Conceptualizing Interaction in online grocery shopping: mapping the customer’s mindset

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Abstract

The commerce of grocery is one the oldest and most commonly used forms of services. Although some people claim to enjoy shopping for the household, for a vast majority of people, grocery shopping has become a chore both time-consuming and stressful for the everyday consumer. The rise of the Internet as a global communication tool has created new forms of businesses and forced many more to adapt to increasingly informed, savvy and demanding customers, and in many industries, e-commerce figures are showing that people are finally ready to buy remotely in the comfort of their homes. It would therefore be foreseeable that the convenience provided by remote grocery shopping would persuade consumers to refill their pantries and fridges without leaving the house.

Grocery, however, is among the business categories with the least successful penetration on the Web. While this has been noted a number of times in previous studies and industry reports, the research community has tried to approach the issue through many different areas. The specifics of grocery shopping are pointed out as main factors for this divergence. Unlike other types of commerce, shopping for groceries is a repetitive process, where clients most often purchase the same products as they did on previous visits, according to their preference. Also, it is the kind of shopping where an order usually includes several items in different quantities, and where tools like shopping lists to assist memory and implicit knowledge to decide quantities are often required. Moreover, because grocery products are usually low-risk, low-interest products, decisions theories show that clients often make a satisfying decision, instead of “the best” one. In spite of these specific characteristics thoroughly discussed throughout literature, grocery e-commerce websites are still implemented at the convenience of the developer and the retailer and not that of the client.

In this research, we argue that the customer mindset for grocery shopping is not being correctly mapped into online grocery solutions. After benchmarking current online solutions and identifying tools and theories that assist our research to define a theoretical framework for the study, a client study was carried out to draw conclusions on the customer activities and decision-making patterns when shopping at the grocery store. Finally, a user-centred design approach was adopted to develop a prototype that incorporates ideas, methods and tools uncovered in the course of this investigation, which can be evaluated by potential customers and compared to what is currently available.
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1 Introduction

1.1 Description of the Problem

In many economies over the world, services represent over 70% of the gross domestic product and figures indicate that this number is yet to increase. Under what is being frequently called a service economy, only in the last few years has any attention been given to the innovation in this sector. While innovation has been largely focused around the evolution of technology, services are complex systems of clients, employees and processes, all supported by technology. Under this pretence, a research community has been growing around the area of services, striving to consolidate the science behind the service industry, and foster the innovation in this sector.

Grocery Retail is one the oldest and most essential forms of retail services. Not only does grocery shopping represent a big part of a person’s monthly expenditure, it also can prove to be a time-consuming, stressful task that needs to be carried out by customers. Most major grocery retailers have therefore undertook the strategy of selling their products online, advertising a convenient, stress-free task that can be performed remotely. Ordering grocery online, although not allowing to physically evaluate the products before buying them (fact valued by a lot of customers), allows the consumer to bypass the trouble of driving to the store, walking around the store to find the products and transporting them back home. With a changing reality of working family households with an increasingly limited time to spare, hence putting a greater value on how they spend their time off work, it would be expected that online grocery sales would have taken off and be on the way to replacing the significance of physical stores. However, although the benefits of remote shopping have revolutionized many forms of business, grocery is at the bottom of the list in terms of online penetration.

A few approaches have been discussed and researched to address this matter. Grocery shopping is different from other forms of shopping, especially in its online component. On the one hand, it is a repetitive process, in which consumers are not looking to buy one single specific item that they have never bought before (such as the case of books or technology products), but instead work in a cyclic manner where very often the client buys the same items as usual to refill his/her consuming needs. On the other hand, the benefits of detailed product information are not as clear in grocery as they are in other forms of online retail, since consumers are more familiar with the type of products being bought. Approaches to address the inefficiency of online grocery shopping have ranged from website usability to product categorization, indicating that this fault can be fought in more than one front.

For instance, Freeman (2003) has done extensive research on the usability issues of online supermarkets in Australia, pointing out several factors which would lead to a decrease shopping cart abandonment rate. Another suggestion is that the websites’ conceptual models to not match the customers’ normal shopping tasks, hence making the job of finding desired items inefficient and unpleasant, greatly depreciating the benefit of convenience of online shopping.
Another approach to e-grocery shopping has been the use of customer data to personalize the shopping experience. Product recommendation algorithms have been suggested (Min H, 2006; Cumby et al. 2005), to a wide range of extents, inclusively with the purpose of predicting the customer’s shopping list integrally, based on a number of indicators derived from customer data.

