it possible for companies to predict customer's needs and behaviors, and therefore provide customized products and/or services (Jayachandran et al, 2005). Additionally, as Payne & Frow (2006) argue: "*What sets present day CRM apart is that organizations now have an increased potential to utilize technology and manage one-to-one relationships with potentially huge numbers of customers in a context of rapid market transformation*".

2.2.4 - CRM functionalities

According to Torggler (2009), based on their setup and structure, CRM systems are categorized into three major areas (which can be connected in a closed architecture): collaborative, operational and analytical.

collaborative CRM	*Contact Management*		*eCRM/Internet*		*Customer Interaction Center*	
operational CRM	*Marketing Automation*	Campaign Development	*Sales Automation*	Order Management	*Service Automation*	Helpdesk
		Campaign Execution		Sales Force Support		Complaint Management
		Campaign Controlling		Product Configuration		Service Requests
analytical CRM	*Marketing Analysis*		*Sales Analysis*		*Service Analysis*	

Figure 5 – Classification of CRM functionality (source: Torggler (2009). The Functionality and Usage of CRM

A. *Collaborative CRM*

It entails all the control and integration "touching points" existent between companies and customers. This sort of CRM is perceived as a communication channel which is responsible for the continuous firm-customer dialogue. It is this dialogue that enables the interactive learning critical for company's relationship management practices.

- *Contact management*: tools for the managing and collection of customer information that is stored in a company's database with the purpose of being used in all the customer oriented processes existent inside the company.

- *eCRM and Internet:* thanks to the integration of Internet into CRM initiatives, customer data derived from online initiatives can be directly incorporated into the company's database. Additionally, there are diverse activities in a company that rely on real time communication between networks inside and outside a firm.

- *Customer Interaction Center*: is the center of operations of the customer service of a company.

B. Operational CRM

This CRM area performs the design, planning and implementation of CRM operational initiatives. It also provides tools that support the daily activities of the company in marketing, sales and service areas by automating the processes associated with customers.

- *Marketing Automation:* mainly responsible for marketing activities, particularly campaign's management. Ensures the communication of the right information, at the right time, in the right channels, ensuring a continuous and valuable interaction with customers.

    - Campaign Planning: some CRM systems are important tools to plan and prepare marketing campaigns.

    - Campaign Execution: with the marketing campaign in course IS can provide applications to select the right content in the right channels. Moreover, CRM systems can also be used to automate the execution and management of campaigns (e.g. personalization of content, event-triggered content).

    - Campaign Controlling: regarding the monitoring of current and/or finished campaigns. The conclusions of these analyses can be used in future campaigns.

- *Sales Automation:* consists in the support to all the direct customer contact related to sales activities (e.g. product configuration and order management).

    - Order Management: is a critical sales function of a CRM system and consists in activities such as: processing and tracking of customer's orders, contract terms, pricing, etc.

    - Sales Force Support: the managing of ordering entry, as well as, supporting functions such as real time matching of appointments and activities make it possible to optimize the sales force work.

    - Product Configuration: "The main purpose of configurators is the individual matching of products and services to the wishes and needs of a customer in the context of a sales call. Configurators can be used both for the individual design of the products and for the presentation of product combination possibilities or product alternatives" (Torggler, 2009).

- *Service Automation:* crucial to ensure long-term customer relationships. CRM systems on this regard can perform a variety of functions both for the customer service and to the company's back-office services.

    - *Helpdesk*: some CRM systems enable automatic matching of customers' incoming requests with the proper staff.

    - *Complaint Management:* regular gathering and organization of complaints, together with automatic management of customer requests are examples of tasks that CRM systems can perform.

    - Service Requests: the main purpose of a CRM system of this nature is to offer a fast and objective solution to customer´s problems. "The information system can support the administration of service data including historical requests and service contracts as well as the administration of the service staff" (Torggler, 2009).

C. Analytical CRM

Seen as the link between the front and the back-office, analytical CRM focuses essentially on the preparation, analysis and optimization of customer-related decision-making processes. It does so based on customer data which is continuously gathered through marketing, sales or service processes and stored in the company's databases. The resulting analyses can provide valuable insights about the market, customer behavior or even future trends that eventually can serve as basis to future CRM activities.

- *Marketing Analysis:* mainly linked to the evolution of the marketing campaigns in course. Also allows the monitoring of various indicators that measure a campaign success. Additionally, functions that measure customer satisfaction (e.g. churn analyses and customer retention rate) are frequently part of the software packages.

- *Sales Analysis:* this analysis includes not only reports on sales activities, but also several indicators (e.g. lost orders and future sales potentials) that enable the optimization of sales processes.

- *Service Analysis:* means the assessment of different aspects regarding the different services and products of a company. Alongside, controlling functions whose role is to monitor the processes and staff, such as human resources or product shortages, are also subjected to detailed analysis.

After getting a grasp concerning CRM theory, understanding its main aspects, it is important to get some knowledge in other topic that is also essential for the purpose of this dissertation: Permission Marketing.

2.3 – Permission Marketing

Due to the characteristics that PromoPad possesses (later explained) it becomes imperative to understand the concept of Permission Marketing. It is of particular interest to grasp the logic behind it, and the differences of it relatively to the traditional marketing.

Even though the idea of customer permission emerged several years ago regarding privacy issues in direct marketing (Krishnamurthy, 2001), it was Seth Godin (1999) who coined the concept of Permission Marketing (PM). PM is perceived as an evolution of direct marketing

(Tezinde et al, 2002) and entails a logic of being customers the ones to give their permission to allow the marketer to present them promotional messages (Godin, 1999).

Godin (1999) explains the reasoning behind PM by contrasting it with what he calls "Interruption Marketing". The author gives this label to the traditional advertising because this way of advertising relies essentially in interrupting whatever the customers are doing with the purpose of having them thinking about something else (Godin, 1999). Godin continues saying that this way of marketing has created an overwhelming clutter in the marketplace which, in turn, has made traditional advertising almost worthless. Ultimately, the author points out, the more efforts marketers put to be heard (increasing the spending and/or the ads' noise level) the less likely they are to be heard once they are contributing to the enlargement of the clutter, hence diminishing their effort and investment's effectiveness. Therefore, PM emerges as *"a fundamentally different way of thinking about advertising and customers."* (Godin, 1999)

According to Godin, as customers do not have enough time to pay attention to the overwhelming number of stimuli they are subjected to, and as in PM customers volunteer themselves to be marketed to (giving their permission), it ensures that customers devote more attention to the marketing message. Therefore, PM turns the existent clutter into an asset.

Besides considering one customer at the time and providing customized content, PM is also: *anticipated* (customers want to hear from you), *personal* (messages are related to the customer individually), and *relevant* (the marketing message is about something that customers are indeed interested in) (Godin, 1999). So, the bottom line is that PM's characteristics incentive customers to engage in a reciprocal long-term relationship with companies, being the exchange between meaningful content (provided by companies) and additional permission (provided by customers) (Godin, 1999). So, since the marketing messages are personalized and only directed to "volunteers", PM generates considerable rates of responsiveness and effectiveness of a company marketing efforts which in turn translates into increasing profits.

With the brief explanation of what the PM concept is, it becomes possible to understand the implications of this type of marketing. Following, Resource Based View (RBV) is approached and presented.

2.4 – Resource Based View (RBV) model

This section is intended to shed a light on the logic behind RBV and its components. It acquires a great importance once this theory is latter applied in the "Discussion" chapter aiming to determine if AR can be of strategically relevance in grocery retailing.

It is a fact that RBV is one of the most widely accepted theory in the strategic management field (Powell, 2001). This theory was materialized by Barney (1991), and clearly embodied a shift in the perception of the determinants of firm's profitability (Brahma & Chakraborty, 2011). If Porter (1980) defended that a firm's profitability was primarily determined by industry factors, Barney (1986) counter argued defending that firm's strategic choices should derive from the analysis of a firm's skills and capabilities as opposed to solely its competitive environment.

In effect, earlier, Penrose (1959) had characterized a firm as an assortment of resources and stressed that were these resources that defined a firm's competitive position. Later, Wernerfelt (1984), following the same logic, defined a firm's resources as "*those (tangible and intangible) assets which are tied semipermanently to the firm"* and argued that a competitive advantage can be based on the resources a firm possesses. Above all, these two authors pioneered the idea that firms should be analyzed from a resource's perspective (firm level), and not only from the product side (industry level) (Armstrong & Shimizu, 2007). However, it was Barney's paper "Firm's resources and sustained competitive advantage" (Barney, 1991) that was considered the first comprehensive, empirically testable theoretical framework of the then dispersed resource-based theory (Newbert, 2007).

Defining a firm's resources and capabilities as *"all the financial, physical, human and organizational assets used by a firm to develop, manufacture, and deliver products or services to its customers"* (Barney, 1995) , Barney, in 1991, developed the RBV theory aiming to explain what is that a firm's resource requires to be a source of competitive advantage. In other words, this theoretical framework intends to help on understanding how competitive advantage is attained and how can it be sustained over time. Barney's work lies on two fundamental assumptions: (1) firm's resources and capabilities are heterogeneously distributed among firms of a given industry; and (2) these same firm's resources and capabilities are imperfectly mobile (Barney, 1991).