Some authors also suggest that the reason why clients cannot easily find their products online is related to an inadequate categorization of the retailer’s product range (Kornum, Bjerre, 2005), making it thus difficult for the client to find a desired product within the retailer’s assortment..

In fact, there seem to be sufficient tools and ideas that appear promising to improve the perceived value of shopping for grocery online. The reality is, however, that these approaches have not yet been integrated to devise a simple, well-structured and intelligent solution that reflects to consumer’s mindset and can be tested.

The purpose of this research is therefore to take from all these approaches, and follow a user-centred approach to designing a solution which can be tested by customers on the level of electronic service quality, namely service efficiency and customer perceived value.

1.2 Wipro Retail

Wipro Retail is a technology-based services company specialized in the retail sector. It came to be in 2006 when Wipro Technologies acquired Enabler, a company created originally by retailer for retailers. Wipro Retail’s client base consists mainly of worldwide high-profile retailers that rely on the deep know-how of the retail business offered by the company’s assets. Such clients include Morrisons, Supervalu, Tesco, Sonae, Ahold, Carrefour, Walmart, amongst many others, and extend throughout many retail industries (Fashion, Grocery, DIY, Department Stores and Wholesale).

Many of the retailers now requesting services from Wipro Retail are grocery retailers, relying on the company’s proven know-how and history of successful implementations. Although most projects implement customized Oracle Retail solutions, the company has fostered a mentality of innovation, offering new solutions fully adapted to each client’s needs.

As a part of the company’s innovation process, the need for a new solution in the area of grocery e-commerce has been identified, and the on-going process of understanding the customer behaviour patterns has triggered a new project aiming to develop a solution that integrates the complexity of operations behind a grocery retail business, and the simplicity needed to interface with an online solution that responds to an everyday need, such as grocery shopping. The purpose of a solution such as the one proposed would be to increase customer satisfaction and simplifying the buying process, hence motivating customers to buy online, and uplifting online sales.
1.3 Dissertation objectives

For this research, the goal set was to identify elements of online grocery commerce which could improve customer experience and efficiency in online grocery commerce, and attempt to design a solution which addresses the main faults found.

This goal can be separated in the following sub-goals:

- **Understand and describe customer behaviour and context in grocery shopping**
  - Identify the most important drivers of choice
  - Prioritize customer needs when shopping online
  - Describe common pattern of thought when shopping grocery

- **Identify and describe current tools and algorithms available**
  - Tools for online grocery shopping usability
  - Tools for developing and analyzing shopping patterns

- **Propose front office – prototyping and validation**
  - Propose database meta-model for suggested solution
  - Develop prototype aimed for simplicity using information about buying process, usability guidelines and customer intelligence to customize user experience.
  - Evaluate prototype

1.4 Organization

This dissertation is organized into five parts. We begin by reviewing related work and literature to accurately project a theoretical framework that supports the relevance of this investigation. In section 3, we describe the methodology followed in the course of the exercise. The report then describes the main observations and describes the finding in the study of client needs. In section 5, the proposed solution is presented based on the information acquired thus far, and discuss the evaluation and results of the functional prototype developed. Finally, we draw conclusion of the investigation and suggestion future possibilities of work in the subject discussed.
2 State of the Art

2.1 Grocery Retail

The Internet has changed the way we, as a society, live. Since the dawning of the Web, systems to aid our everyday lives have been developing rapidly, and its benefits are obvious to every business and individual. E-Commerce is the Web’s buzzword for online shopping and it has revolutionized the way retailers do their businesses.

Online Grocery shopping, however, has been falling behind expectations in relation to e-commerce in other areas (Ramus, Nielsen, 2005), particularly when considering share of total consumer spending against offline orders.

While businesses of all types have been trying to make their interaction with the customer more conversational, especially with the rise of the Internet as a means to communicate to a wider public at a lower cost, grocery retailing is one business that has not yet achieved this goal to all its potential, especially considering the huge amounts of data collected by retailers about their customers nowadays.

The following chapter briefly describes the evolution of e-grocery and more recent innovative views of electronic grocery commerce, namely in mobile computing.

2.1.1 The evolution of Grocery E-Commerce

In the prime of the dot com era, in the 90’s, US-based Webvan was created as the first major online grocery store. It focused mainly on technology, allowing clients to order their products online and using advanced functionality for the time like shopping carts and online payments from an early stage. Around 2001, though, Webvan filed for bankruptcy, leaving room for another online solution, mostly focused on its delivery processes and existing infrastructure to succeed. That company was Peapod later bought by Royal Ahold, and still today stands out as one of the leading Grocery E-Commerce sites, although delivering only for selected states in the USA. As described by (Lunce, Lunce, Maniam, 2005), for years, grocery was seen as a retail business which had no place in the Web.

Nowadays, however, grocery retailers battle each other for any piece of competitive advantage, and online sales are seen as one of the ways to go. Even traditional retailers have opted for diversification by acquisition just to grab a share of the online grocery market, like Walmart through ASDA. Amazon, for example, known one of the experts in online retail and customer intelligence, has bought Webvan’s brand name to enter this market, and has brought its Web 2.0 company competences into the online grocery market. Clients can now rate grocery products, post reviews, get product suggestions and share their own recipes. In the UK market, both Tesco and ASDA compete at the cost leadership level, hence taking advantage of their websites to make sure clients see their promotions, making e-commerce a significant service channel to serve their business strategies.
In Portugal, the two main websites for online grocery shopping are Continente Online and @Jumbo. Both have similar interfaces, implementing a category browsing mindset, with searching capabilities included and shopping lists and shopping cart functionalities. An early evaluation, complemented with the studies at Wipro, showed that these websites are not as easy or efficient to use as they could be and to not simplify the customer buying process nor do they make use of the implicit consumer intelligence.

2.1.2 Mobile E-Grocery and the future of Grocery

Besides E-Commerce, other E-Grocery solutions have been developed and are research solutions have been proposed, that attempt to address the same problem of customer-centricity, many of which were implemented in mobile devices. This stresses the fact that there is a potential to assist client in their grocery shopping through technology.

One of the most well-known is the Easi-Order (Newcomb, Pashley, Stasko, 2003), an application installed in a PDA that focused on the creation of a personal shopping list that could be sent to the online store. This solution was implemented in several Safeway stores across the UK. The Shoppers Eye addressed the lack of awareness of customer in relation to existing buying opportunities. By carrying a handheld device around in the shopping mall, the customer was able to share its shopping list with retailers which in turn made their bids. Klever-Kart is a solution embedded on the shopping cart which provided the customer useful information on products, such as sales, nutrition, etc. The Georgia Institute of Technology proposed a solution of a PDA application very focused on simplicity and ease of use, aimed at aiding the consumer around the grocery stores, providing a map of the stores and integrated a shopping list functionality that helped the customer find the items on the list.

For long now, grocery has also been pointed out as one of the prime targets of ubiquitous computing. The idea of intelligent refrigerators and a smart home in general, may involve a lot of research in aligning technology, retailer’s processes and client interfaces, and indeed some intelligent grocery system have been suggested, like iGrocer (Shakar, Nair, Helal, 2003) and MyGrocer (Kourouthanasis et al. 2002). The existence of these systems and research support the assumption that grocery shopping is based on repetitive patterns of purchase, as opposed to careful consideration on each purchase.
Easy Grocery (Sommerville, Stuart, Barlow, 2006) is another interesting work, which suggests the future of grocery shopping may be associated with better visual representation of products and store layout, through a user interface. The solution presented, suggests a 3D representation of the store, in which the user can navigate and select the products from the virtual shelves.
2.2 Customer Centricity

The common point between all service forms is the existence of a client for which the service is being provided. Not surprisingly, with the rise of the service dominant logic, several efforts have been made to better understand the customer context and design services to better serve him/her. The following section describes a few tools and ideas that assist the service-thinking centred on the customer.

2.2.1 Outcome-Driven Innovation

Innovative solutions can change the way people like, create entire markets and leave others to oblivion. Disruptive innovation, however, is not easy to come by, but without an innovative frame of mind, a company cannot think of its business as long-term. Companies like Apple and Google have actually assumed innovation as one of their implicit benefits, have are therefore always under pressure to come up with revolutionizing products. A focus on customer activities has therefore become evident, as a way of studying how to satisfy any client unfulfilled need and therefore be innovative at the eyes of the customer.