Barney refers that not all resources have the potential to be a source of competitive advantage or sustained competitive advantage. In order to assess this, managers must evaluate if their firm's resources and capabilities obey to four important characteristics:

Valuable – firm's resources are valuable when they enable the firm to generate or implement strategies that lead to efficiency and effectiveness, or *"attributes only become resources when they exploit opportunities or neutralize threats in a firm's environment"* (Barney, 1991).

Rare – according to Barney (1991) a resource and/or capability cannot be widely available to a large number of other firms, i.e. it must be distinctive and not owned or easily obtained by competing firms. If accessible to many firms the resources are not rare and therefore cannot be a source of competitive advantage. Nevertheless, still stating Barney common resources can still be valuable even though they are not rare and not possible to be a source of competitive advantage. Usually these valuable common resources are critical for the survival and competitive parity of companies in a certain industry.

Imperfectly imitable – when a resource and/or capability are controlled solely by a firm and if other firms are not able obtain or replicate them (Barney, 1991). Barney stated that firm resources can possess this characteristic for one or a combination of three motives:

- Unique historical conditions: acknowledging firms as intrinsically historical and social entities Barney makes a point saying that a firm's ability to make use of particular resources is influenced by its place in time and space. Indeed, if that specific time passes, these specific resources cannot be acquired by other firms anymore.

- Causally ambiguity: occurs when the relationship between the firm resources and its competitive advantage is not understood or poorly understood. Not being able to identify the resources that are the basis of a firm's competitive advantage makes it very complicated to others to replicate it.

- Social complexity: if resources of a firm are highly complex from a social point of view, such as culture, relationship with suppliers or customers or even reputation, going *"beyond the ability of firms to systematically manage and influence"* (Barney, 1991) it creates barriers to imitation.

Non-substitutability – a resource must have no equivalent otherwise if there exist so other companies can follow the same strategy nullifying the competitive advantage linked to that resource. If competitors are able to replicate the strategy implemented by a firm it will no longer be able to sustain its competitive advantage.

Furthermore, Barney (Barney, 1991) concludes pointing that if a firm controls resources and/or capabilities which are simultaneously rare and valuable it is able to achieve a competitive advantage (short term); if additionally the firm is able to ensure that these resources are also inimitable and non-substitutable then it is able to sustain the competitive advantage attaining a sustained competitive advantage *"A firm is said to have a sustained competitive advantage when it is implementing a value creating strategy not simultaneously being implemented by any current or potential competitors and when these other firms are unable to duplicate the benefits of this strategy"* (Barney, 1991).

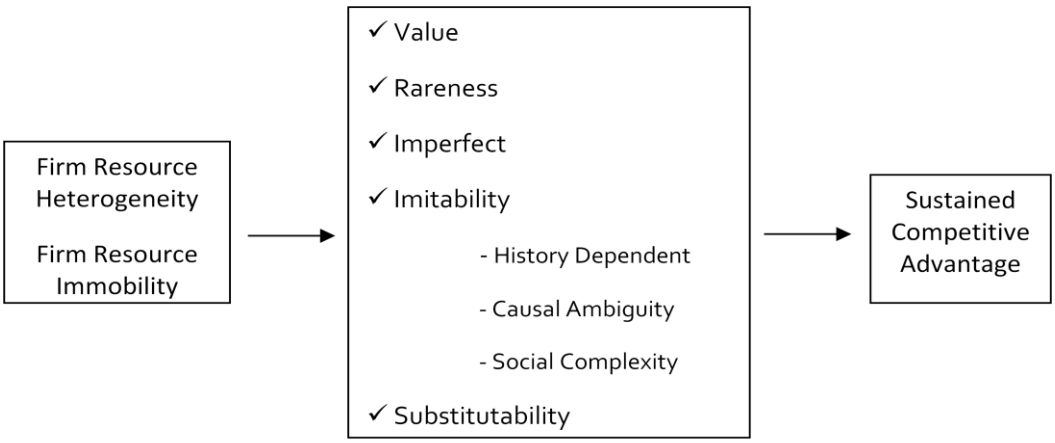


Figure 5 – The relationship between resource heterogeneity and immobility, value, rareness, imperfect imitability and substitutability, and sustained competitive advantage
(source: Barney (1991). Firm Resources and Sustained Competitive Advantage

With this last theme, RBV, it is possible to understand the theory regarding what it takes to companies to achieve a sustainable competitive advantage. Also, this is the last relevant topic, for this dissertation purpose, in what regards the existent literature. The next chapter is devoted to the introduction and detailed explanation of the PromoPad.

III. PromoPad

This chapter presents the PromoPad, thus being the basis to answer the first research question: Do customers value the extra functionalities AR can bring to the shopping experience in grocery retailing?

Firstly, the importance of persuasive information systems (PIS) in today's competitive retail industry is highlighted, and then, the reason why PromoPad is proposed is also addressed. In order to give a deeper perspective of what is PromoPad, its explanation and architecture are briefly presented, being followed by the Dynamic Context concept which is the essence of this device. To summarize, PromoPad's functionalities are enumerated in the last section of this chapter.

3.1 - Persuasive Information Systems: importance and advantages

"A growing number of information technology systems and services are being developed to change user's attitudes or behavior or both" (Kukkonen & Harjumaa, 2009). Moreover, as Smith (2011) states, emerging technologies represent huge opportunities to foster the development of unprecedented innovative and engaging shopping experiences once they allow a level of interaction and experience customization. According to Kourouthanassis et al (2007), a persuasive information system (PIS) is an emerging type of information systems where information technology is progressively integrated in the physical environment, integrating the user needs and requests when desired. The authors conclude arguing that PIS enable the interaction between the user and both devices deployed and the physical environment.

Thus, still according to Kourouthanassis et al (2007), the most important benefits derived from the implementation of PIS is the creation of new shopping experiences and, the resulting consumers' interest and excitement. Moreover, the authors continue, the real-time tracking of customer shopping behavior allowing the identification of consumers' shopping needs and their effective satisfaction, and the introduction of personalized marketing/promotional programmes consist in other relevant advantages of implementing leading edge technologies in the retail environment. "*This is particularly important in the competitive retail sector where the provision of complimentary shopping schemes (e.g. loyalty club and direct marketing programmes), the advent of the Internet, and the urbanization of nowadays society have created*

the new consumer who is more knowledgeable about comparable product costs and price; more changeable in retail and brand preferences; showing little loyalty; self-sufficient, yet demanding more information; who holds high expectations of service and personal attention; and is driven by three new currencies: time, value, and information." (Kourouthanassis et al, 2007).

In this line, PromoPad, an AR shopping assistant prototype, which provides real-time context modification, is proposed as a means of enhancing customers' experience. How can PromoPad use improve customers' shopping experience? What is it that PromoPad has and enables? Following, to answer these questions, the reason why PromoPad was selected, its presentation, as well as implicit benefits, and possible concerns are addressed.

3.2 - PromoPad proposal

Among other characteristics, that are developed further down, PromoPad seems to overcome the social challenges[2] that can prevent customer's adoption, and thus gathering the needed conditions to be widely accepted.

Specifically, by being light-weight and portable, and with a natural and intuitive interface (Zhu et al, 2004), PromoPad requires little user interference due to its user-friendliness. As so, it does not cause neither user's discomfort nor requires training, two critical issues for the success of such an interface.

Moreover, as it is further developed, PromoPad records customer's data in order to create customer profiles and therefore adapts the information presented to the individual's needs and interests. Nevertheless, the customer is in control of choosing whether he/she is willing to provide is personal information and benefit from a customized experience, or, on the contrary, he/she is not willing to do so and hence be presented with a non-member or generic profile.

3.3 - PromoPad – an AR-based Shopping Assistant

Developed by Zhu et al (2004), it is an in-store AR-based device that works both as a context-sensitive shopping assistant and as a tool to develop personalized advertising. Besides being an intelligent shopping aid that provides consumers with meaningful help/information when required, it also minimizes customer effort (Zhu et al, 2004). This hand-held device prototype,

[2] "Limitations of AR: challenges to be overcome" section

PromoPad, does not present passive information, in fact, it is context sensitive, i.e., it is based on the concept of dynamic contextualization (developed further down in section 3.5).

Zhu et al (2004; 2006) explain that dynamic contextualization not only discovers and exploits the user context and environment at each moment, as it also transforms in real-time, using AR technologies, the context of the user according to his/her interests and needs: *"With dynamic contextualization, the context can be modified to be more meaningful for the focal objects and more interesting to the users"* (Zhu et al, 2004). These properties bring unparallel potential once as the virtual complements are tailored to customers' interests and preferences, the modification of the context enriches the customer's shopping experience: *"In addition to providing assistant information, the PromoPad focuses on provide most relevant information to improve shopping experience"* (Zhu et al, 2006).

3.4 - The PromoPad System

3.4.1 - Company Perspective

As stated before, PromoPad is based on AR technology. More specifically, the system comprises a front-end user component, a Tablet PC that slips into the shopping cart cradle, and a back-end server component consisting in servers that compile inventory databases, customers' profiles and business logic. The Tablet PC camera makes it possible to know the customer's position relatively to the shopping cart and store shelves, and thus, a see-through view is provided containing additional product's information which is returned from the servers and databases.

3.4.2 - Customer Perspective

Essentially, the customer scans his/her member card or simply logs in as a member, and based on data previously gathered the system delivers information customized to the user's needs and interests instead of burden him/her with a large amount of standard information – Dynamic Contextualization (explained in the next section). Customer historical information along with business logic allow the system to predict the probability of customers being interested in a certain kind of information. If this probability is high the PromoPad delivers the information to the customer emphasizing the product; if, on the other hand, the probability is not that high but still considerable the device presents information as a way to trigger a possible impulse purchase; lastly, if the probability is low the PromoPad assumes that the information is not of the customer's interest and simply does not present it. The moment the

customer checks out the purchases and items searched are recorded in the company databases helping refining customer's profile. Ultimately, in case of non-member consumers a generic profile is presented.

3.5 - Dynamic Contextualization - concept and domains

PromoPad is able to enhance the customer experience as it is based on the dynamic contextualization concept (Zhu, 2006). In fact, dynamic contextualization the source of PromoPad's value preposition, and it represents an extension of direct and indirect experiences, particularly a combination of both. On one hand, there is the unmediated interaction between consumers and products, meaning that consumers can take advantage of all their senses – direct experience; on the other hand, there is the indirect aspect of the experience materialized on the possibility to access secondary sources of information - indirect experiences. The dynamic contextualization complements the richness of a direct experience with a variety of additional product information (such as background information, user's reviews and use scenarios of a product) that is not available through an exclusively direct experience. In other words, using augmented reality technologies, it allows real-time modifications of the customer context based on the interaction among the customer, the environment itself and the focal object: *"With dynamic contextualization, the administrators of the system can control the interest flow of the users by virtually modifying the focal entity's context information. In a shopping environment, dynamic contextualization is a business strategy that the retailers can use to virtually change the product settings, placed objects in more complementary settings"* (Zhu et al, 2004).

"The new capability of the PromoPad is that it can selectively display information that is related to the product under inspection and information that is tailored to individual needs. In other words, the information that is presented to the user is highly related to the context of the user, and the product under inspection" (Zhu et al, 2006). This PromoPad's capability of understanding the relevance of the information presented is a result of three main domains and/or criteria: location context, user context and product context.

- <u>Location Context</u>: as previously mentioned the use of the PromoPad (Tablet PC) allows the tracking of the customer, knowing exactly his/her location and the product that is under inspection;

- User context: the device continuously records customer data such as brand preference, buying history and product preferences. From this, the PromoPad system develops a shopping pattern and the consumer´s profile based on both shopping habits and demographics. Hence, all the information and suggestions PromoPad presents is consequence of user's preferences.

- Product context: are the different products – complementary products - that are somehow related to the product under inspection. This is an attempt to contextualize the focal product and therefore influence customer's attitude towards it. The PromoPad suggests two types of complementary products: functional complementary products which are products that can be consumed together and that by having a very close relation can induce simultaneous purchase; and sociocultural complementary products which represent products that although not having an evident relation, are related concerning some sociocultural process. Examples of focal products and their complementary products are presented in the table below.

Focal Products	Functional Complementarity	Sociocultural Complementarity
Digital camera	Photo papers, memory card, printer for digital camera, picture-editing software	Vacation package, plane ticket, ball park tickets
PDA	PDA keyboard, PDA software, Wireless Internet access, memory	Tie, pen, cell phone, laser pointer pen
Perfume	Body wash, deodorant, antiperspirant	Jewelry, candles
Pen	Notebook, highlighter, pencil jar	Hair tie
Candy bar	Soda, popcorns, ice cream	Ball park tickets, Big 'n' Tall clothes or shoes
Wine	Wine stand, cork screw, glasses	Crystal container, romantic dinner, travel package to winery
Detergent	Fabric softener, stain remover	Glass cleanser, floor cleaner

Figure 6 - Product complementarity examples (source: Zhu et al (2004). Personalized In-store E-Commerce with the PromoPad: an Augmented Reality Shopping Assistant)

The critical aspect, the one that transforms PromoPad into a device with tremendous potential, is the fact that the information the device presents is a real-time response to user's preferences and interests, i.e. the information presented is of the most use/interest to that specific customer.

Having understood the PromoPad's concept and potential it is critical to know its functionalities. These are the functionalities that are presented to and evaluated by the customers in the questionnaire.

3.6 - Functionalities

PromoPad is able to perform various functionalities which are divided into two groups: shopping assistant and personalized advertising. All PromoPad's functionalities are explained below:

- **Additional product information**: PromoPad overlays complementary information such as the product's origin or its components;
- **Presentation of complementary products**: the consumer is presented with complementary products of the focal product. These products can have a functional or social relation with focal product: the first are products that can be consumed together, while the latter are products that have pleasant relationships with each other (appendix 2);
- **Optimization of shopping routes**: the device shows the path to the aisle/product the consumer is looking for;
- **Highlight products with discounts**: the products that the grocery retailing company decides to apply a discount are highlighted to the consumer in the augmentations presented;
- **Presentation and comparison of prices of similar products**: equivalent brands are presented to the consumer making price comparisons possible;
- **Provide 3D representations of product consumption situations**: gives 3D examples of possible consumption situations of the product under inspection;
- **Customized coupons/discounts**: based on the consumer information collected PromoPad presents discounts in the products which are more meaningful and have higher interest for the customer;
- **3D advertising**: the ads referent to the products under inspection are presented in a 3D fashion;
- **"Personalized advertising"**: the ads that are presented to the consumers are only those that the system finds of interest of the consumer.

The following table summarizes all the PromoPad's functionalities (above explained).

	Functionality
Shopping assistant	**Additional product information** (about the origin and components of the product)
	Presentation of complementary products (functional and social complementary products)
	Optimization of shopping routes
	Highlight products with discounts
	Presentation and comparison of prices of similar products
	Provide 3D representations of product consumption situations
Personalized Advertising	**Customized coupons/discounts** (in products where the probability of customer's interest is higher)
	3D Advertising
	"Personalized Advertising" (only subjected to advertising related to products the customer value)

After making a thorough analysis of what PromoPad consists in, its benefits/advantages, and last but not least, its functionalities, it is possible to get an idea about PromoPad's potential. Promopad functionalities are used in the context of this work to find out if *customers value the extra functionalities AR can bring to the shopping experience in grocery retailing* (first research question). The research model containing the issues for answering the first research question and the corresponding questionnaire are developed in the next chapter.

IV. Research Model & Questionnaire

This chapter is dedicated both to the research model and the questionnaire. First of all, the research model is developed aiming to describe and structure what is intended to be learned and how it is learned. From this, hypotheses are created and the questionnaire is designed to test those hypotheses. The motives and structure both of the research model and the questionnaire, as well as the connection between them are thoroughly explored in this chapter.

4.1 – Research Model

The research model has as its primary objective to structure what is intended to be learned. Built on the PromoPad and the existent literature, hypotheses are created aiming to answer to the first research question. Since the questionnaire is the tool that allows the testing of the hypotheses it is designed based on the research model.

4.1.1 – Assumptions

As a starting point, the research model has two assumptions associated:

1. *Mobile handheld devices are widespread;*

This seems a fair assumption once the International Data Corporation (IDC) forecasts that smart mobile devices' shipments, such as phones and tablets, are expected to be greater than PC shipments by mid-2012 (IDC, Dec 2010). Verizon, a global company leader in innovative communication, information and entertainment, even stated in its white paper "The near future of retail: meeting the demands of the mobile consumer" that: "*This kind of growth is putting smart devices into the hands of most shoppers, and is providing retailers new ways to engage with them. Using advanced mobile applications, retailers can deliver relevant information, discounts, and products that meet a consumer's individual preferences —right at the moment they show signs of interest".*

2. *Consumers know how to use AR based devices;*

In the interview[3] made to one of Layar´s[4] founders, Maarten Lens-FitzGerald, when asked about whether people had difficulties in using AR handheld devices, he said: *"Some do. But once they see it then there is no problem. Key is of course to have a good connection and a good device"*. So, it becomes evident that, if "technicalities" are ensured (connection, device, etc), when consumers get to try AR based devices they easily learn how to manage it.

4.1.2 – Hypotheses

In effect, the first research question of this dissertation - *Do customers value the extra functionalities AR can bring to the shopping experience in grocery retailing?* – has a critical objective of understanding if customers value the functionalities PromoPad provides (presented in the section 3.6). Therefore, it becomes crucial to understand how customers perceive PromoPad's functionalities. As so, to achieve a final answer it is essential to analyze the following hypothesis:

- H1. Customers value PromoPad's functionalities.