Outcome-Driven Innovation (ODI) is a method that aims to transform the process of Innovation from an unstructured ideas-first model, to a clear step-by-step framework that starts with the identification of customer needs and maps the needs to be satisfied with the opportunity their provide for successful innovation. The authors argue that customer needs must be taken into account as a part of a customer job, i.e. the customer wants to use the functionality of a product or service as a part of a bigger purpose. A product or service may satisfy more than one job, and customer jobs can be emotional (i.e social or personal) or functional. (Ulwick, 2009) defines the universal job map as a generalization of the process that most jobs needs to go through – Define, Locate, Prepare, Confirm, Conclude, Modify, Monitor and Execute.

![Diagram of the Universal Job Map](image)

Each step of the process is divided into actions, which have desired outcomes by clients, commonly perceived as user needs. By analysing each action taken in a customer job, a company can have a structured view of the customer needs implied in using a product in their
real context, and can be examined individually by importance and satisfaction yielded. The method of ODI then suggests an opportunity algorithm that weights the satisfaction against the importance and returns an opportunity indicator, showing the level of impact the innovation step can have in the market.

This approach is important to this investigation because it supports the assumption that in a client-oriented business world, one has to start the analysis from the customer jobs and context to provide noteworthy innovations to a sector. Not only focusing on the functional jobs being carried out, outcome-driven innovation shows how to think outside the innovation box and inside the customer head.

2.2.2 Service Blueprinting

Service Blueprinting is a practical tool that assists innovation in services. Sharing some similarities with BPMN and UML, this tool represents a simplified notation highly oriented towards the needs of service innovation, in a manner that is understandable not only for the service designers, but also to clients and other company stakeholders, such as managers and frontline employees. As such, it allows collaborative design of the service process, leaving the least amount of ambiguity to the implementation phase. It can be used not only to develop new services, but also to improve existing ones. A Service Blueprint consists of a diagram constructed around the customer activities and is typically formed by five components:

- Customer Actions
- Onstage/visible contact employee actions
- Backstage/invisible contact employee actions
- Support Processes
- Physical Evidence

Figure 8 shows an example of a service blueprint for a self-service DVD Rental Kiosk.
In the context of service blueprinting, three lines of separation are described and exemplified in the diagram. The line of customer interaction, which indicates between which actions of the system the client interacts with onstage actors; the line of customer visibility, which indicates from which point the customer loses visibility of the service operations, and the line of internal interaction, which indicates the stage where the service operations are solely backstage and performed within the company.

Service Blueprinting is a tool to assist the evaluation of the service operations and design of the customer experience, and although an initial framework is suggested by the original authors, several light variations of the diagrams exist in the literature, focusing on the service specifics.

### 2.2.3 Customer Experience in Online Grocery Shopping

A service transaction is an intangible, transformational process that occurs across a certain period of time. As such, it is essential that the customer has a positive experience when being served. (Meyer, Schwager, 2007) divide customer experience as the internal and subjective responses to direct or indirect contacts with the company. While direct contact refers to the course of the service being provided by the company, indirect contact involves other encounters with representations of the company, such as word-of-mouth, recommendations, news reports, etc.

In the context of online shopping in general, and grocery shopping in particular, usability plays a great role in customer experience, mainly in regards of an efficient and logical shopping experience (Freeman, 2006). Ease of use and intelligent product recommendations have been appointed as key benefits to drive positive customer experience when making use of a grocery e-commerce solution, serving as the main drivers of repeated purchase and
customer satisfaction. Hence, it comes with no surprise that Human Computer Interaction has been playing an increasingly important role in the design of e-commerce websites.

2.2.4 Activity Modelling

Some form of representation is necessary to illustrate the context of customers and their interaction with it. (Constantine, 2006) provides a user-centred approach to representing user context and its own vocabulary. This tool bares resemblances to Unified Modelling Language (UML) and BPMN (Business Process Modelling Notation), but focuses on the interaction of participants with the context.