This hypothesis intends to validate whether the consumers find useful the functionalities that PromoPad is able to provide. Hence, it aims to assess usefulness of the following functionalities: presentation of additional product information (product's origin and components for instance); presentation of complementary products to the focal product (both functional and social products can be presented); optimization of shopping routes; highlight products with discounts; presentation and comparison of prices of similar products (allowing the comparison among competing brands); the availability of 3D representations of product consumption situations; customized coupons (discounts in products that are meaningful to the customer); presentation of 3D advertising; and personalized advertising (customers are only subjected to ads of products that are of their interest).

Furthermore, although not directly associated with the functionalities, it is known that PromoPad is only able to customize the content it presents to the customer if it records customer's information. Indeed, it is this customer information that afterwards serves as basis to the customization of the shopping experience. Therefore, in order to fully exploit PromoPad's potential it is mandatory to understand if customers would be willing to allow the

[3] Appendix 2
[4] Layar is the world's largest mobile AR platform and a pioneer in AR - http://www.layar.com/

recording of their purchases and product/brand choices. Only if customers give their permission to collect their information, generated while shopping, PromoPad can develop its role as a persuasive information system. Hence, a second hypothesis has to be tested:

- H2. Customers are willing to allow the recording of their purchases and choices to benefit from a customized/personalized shopping experience.

By evaluating whether customers value the functionalities, and if they are willing to provide part of their shopping information it is possible to derive a robust answer to the *"Do customers value the extra functionalities AR can bring to the shopping experience in grocery retailing?"* research question.

Nevertheless, to test the hypotheses it is needed to ask customers. Ultimately, the questionnaire, which is developed precisely based on the research model, is the means by which the validation of the two hypotheses above described is afterwards possible.

4.1.3 - From the research model to the questionnaire

With the knowledge of the hypotheses that have to be validated, it is required to convert those hypotheses into questions to be asked to the consumers in the questionnaire[5]. Particularly, the questions presented in the questionnaire result from the matching of the hypotheses posed (and derived from the research model) and the theory on PromoPad.

To start with, in the questionnaire it is asked, in a scale ranging from 1 - *"Not useful at all"* to 4 - *"Extremely useful"*, customers' perception of the usefulness and value of the referred functionalities - H1. As it was mentioned in the "Introduction", if there is no value creation there is no strategy. Thus, as PromoPad was the device chosen to embody the functionalities AR can add to the grocery shopping experience, Q1 to Q9 (Appendix 4) represent an outcome of all the functionalities PromoPad is capable of providing (section 3.6), together with the need to know which ones are valued by the consumers. Ultimately, a 4-level scale was selected to avoid respondents' neutral positions regarding their appraisal of the functionalities.

[5] Complete questionnaire – appendix 4

H1. Customers value PromoPad's functionalities

Q1: Get additional product information (e.g. information about the product's origin, components and other users' ratings and opinions)

Q2: Get information about complementary products of the product you are looking for (imagine you are looking for a hotdog and you are able to get information about ketchup, or you are looking for a bottle of wine and you get information about glasses)

Q3: Get help on your path to get the products you are looking for, reducing the time spent If you are looking for a shampoo the device shows you exactly the path to the shampoos' aisle)

Q4: Know which products in the store are under discount

Q5: Get the prices of similar products allowing making price comparisons e.g. competing brands

Q6: Watch 3D representations of product consumption situations

Q7: Get personalized discounts i.e. on products that are meaningful to you (Instead of having generic discounts you would get discounts on products that you actually buy and value, according to your own interests)

Q8: Watch 3D ads

Q9: Be only subjected to ads that are related to products of your interest

With the first questions it was "only" appreciated respondents' evaluations about the functionalities independently. As so, by putting it in relative terms, it is possible to understand the functionalities respondents find more appealing. In that sense, with the purpose of getting a grasp about the functionalities' relative importance, it is asked to customers to rank, from all PromoPad's functionalities, the top 3 most valued. In practical terms, this question (Q10) aims to understand the characteristics that have to be emphasized the most in order to trigger grocery retailing customers to try and use PromoPad.

Concerning the hypothesis 2, as it can be seen in the figure below, consumers are presented with concrete situations (Q11 to Q13 – Appendix 4) and are requested to indicate, in a scale ranging from 1- *"Definitely unwilling"* to 4 - *"Definitely willing"*[6], to what extent they would be willing to allow the recording of their shopping choices in order to benefit from a personalized shopping experience, namely in terms of discounts/coupons, information presented, and ads showed.

The reason for this question arises from the fact that even though customers find PromoPad's functionalities "Useful" or "Extremely useful", if they are not willing to give their permission for the recording of their purchase choices, PromoPad cannot perform its job in an effective way. In other words, without customers' permission, the value PromoPad adds is limited, thus

[6] For the same reason previously evocated in the question 1, a 4-level scale was again selected to avoid neutral positions.

existing the possibility of turning PromoPad into something unattractive. So, customers' responses on this regard acquire great importance for the validation of the second hypothesis.

H2. Customers are willing to allow the recording of their purchases and choices to benefit from a customized/personalized shopping experience

Q11: You could be able to get discounts on your favorite cookies instead of some other random brand that you do not like/purchase (i.e. to get discounts customized to your interests and tastes)

Q12: Imagine you are an athlete and you do not drink alcohol. By allowing the recording of your information the device does not burden you with information about alcoholic drinks once it knows you do not value it (i.e. to get additional information only on products that are of your interest)

Q13: If you regularly buy milk and you never buy salt, instead of being subjected to ads indiscriminately (both milk and salt) you would only be subjected to milk ads (once you just do not value salt) (i.e. to be only subjected to ads that can indeed have interest to you)

Q14: Overall, how willing would you be to allow the recording of your shopping choices to have a customized/personalized shopping experience?

Lastly, after all the above domains have been evaluated, a final question on the likelihood (from 1 – *Very Unlikely* to 4 – *Very Likely*) of using PromoPad to shop in a grocery store is made. Even finding PromoPad's functionalities as "Useful" or "Extremely useful", and even being willing to allow the recording of their shopping choices in order to benefit from a personalized shopping experience, customers could still not be willing to use PromoPad when shopping. Indeed, user-friendly concerns and/or fashion concerns[7] could prevent customers from using the device. Hence, in the questionnaire a description of PromoPad's way of functioning and design is provided. Moreover, this question appears as a way to ensure that all the reasons that could prevent PromoPad from being used – functionalities not valued, information recording permission not granted, and/or user-friendly and/or fashion concerns not overcome - are covered and assessed.

As it can be understood from all the justifications given on the questions that constitute the questionnaire, all the relevant issues are covered and as so, the hypotheses posed can be effectively tested, making their validation well grounded.

[7] "Literature Review" chapter, Section 2.1.3 - Limitations of AR: challenges to be overcome

4.2 – Questionnaire's and Sample's Characterization

To validate the hypotheses above described, an online questionnaire [8] was conducted in April 2012. The questionnaire - designed in the online survey software QuestionPro[9] - was meant to gather the relevant and appropriate information (primary data).

The choice of this method of data collection was based on the advantages that are inherent to it, namely: easiness of use, convenience and confidentiality. Furthermore, in this case, there are no inhibitors (frequently associated to face-to-face questionnaires), hence increasing the reliability, and diminishing the risk of bias.

In terms of distribution/divulgation, two different channels were used: Facebook and direct mailing. It is noteworthy to say that Facebook was the primordial means of divulgation, being only a residual number of questionnaires sent through direct mailing. Facebook was elected as the main distribution channel due to its broad reach and respondent's familiarity with it. This, in turn, meant a relatively fast adherence in terms of responses, and thus an efficient and cost effective method.

The questionnaire comprised three main sections – functionality's appraisement, privacy issues and demographics – in line with what was intended to be tested. From the respondents reached, 151 accessed the questionnaire, and from these, a total of 131 really started it. Specifically, from the ones who started, 101 (73,72%) completed the whole questionnaire. Hence, the relevant number of observations for analysis' purposes is 101.

In general terms, the average time of completion of the questionnaire was 6 minutes, and from the relevant observations 58,42% are aged in the 18-24 years interval, and 61,39% of the 101 respondents are female.

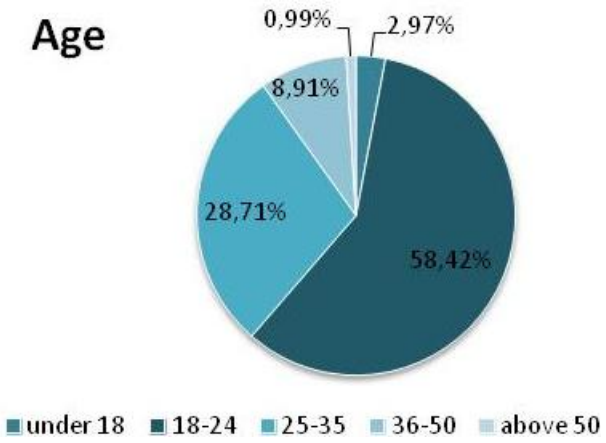
With the explanation of the reasons for each question that composes the questionnaire conducted, along with its general description regarding means of distribution, rates of response and brief characterization of the sample, it becomes pertinent to present the data/results collected.

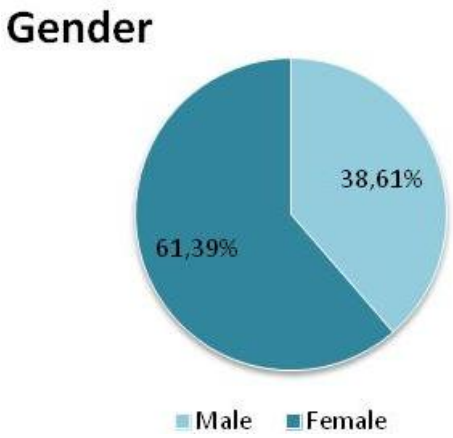
[8] Appendix 4
[9] QuestionPro – Online Research Made Easy™ website: www.quesitonpro.com

V. Results' Analysis & Preliminary Conclusions

In this chapter, in a first phase, the description of the sample is made – Demographics -, followed by an analysis of the data gathered in the questionnaire conducted. After this, as a conclusion of the chapter, from the data collected, preliminary conclusions are drawn.

5.1 – Demographics





In terms of sample characterization it can be briefly presented as:

- The **majority of the respondents** were aged between the **18 and 24** years old, specifically 58,42%;
- The **second more represented** range of age was the one comprising respondents from **25 to 35** years old;
- Approximately **61%** of the respondents were **women**, and consequently the remaining 38% were men.

5.2 - Results' Analysis

The analysis of the results are described and summarized according to two main areas that compose the questionnaire: functionality's appraisement and privacy issues.

5.2.1 - Functionality's Appraisal

		Scale			
		Not useful at all	Not useful	Useful	Extremely useful
Functionalities	(Q1) Get additional product information	1,98%	3,96%	**67,33%**	26,73%
	(Q2) Get information about complementary products	0,00%	18,81%	**61,39%**	19,80%
	(Q3) Get help on the path to the products	0,99%	3,96%	29,70%	**65,35%**
	(Q4) Know which products in the store are under discount	0,00%	0,99%	23,76%	**75,25%**
	(Q5) Get the prices of similar products allowing price comparisons	0,00%	3,96%	19,80%	**76,24%**
	(Q6) Watch 3D representations of product consumption situations	12,87%	**59,41%**	27,72%	0,00%
	(Q7) Get personalized discounts	0,00%	1,98%	29,70%	**68,32%**
	(Q8) Watch 3D ads	32,67%	**48,51%**	18,81%	0,00%
	(Q9) Be only subjected to ads that are related to products of interest	7,92%	24,75%	**60,40%**	6,93%

Concerning the evaluation of the usefulness of PromoPad's functionalities the results can be synthesized as following:

- The **majority** (7 out of 9) of the **functionalities** were said to be either ***Useful* or *Extremely Useful***;
- **4 functionalities** were inclusively regarded as ***Extremely Useful***;
- In relative terms, the **shopping assistant functionalities are more valued** then the personalized advertising ones, 5 out of 6 comparing to 2 out of 3;
- There were **only two functionalities** categorized as being either ***Not Useful* or *Not useful at all***: Watch 3D representations of product consumption situations and Watch 3D ads.

	General Evaluation of the Functionality	
	Not useful	Useful
Get additional product information	5,94%	94,06%
Get information about complementary products	18,81%	81,19%
Get help on the path to the products	4,95%	95,05%
Know which products in the store are under discount	0,99%	**99,01%**
Get the prices of similar products allowing price comparisons	3,96%	**96,04%**
Watch 3D representations of product consumption situations	**72,28%**	27,72%
Get personalized discounts	1,98%	**98,02%**
Watch 3D ads	**81,19%**	18,81%
Be only subjected to ads that are related to products of interest	32,67%	67,33%

The table above categorizes respondents' appraisements of the functionalities into *Not Useful* and *Useful*[10]. From it, it is clear that the **functionalities that gather the highest percentages** are:

[10] Useful in this case aggregates the scale levels of "*Useful*" and "*Very useful*" while Not Useful comprises "*Not Useful*" and "*Not Useful at All*"

1. Know which **products** in the store are **under discount** – 99,01%
2. Get **personalized discounts** – 98,02%
3. Get the prices of similar products allowing **price comparisons** – 96,04%

Based on the data regarding customers' appraisal of the usefulness of the functionalities, it is fair to state that the **majority of the functionalities are perceived as useful**, with special focus to the three functionalities just described.

	1st		2nd		3rd	
Get additional product information	15	14,85%	8	7,92%	15	14,85%
Get information about complementary products	9	8,91%	8	7,92%	17	**16,83%**
Get help on the path to the products	15	14,85%	13	**12,87%**	27	**26,73%**
Know which products in the store are under discount	19	**18,81%**	35	**34,65%**	13	**12,87%**
Get the prices of similar products allowing price comparisons	22	**21,78%**	26	**25,74%**	10	9,90%
Watch 3D representations of product consumption situations	0	0,00%	0	0,00%	1	0,99%
Get personalized discounts	21	**20,79%**	10	9,90%	14	13,86%
Watch 3D ads	0	0,00%	0	0,00%	0	0,00%
Be only subjected to ads that are related to products of interest	0	0,00%	1	0,99%	4	3,96%

Regarding the ranking, it **corroborates the answers given relatively to the usefulness of the functionalities**. Additionally, other insights can be derived:

- As the **most useful** functionality the order was the following:
  1st) Get the prices of similar products allowing **price comparisons**;
  2nd) Get **personalized discounts**;
  3rd) Know which **products** in the store are **under discount**;

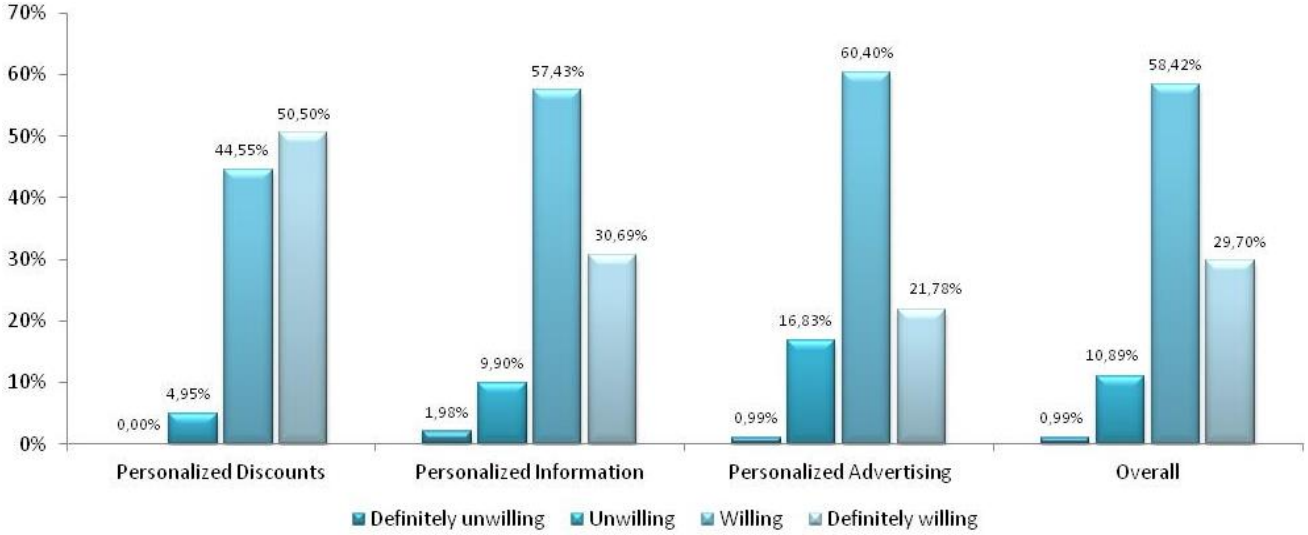
- As the **second most useful** functionality:
  1st) Know which **products** in the store are **under discount**;
  2nd) Get the prices of similar products allowing **price comparisons**;
  3rd) Get help on the **path** to the products;

- Finally, as the **third most useful** functionality:
  1st) Get help on the **path** to the products;
  2nd) Get information about **complementary** products;
  3rd) Know which **products** in the store are **under discount**;

Comparing questions 1 to 9 with question 10 it is possible to observe that, even though in a different order, the functionalities most valued are the same. **That is, the functionalities that**

got more percentage in questions 1 to 9 were the same that respondents said to be the most preferred (number one) in question 10. Particularly, the **most valued** functionalities are related with **potential savings, followed** by functionalities related with **complementary/auxiliary information.** Ultimately, only two functionalities were not valued by the respondents[11].