According to (Constantine, 2006), activity modelling is “a systematic approach to organizing and representing contextual aspects of tool use”. This method is based on the Activity Theory, a way of describing and characterizing the structure of human activity, and provides a set of guidelines, as well as a systematic set of tools to represent user context. (Constantine, 2006), describes a vocabulary specific to this representation, partly inherited from other framework of context representation, represented in figure 9.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="activity.png" alt="Symbol" /></td>
<td>activity, user actor</td>
<td>activity participant interacting with the system of reference</td>
</tr>
<tr>
<td><img src="role.png" alt="Symbol" /></td>
<td>role, user role</td>
<td>relationship between an actor and the system of reference</td>
</tr>
<tr>
<td><img src="system.png" alt="Symbol" /></td>
<td>system actor</td>
<td>non-human system (software or hardware) interacting with the system of reference</td>
</tr>
<tr>
<td><img src="player.png" alt="Symbol" /></td>
<td>player*</td>
<td>activity participant not interacting with the system of reference (but often an actor with other systems)</td>
</tr>
<tr>
<td><img src="artifact.png" alt="Symbol" /></td>
<td>artifact, tool*</td>
<td>any artifact employed within an activity</td>
</tr>
<tr>
<td><img src="activity.png" alt="Symbol" /></td>
<td>activity*</td>
<td>collection of actions or tasks undertaken for some purpose</td>
</tr>
<tr>
<td><img src="task.png" alt="Symbol" /></td>
<td>task, task case</td>
<td>action by an actor in interaction with the system of reference for some goal within an activity</td>
</tr>
<tr>
<td><img src="action.png" alt="Symbol" /></td>
<td>action*</td>
<td>action by a player for some goal within an activity</td>
</tr>
</tbody>
</table>

Figure 9 - Activity Modelling Vocabulary - Source: Constantine, 2006

Assisted by the described vocabulary, users of activity modelling are then more able to represent user context, namely regarding interaction with tools and other participants. Activity modelling is based on user tasks and is meant to assist the design of user-centred tools (i.e. software, services, etc). The stages of representation of assist design are represented in figure 10.
Context Maps allow representing the interaction of participants with involving players and tools, getting a sense of what influences assist an actor along the course of his activity. Each actor and player should have a role defined in a participation map that interferes with the execution of the activity being described. An activity map, on the other hand, focuses on breaking down activities into tasks and actions. Although it is not meant to extensively describe all actions in the activity, it provides a way of noting the most relevant tasks and describes how they affect each other (i.e. whether one activity precedes another or whether they occur simultaneously).

In the context of this investigation, activity modelling provides the tools to better understand and represent the context and behaviour of clients, when shopping at the grocery store. When part of the purpose is the context of client’s into an online solution, it becomes essential to have tools that assist representation of the activities. In section 4, we provide examples of the use of this method in mapping activities of clients when shopping for groceries at the store.

2.2.5 The significance of shopping lists

One of the activities of grocery shopping is the use of a shopping list to aid the shopping process. Although people have been using grocery lists for a long time, little attention has been given by the research community to this element of grocery shopping (Basset, Beagan, Chapman, 2008). Grocery lists are an assistant for the scripted behaviour of grocery shopping, while at the same time serving as a memory aid for the household grocery needs (Thomas,
Consumers use them in a variety of manners: some use extensive, detailed lists, perceptible to anyone that reads it, while others just list the items that are not commonly in their shopping process, avoiding forgetting about them. Grocery shoppers create lists in many kinds on formats, from blank pieces of paper, post-its, pre-made checklists or even PDA programs used for that sole purpose such as HandyShopper or PocketShop. Moreover, some customers create their lists mentally, while others do not plan their trip at all, relying on the store display to remember their household needs (Basset, Beagan, Chapman, 2008). Building a grocery list is often not an individual process. Items on a list reflect not only the consumer’s intent, but those of the remaining people in the household. Hence, building a grocery list is often a collaborative process, either implicitly (by having a mother thinking about what her kids might want) or explicitly (by posting a draft of the list on the refrigerator and having different people adding their needs to the list). A research study conducted in Australia concluded that in most family households, the same person always does the shopping. In all but one participant of this same study, the person who did the shopping was female and most of the participants stated that they always use some form of grocery list.
2.3  Electronic Service Quality Assessment

2.3.1  Service Quality

Service Quality is commonly defined as being the difference between what how a service should behave and how a service actually behaves. Nowadays, services are in fact complex systems, and the gap between how the system was initially defined the way it finally behaves when it reaches the final customer marks the difference between an adequate service and an inadequate one.