5.2.2 – Privacy Issues



In terms of **willingness to allow the recording of their shopping choices to benefit from a personalized shopping experience**, respondents answers can summarized as the follow:

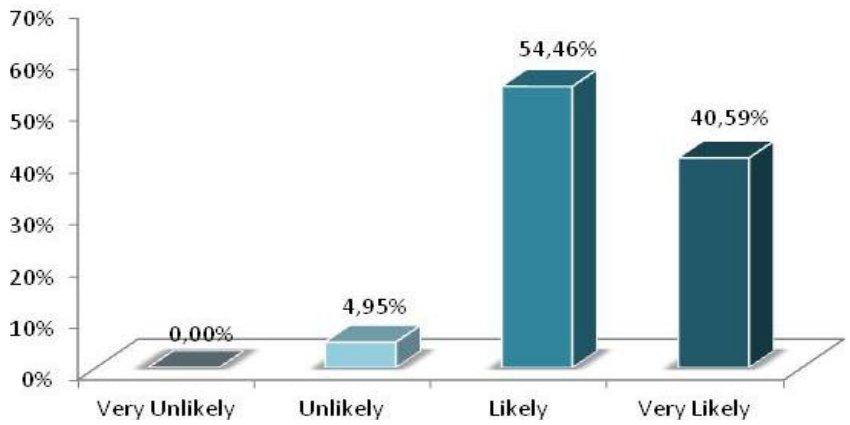
- In **all the domains**, i.e. discounts/coupons, information presented, and ads showed, **respondents were willing[12] to allow the recording of their shopping choices**, with percentages above the 80%;
- **From the three domains, the one that showed the highest percentage of willingness to allow the recording of the shopping choices was the "discounts/coupons".** That is, in order to benefit from personalized discounts roughly 95% of the respondents were available to allow the recording of their shopping choices.

[11] Further detailed in the "Preliminary Conclusions" section and "Discussion" chapter

[12] Means that the respondent answer that he/she was either *Willing* or *Definitely willing*

Regardless of the benefit associated, and with considerable percentages, **respondents were willing to give their permission to have a personalized grocery shopping experience.**

Even though *Q15: Considering the functionalities and characteristics the PromoPad presents, how likely would you be to use it when shopping in a grocery store?* is not directly related to any of the two areas[13] that compose the questionnaire, it was an essential question to be made. In other words, customers could value PromoPad's functionalities and be willing to provide their information to have a personalized shopping experience and still not be available to use it when shopping in a grocery store.



Nevertheless, the results were in line to what was answered before:

- **95,05% of the respondents replied positively when asked about the likelihood of using the PromoPad when shopping.**

These responses, on the likelihood of using PromoPad when shopping, illustrate that the earlier mentioned **user-friendly and fashion concerns are not an issue for respondents**.

5.3 - Preliminary Conclusions

From the data collected and the analysis made above, some preliminary conclusions can be drawn. These conclusions are of great importance since they are further crossed with hypotheses that are intended to be validated.

Functionality's Appraisement

- The **most valued** functionalities are related with **potential savings** :

[13] Functionality's appraisement, privacy issues and demographics

- Know which products in the store are under discount
- Get personalized discounts
- Get the prices of similar products allowing price comparisons

- The functionalities that are **also valued** but are not the top 3 are related with **complementary/auxiliary information,** namely:
  - Get help on the path to the products
  - Get additional product information
  - Get information about complementary products
  - Be only subjected to ads that are related to products of interest

- The functionalities that are **not valued** by the respondents are:
  - Watch 3D representations of product consumption situations;
  - Watch 3D ads

- Regarding the **ranking of the functionalities,** the ones more referred as the **"most useful"** were the same that got the highest percentages when evaluated individually. Specifically:
  - Get the prices of similar products allowing price comparisons
  - Get personalized discounts
  - Know which products in the store are under discount

Privacy Issues

- **Regardless of the benefit** (personalized discounts/coupons, information presented, or ads showed) **respondents said to be willing to allow the recording of their shopping choices to benefit from a personalized shopping experience.**
- The benefit that revealed a higher percentage of willingness to allow the recording of their shopping choices was the personalized discounts/coupons.

PromoPad's appraisal

- Aware of **PromoPad's** way of functioning and characteristics, when asked about the **likelihood of using it** 95,05% of the respondents said to be ***Very likely* or *Likely* to use it when shopping in a grocery store.**

With the analysis and the resulting preliminary conclusions completed, the matching with the hypothesis posed in the "Research Model & Questionnaire" chapter is required in order to validate them. In the next chapter "Discussion" of this dissertation is made and the answers to the research questions of this dissertation are given.

VI. Discussion

In this chapter, with the final purpose of achieving an answer to the research proposal, the two research questions are discussed and answered. As so, the discussion consists in the matching among the hypotheses posed, the preliminary conclusions, and the theory presented in the "Literature Review".

Specifically, the results and preliminary conclusions are discussed and crossed with the hypotheses developed in the preceding chapter with the purpose of understanding whether these are confirmed or not. With this, the answer to the first research question is given.

To conclude, with the answer to the first research question attained, the second research question is addressed. To do so, RBV theory is applied.

With the two research questions answered, there are conditions to accomplish a response to the research proposal of this dissertation in the subsequent chapter.

6.1 – Valorization of the extra functionalities AR can provide

H1. Customers value PromoPad's functionalities

Regarding PromoPad's functionalities (section 3.6), as it was seen before in the analysis of the questionnaire's results and in the preliminary conclusions (chapter V), the majority of the functionalities are perceived as "Useful" or "Extremely useful" (section 5.2), with the exception of the "visualization of 3D representations of product consumption situations" and "watch 3D ads", all the other functionalities were characterized as useful[14]. As so, if the matching of the preliminary conclusions (section 5.3**)** and the **hypothesis 1** (section 4.1.2) is made, it can be concluded that this hypothesis is **confirmed**, i.e. **customers do value PromoPad's functionalities.**

Additionally, the results show (section 5.2.1) that from all the functionalities PromoPad is able to provide, the most valued are primarily the functionalities related with potential savings[15],

[14] Section 5.2.1

[15] (1) Know which products in the store are under discount, (2) get personalized discounts and (3) get the prices of similar products allowing price comparisons.

followed by the ones associated with complementary/auxiliary information[16]. This can be important regarding the promotion of the PromoPad in the grocery stores. Knowing the functionalities that cause greater impact on customers, in an initial stage, to trigger the trial of PromoPad, these functionalities/benefits PromoPad has should be emphasized by the companies and respective staff of the grocery stores.

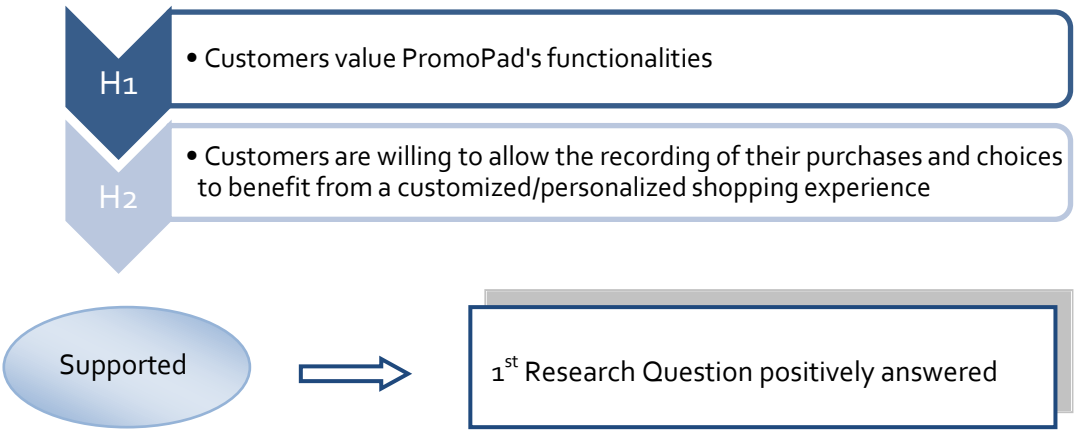
H2. Customers are willing to allow the recording of their purchases and choices to benefit from a customized/personalized shopping experience.

In what concerns the second hypothesis, it can be seen in the analysis of the questionnaire's results and in the preliminary conclusions (chapter V) that the responses were positive across all the three benefits that could be derived from the permission given - personalized discounts/coupons, information presented, and/or ads showed. So, if the crossing of the preliminary conclusions (section 5.3**)** and the hypothesis 2 (section 4.1.2) is done it can be concluded that this **hypothesis is also supported**. Meaning: **customers are willing to allow the recording of their purchases and choices to benefit from a customized/personalized shopping experience.**

Furthermore, it is noteworthy to point out that, even though customers said that watching 3D ads was not something they found useful, the fact is that when asked about their willingness to provide information to be only subjected to ads of their interest, 82,18% of the respondents said to be willing or definitely willing to do it. This goes in line with the Permission Marketing thinking; as customers do not have enough span of attention to respond to the overwhelming number of stimuli they are subjected to, they are willing to provide their information in exchange for being only subjected to ads that are meaningful to them:*"PM turns the existent clutter into an asset."* (Godin, 1999).

Concluding, it was described and explained that to assess the first research question the two hypotheses above described should be validated. It is observable through the analysis and interpretation of the results that these support the hypothesis posed. Therefore, it can be stated that **customers value the extra functionalities AR can bring to the shopping experience in grocery retailing.**

[16] (1) Get help on the path to the products, (2) get additional product information, (3) get information about complementary products, (4) be only subjected to ads that are related to products of interest



Another important point is that, as it was confirmed with the validation of the hypothesis 2 (section 6.1), it is possible to state that customers **are willing to give their permission regarding the recording of their shopping information in order to have a customized shopping experience**. It is known that PromoPad selects the virtual information it adds (or not adds) to the customer's environment based on the information - inventory databases, customer' profile and business logic - it stores in its back-end servers. **The exchange of information (customers) for meaningful content (company), gives room for a customer-company relationship mainly build around trust and benefits** (Permission Marketing). Once **customers** feel they are **benefiting from this "trade"** (not being burden with standard information) this will result in an **increasing use of the PromoPad**, which will, in turn, means more customer information gathered, and ultimately **more accurate matching between customers' interests and the augmentations presented.** So, in terms of benefits, the longer the relationship customer-company gets, the better PromoPad´s performance is going to be. From the perspective of the **companies** it means a **creation of a differentiated value preposition**, in terms of offers and communication (as long as CRM enables the personalization of the content presented), and from the perspective of the **customers** it means **higher benefits derived** from each shopping experience.

Last but not least, it is interesting to be aware of the link between PromoPad and CRM functionalities. PromoPad clearly embodies a "touching point" between the customer and the company, and as so, it represents a communication channel and an enabler of the **constant firm-customer dialogue**. **Why is it important? Because this dialogue is key for the company's learning regarding its customers**. PromoPad constitutes a *contact management* tool responsible **for the managing and gathering of customer information** that is the **raw material for all the company's customer-oriented processes**, and, more importantly, **for the**

development of customer knowledge. In operational terms, PromoPad facilitates the automation and personalization of marketing activities, and *"focuses on providing the customer with adequate information at the right time, though the appropriate channels, in order to ensure a continuous interaction with the customers"* (Torggler, 2009).

6.2 – Strategic relevance of the information collected

With the answer to the first research question and all the relevant insights related to it made, it is time to apply RBV theory as a way to address the second research question of this dissertation: "**Can the information collected through the consumers' use of AR be strategic to grocery retailing companies?"**

Valuable - as it was concluded in the previous section, PromoPad is capable of giving, to the companies which implement it, the possibility of creating a differentiated value preposition (as long as CRM enables the personalization of the content presented) – **value creation**. This value creation is **materialized in the increasing fit between a company's offers and communication and customer's interests and needs.** Enabled by the information constantly gathered, which is the basis for the augmentations, **PromoPad's characteristics – dynamic contextualization and personalization of the contents presented - ensure added value to customers**.

Rare – the customer knowledge that can be derived from the use of PromoPad is rare because if other companies also want to have that customer knowledge they have to communicate with the customers in a way that important customer's information can be "extracted". So, the first grocery retail company that invests and explores the PromoPad may enjoy an important first mover advantage since the company has **access to relevant customer** information that by being transformed - through CRM - into customer knowledge can mean a **competitive advantage** relatively to its competitors. By being the first company exploring PromoPad (and as far as it known, AR in a grocery retailing context), the company can be able to enjoy from the **"wow factor"** inherent to the fact of being the **first implementing a new and highly interactive AR interface; but more importantly, the company will be able to get and take advantage of a profound knowledge about its customers.**

Imperfectly imitable - it is undeniable, and important to highlight, that the **possibility of copy exists**. Nevertheless, this risk of copy **only holds for the technology itself, because the knowledge about the customers already gathered by the first mover company, as well as**

the level of interactivity and trust conquered is hardly imitable or copied. As so, **by the time other companies possibly implement PromoPad, the first mover firm will already possess important and relevant knowledge about its customers.** This knowledge, as it was mentioned before, is **hardly imitable,** meaning that the **followers are going to be in disadvantage.** Note that this disadvantage is going to increase proportionally to the time followers take to imitate the first mover firm.

Non-substitutability - customers will have to bear a **switching cost** if they **change of grocery retailing company**. As the first firm is going to have more customers' information and knowledge, it is also going to have/present more suitable offers and communication. In other words, **while with the first mover company's customers can be already reaping the benefits resultant from their time and effort spent, as well as information conceived, if engaging with other firm (follower), customers will have to start the process all over again. So, in fact, this switching cost can prevent customers from changing grocery retailing company.** Ultimately, as it was mentioned before, with PromoPad, the longer the relationship customer-company gets the better its performance and consequently the greater the benefits it can provide to customers.

In summary, customer's information is the key element for the functionalities and benefits PromoPad is able to provide. This **information may be transformed into customer knowledge through the use of CRM**. The **value and rareness connected of that information assures a competitive advantage for** the grocery retailing company that implements PromoPad. Moreover, this **competitive edge can be sustained over time since the information a company gathers is unique, making the advantage inimitable by other companies.** Hence, **the information collected through the consumers' use of AR can be strategic to grocery retailing companies.**

2nd Research Question positively answered

In this chapter, the hypotheses posed were validated, and the research questions answered. Additionally, the discussion generated important insights and knowledge to arrive to a final conclusion concerning the research proposal of this dissertation. The next chapter comprises the final conclusion regarding the research proposal, and the limitations and suggestions concerning future research.

VII. Conclusion

7.1 – Main conclusions

The main purpose of this dissertation was to answer to the following research proposal: "**Can the implementation of Augmented Reality in grocery retailing be strategic for companies?"** To accomplish this, two research questions where developed, namely: **(1)** "**Do customers value the extra functionalities AR can bring to the shopping experience in grocery retailing?"**, and **(2) "Can the information collected through the consumers' use of AR be strategic to grocery retailing companies?"**

To approach the first research question, PromoPad, an AR-based persuasive device which performs shopping assistant and personalized advertising functionalities, was selected to represent the functionalities AR can bring to a grocery shopping experience (chapter III). When asked, customers considered the majority of the functionalities as being *"Useful"* or *"Extremely useful"* (section 5.2). In fact, the functionalities related with **potential savings** were the most valued followed by the ones related with **complementary/auxiliary information**. In the same section, but regarding privacy issues, consumers revealed to be willing to allow the recording of their shopping choices to benefit from a personalized shopping experience. Lastly, almost all (around 95%) of the respondents replied positively when asked about the likelihood of using the PromoPad when shopping in a grocery store. **These findings, as it is demonstrated in the discussion of this dissertation, support the two hypotheses postulated**: *"H1 - Customers value PromoPad's functionalities"* and *"H2 - Customers are willing to allow the recording of their purchases and choices to benefit from a customized/personalized shopping experience"*. Based on this reasoning, it is possible to conclude that **customers value the extra functionalities AR can bring to the shopping experience in grocery retailing.**

Moreover, also in the discussion chapter, by applying RBV theory, **it is concluded that the information PromoPad gathers can be a source of a competitive edge.** Specifically, this competitive edge is possible to be created if **CRM is applied to the customer's information transforming it into customer's knowledge.** The latter, due to its uniqueness, value, and the fact of being hardly imitable or copied, constitutes a source of a sustained competitive advantage for companies. This gives evidence to conclude that **the information collected through the consumers' use of AR can be strategic to grocery retailing companies.**

With all that was discussed and the answers to the two research questions, the final purpose of this dissertation can be at last fulfilled. So concluding, PromoPad through its augmentations is able to conceive various benefits to customers. As **customers value what PromoPad is able to add to their shopping experience**, they are **willing to provide their shopping information** in order to increasingly benefit from it. Due to this fact, an **increasing amount of customer information** is collected which increases the benefits provided to the customers. **The information gathered, through the use CRM, can be translated into customer knowledge.** By possessing **profound customer knowledge, which due to its value and rareness, and "hardly-imitable-or-copied" nature**, the grocery retailing companies that implement PromoPad can develop a **sustainable competitive advantage** over their competitors. Hence, it is concluded, based on the evidences collected throughout this dissertation, that indeed **the implementation of Augmented Reality in grocery retailing can be strategic for companies.**

7.2 – Limitations

It is also important to point out some possible limitations to this dissertation:

- Although in the beginning of the questionnaire there was a link that directed respondents to a video where the concept of AR was showed and explained, it is possible that even with it, some respondents were not fully knowledgeable of what the technology consists in. Therefore, some answers can be biased for the lack of respondent´s knowledge;

- PromoPad was the device chosen to embody what AR could add to the grocery retailing shopping experience. This choice is due to the potentiality the device presented in terms of design and functionalities, however the truth is that another device could have been chosen eventually with other functionalities;

- The sample of the questionnaire conducted is mainly constituted of respondents aged between 18 and 24 years old. Thus, the conclusions achieved on the course of this work are only valid to populations to which this sample (used in this dissertation) is representative of.