SERVQUAL is a method, initially proposed by Parasuraman, of evaluating the different gaps of service quality, in order to assess the client perception of the service. It describes the Gap Model represented in figure 13, which consists of describing 4 Gaps that separate customer expectations from perceptions.

- Gap 1 refers to the difference between what the customer expects and what the company thinks that the customer expects
- Gap 2 happens when the design standards set by the company do not meet the customer expectations
- Gap 3 occurs when the delivery of service does not perform according to specified and fails to meet standards
- Gap 4 is the gap created when the communication associated with the service does not accurately describe the service delivered
- Gap 5 is the described as being the products of all previously described gaps. This means that the gap will be as significant as the significance of all other gaps. Conversely, if all other gaps are resolved, then the perceived service and the expected service should not have a gap separating them.

Figure 13 - Gaps Model - Source: Parasuraman
2.3.2 Service Attributes

Like many objects of research in science, services are often broken down into characteristics, called service attributes. One of the approaches of evaluating service quality is by identifying and benchmarking the service attributes and the satisfaction they represent to clients.

When using a service, clients have expectations of how the service should work. The Kano Model of Quality, initially conceived for to evaluate product development but later adapted to evaluate service quality, represents a way of looking at service attributes and their performance and classifies them as follows:

- **Satisfiers** represent those attributes which clients expect from the service and how it should behave. Presence of these characteristics will not make satisfied customer, however, lacking of them will make client unhappy.
- **Delighters** are the characteristics which go beyond client expectations. These will bring an edge to customer satisfaction, but do not replace those that satisfy the user’s most basic needs.
- **Dissatisfiers** are those that represent the basic fulfilment of the client need, without which clients will be unsatisfied.

While it may not be an easy task to decompose a service into attributes, the real challenge lies in how to best measure them and improve each one, while considering the trade-offs implied. A study by (Jeanselme M, Reynolds J, 2006), has identified the most desirable online service...
attributes. The findings (represented in figures 15 and 16), assert that ordering time is at the top of the list for online shoppers.

![Figure 15 - Weighted preference of online service attributes Source Wilson-Jeanselme M, Reynolds J, 2006](image)

![Figure 16 - Weighted preference of attributes for 3 online supermarkets Source Wilson-Jeanselme M, Reynolds J, 2006](image)

The significance of this result for the purposes of this investigation is clear. The high perceived value of decreased ordering time by online customers, shows that there is a need for more efficient online interfaces.

2.3.3 Electronic Service Quality: E-S-QUAL

Several authors argue as to what the dimensions to evaluate electronic service quality should be considered (Kim, Lennon, 2006). There has been thus an effort to define a standard framework to evaluate service quality of online solution, based on the more traditional SERVQUAL, initially developed to evaluate service quality of services in general. Service Quality Frameworks are divided into dimensions, which are levels at which the object of evaluations is considered. Each framework provides different dimensions, and often different naming for similar dimensions (See annex 6 for a list of frameworks).

One of these frameworks, was developed by Parasuram et al. (2005), based on the participation of sufficient respondents with online experience. E-S-QUAL subdivides into two levels of detail:

1. E-S-QUAL Core, which describes the dimensions of:
   a. Efficiency – “the ease and speed of accessing and using the site” (Parasuram et al 2005), referring to ease of website access; ease in finding information and navigating to a desired location, and minimal effort on checkout.
   b. Fulfiment – “the extent to which the site’s promise about order delivery and item availability are fulfilled” (Parasuram et al. 2005), implied by the availability of items in stock, and the capability of delivering them in the promised timeframe
   c. System Availability – “the correct technical functioning of the website” (Parasuram et. al 2005), which asserts the importance of eliminating broken links and bugs that interfere with the predicted behaviour of the website, and
   d. Privacy – “the degree to which the site is safe and protects customer information” (Parasuram et. al 2005), meaning that it is essential for the
perceived value of a website the notion that private information will not be misused;

2. **E-S-QUAL Subscale (E-RecS-QUAL)**, describes in three dimensions:
   a. Responsiveness – “the effective handling of problems and returns through the website” (Parasuram et al. 2005), stressing the importance of continuity of the order cycle in the online solution,
   b. Compensation – “the degree to which the site compensates customers for the problems”, such as returning handling fees and shipping costs with minimal effort, and
   c. Contact – “the availability of assistance through phones or online representatives”, referring to the capability of accessing help resources through the website, or that they are duly references in it.