7.3- Future Research

During this dissertation many subjects emerged as interesting aspects to be either developed or further developed.

- ✓ It would have been interesting to develop a preliminary study or a focus group where respondents could actually experience and try the PromoPad, having, this way, a better perception of the device and its functionalities;

- ✓ PromoPad allows the personalization of coupons and discounts, which means that prices will be different for different customers. As so, an interesting topic to be developed would have been price discrimination in this context;

- ✓ The financial appraisal of the PromoPad's implementation could be an interesting matter to be explored. In this dissertation the return on investment was not covered, so this could represent a valuable complement.

- ✓ As it was said in the previous section, the sample of the questionnaire conducted is mainly constituted of respondents aged between 18 and 24 years old. It would be interesting to see the results achieved with a different sample, representative of other population.

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VIII. Appendices

APPENDIX 1 – COMPARISON OF DIFFERENT TECHNIQUES FOR DIFFERENT TYPES OF DISPLAY

Types of Displays	HMD		Handheld			Spatial		
Techniques	Video-see-through	Optical-see-through	Video-see-through			Video-see-through	Optical-see-through	Direct Augmentation
			Types of Displays	HMD	Handheld			
Advantages	complete visualization control, possible synchronization of the virtual and real environment	employs a half-silver mirror technology, more natural perception of the real environment	portable, widespread, powerful CPU, camera, accelerometer, GPS, and solid state compass	portable, powerful CPU, camera, accelerometer, GPS, and solid state compass	more powerful	cost efficient, can be adopted using off-the-shelf hardware components and standard PC equipment	more natural perception of the real environment	displays directly onto physical objects' surfaces
Disadvantages	requires user to wear cameras on his/her head, requires processing of cameras video stream, unnatural perception of the real environment	time lag, jittering of the virtual image	small display	becoming less widespread, small display	more expensive and heavy	do not support mobile system	do not support mobile system	not user dependent: everybody sees the same thing (in some cases this disadvantage can also be considered to be an advantage)

(source: Carmigniani et al (2011). Augmented reality technologies, systems and applications)

APPENDIX 2 – PRODUCT COMPLEMENTARITY EXAMPLES

Focal Products	Functional Complementarity	Sociocultural Complementarity
Digital camera	Photo papers, memory card, printer for digital camera, picture-editing software	Vacation package, plane ticket, ball park tickets
PDA	PDA keyboard, PDA software, Wireless Internet access, memory	Tie, pen, cell phone, laser pointer pen
Perfume	Body wash, deodorant, antiperspirant	Jewelry, candles
Pen	Notebook, highlighter, pencil jar	Hair tie
Candy bar	Soda, popcorns, ice cream	Ball park tickets, Big 'n' Tall clothes or shoes
Wine	Wine stand, cork screw, glasses	Crystal container, romantic dinner, travel package to winery
Detergent	Fabric softener, stain remover	Glass cleanser, floor cleaner

(source: Zhu et al (2004). Personalized in-store e-commerce with the PromoPad: an augmented reality shopping assistant)

APPENDIX 3 - INTERVIEW TO MAARTEN LENS-FITZGERALD (LAYAR'S COFOUNDER)

As a pioneer in Augmented Reality it is important and interesting to know more about your experience.

Why AR? How did you (Layar's founders) realize the potential of this technology? Why this technology and not other?

We saw the potential of the technology. We come from mobile and were interested with physical world hyper linking. AR is the best way, especially now it is possible for all with smart phone penetration. Creative inspiration was:

- Dennocoil http://en.wikipedia.org/wiki/Denn%C5%8D_Coil
- Rainbows end http://en.wikipedia.org/wiki/Rainbows_End

What were the major difficulties/challenges?

So many. The key challenge is how to shape a new medium, what metaphors ("layers" vs WebPages) to use, and what interface choices to make (still going on). Secondly is how to get people to do and use it. It's like explaining the web in 1992 where people were just happy with their fax.

In general do people had difficulties in using AR in handheld devices?

Some do. But once they see it then there is no problem. Key is of course to have a good connection and a good device.

How did you get to know the functionalities (layers) customers would value?

We measure and follow all that goes one on our platform and learn from that. When something is being used a lot or not, it says a lot about the functionality.

As I told you before, my dissertation is about AR implementation in grocery retailing environment. I would like to have your opinion on this regard.

Do you think that the implementation of AR in grocery stores would provide a better shopping experience to customers?

It could help. Key is first to get the infrastructure right. I mean, you need good wifi, next what experience you provide and why. The Korean retail AR example is a good one. A store can be

empty apart from posters showing the products. Customers hold their phone over the products pictured on the wall and the "buy" it by adding it to their virtual shopping cart. This way the store doesn't need to have an inventory.

In this industry (grocery retailing stores) which functionalities do you think customers would value the most?

- More content (video, reviews, howto's etc)
- Social engagement (like, share etc)
- Direct commerce (buy now)

Thank you for your collaboration.

APPENDIX 4 – QUESTIONNAIRE

General Introduction: Dear respondent, I am a student from Católica-Lisbon currently doing my thesis. I would very much appreciate if you could answer the following questionnaire about an Augmented Reality based Shopping Assistant. There are no right or wrong answers. It is all about your preferences and all responses are confidential. The questionnaire will not take more than 5 minutes. Thank you very much for your time.

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Introduction to PromoPad: PromoPad is an Augmented Reality based device that performs personalized advertising and shopping assistance. In a grocery shop (e.g. Supermarket) the consumer has access to a Tablet PC. The device can then be either held by the consumer or be slipped in the cart cradle. By pointing the device to the products the consumer is able to benefit from various functionalities. (To better understand what Augmented Reality is you can take a look at this short video (http://www.youtube.com/watch?v=XZ5_q2k55Mk)

Page Break

Scale: For the following 9 questions consider a scale ranging from *"Not useful at all"* to *"Extremely useful"* in order to indicate the importance the following functionalities would have to you when shopping in a grocery store:

Q1: Get additional product information (e.g. information about the product's origin, components and other users' ratings and opinions)

Q2: Get information about complementary products of the product you are looking for (imagine you are looking for a hotdog and you are able to get information about ketchup, or you are looking for a bottle of wine and you get information about glasses)

Q3: Get help on your path to get the products you are looking for, reducing the time spent If you are looking for a shampoo the device shows you exactly the path to the shampoos' aisle)

Q4: Know which products in the store are under discount

Q5: Get the prices of similar products allowing making price comparisons e.g. competing brands

Q6: Watch 3D representations of product consumption situations

Q7: Get personalized discounts i.e. on products that are meaningful to you (Instead of having generic discounts you would get discounts on products that you actually buy and value, according to your own interests)

Q8: Watch 3D ads

Q9: Be only subjected to ads that are related to products of your interest

Q10: Please **rank** the *three* functionalities that you find more useful

- Get additional product information
- Get information about complementary products of the product you are looking for
- Get help on your path to get the products you are looking for, reducing the time spent
- Know which products in the store are under discount
- Get the prices of similar products allowing making price comparisons
- Watch 3D representations of product consumption situations
- Get personalized discounts i.e. on products that are meaningful to you
- Watch 3D ads
- Be only subjected to ads that are related to products of your interest

Introduction to Privacy issues: To be able to experience a personalized shopping experience, similarly to what happens with loyalty cards, customer's information regarding shopping choices and preferences have to be recorded. By allowing the recording of information regarding shopping choices and preferences the customer will be presented with customized instead of standard information. Moreover, the device will only present additional information if, based on customer's preferences, it considers it is relevant (not being burdened with large amounts of irrelevant information)

Scale: Using a scale ranging from *"Definitely unwilling"* to *"Definitely willing"*, please indicate to what extent you would be willing to allow the recording of your shopping choices (similarly to what happens with loyalty cards) in order to benefit from the following situations:

Q11: You could be able to get discounts on your favorite cookies instead of some other random brand that you do not like/purchase (i.e. to get discounts customized to your interests and tastes)

Q12: Imagine you are an athlete and you do not drink alcohol. By allowing the recording of your information the device does not burden you with information about alcoholic drinks once it knows you do not value it (i.e. to get additional information only on products that are of your interest)

Q13: If you regularly buy milk and you never buy salt, instead of being subjected to ads indiscriminately (both milk and salt) you would only be subjected to milk ads (once you just do not value salt) (i.e. to be only subjected to ads that can indeed have interest to you)

Q14: Overall, how willing would you be to allow the recording of your shopping choices to have a customized/personalized shopping experience?

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Q15: Considering the functionalities and characteristics the PromoPad presents, how likely would you be to use it when shopping in a grocery store?

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Q16: Age: 1) Under 18 2) 18-24 3) 25-35 4) 36-50 5) Above 50

Q 17: Gender 1) Male 2) Female