Since convenience and saving of time is one of the main reasons for shopping online (Ranganathan and Ganapathy, 2002), efficiency is possibly one of the most important factors in grocery online retailing. Kim, Lennon (2006), adapted the framework to include three further dimensions, which were considered relevant to apparel retailers based on prior studies:
   a) Personalization – giving customer personal attention, understanding their specific needs,
   b) Information – Referring to both company and product related information, checked for completeness and clarity, and
   c) Graphic Styles – which refers to product images, layout, print size, which not only provide greater usability, but also are able to influence the customer when shopping online.

The addition of these three dimensions was argued in the context of apparel online shopping, however, the observation and research done so far suggests that these should also be considered in online grocery shopping, namely graphic styles and personalization.
2.4 Principles of Interaction Design

Usability is an area being increasingly valued by businesses facing demanding clients unwilling to spend time learning how to interact with the object. The recent trend of touch screens and simplified interfaces has apparently won the heart and preference of many customers, which consider easy-to-use solutions as the most innovative. Online services are partially a form of self-service, and the importance of the way the client fulfil his duty in the co-creation of the service is directly linked to how well he can use the system.

2.4.1 Usability Principles

(Preece, Rogers et al., 2002) defined usability as “a measure of the ease with which a system can be learned or used, its safety, effectiveness and efficiency, and the attitude of its users towards it”. Although the most intuitive goals of usability are associated with “ease of use”, (Preece, Rogers et al., 2002) has defined two types of usability attributes: “usability goals” (effectiveness, efficiency, safety, utility, learnability and memorability), another set of attributes define the “user experience” – satisfying, enjoyable, fun, entertaining, helpful, motivating etc. Both are represented in figure 17.

![Usability Goals](image)

Figure 17 - Usability Goals - Source: Interaction Design (Preece, Rogers et al., 2002)

While usability applies to everything capable of being “used”, be it product, service or system, a lot of attention has been put into the usability of online software, with the rise of the Internet as a form of remote business. Jakob Nielsen is considered to be one of the usability gurus of the Web and has done extensive research on the usability of websites. He proposed a set of 10 heuristics, initially proposed to evaluate websites, which are well accepted within the community, and help usability designers to follow the best practices when developing websites:

- Visibility of system status
The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

- **Match between system and the real world**
  - The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

- **User control and freedom**
  - Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.

- **Consistency and standards**
  - Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

- **Error prevention**
  - Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

- **Recognition rather than recall**
  - Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

- **Flexibility and efficiency of use**
  - Accelerators - unseen by the novice user - may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

- **Aesthetic and minimalist design**
  - Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

- **Help users recognize, diagnose, and recover from errors**
  - Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

- **Help and documentation**
  - Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

Previous studies of usability have pointed out that usability faults may be one of the main factors of frustration for online shoppers, and therefore lost sales. Motivated by the promising rise of grocery e-commerce over the coming years, a few studies on grocery online solutions' usability have been performed. Completed orders at online grocery stores have an average of 54 items (Wilson, 2003). When a user has difficulty in finding and selecting a single item, it is unlikely that he/she will submit himself/herself to the trouble adding the remaining 53. Finding and adding a product to cart should therefore be easy and time-efficient. This suggests that usability main play a very important role in online grocery commerce. Freeman (2003) sets ten preliminary guidelines for orders that deal with multiple-item multiple-quantity situations such as grocery shopping:
1. Informative Homepage
2. Pages should follow a clear left to right path
3. Searching capabilities should be visible and usable
4. Searching available across multiple columns
5. Logical ordering results with consistent naming
6. Separate column for each part of the description
7. Each row differentiated
8. Clear method for item and quantity selection
9. Buttons differentiated from text and graphics
10. Simple instructions

The guidelines described in this chapter, although not offering solutions to the problem in question, assist us to pursue our goal without committing many of the most common mistakes already identified by usability experts.

2.4.2 Usability Development Cycle

Developing products or services should start with the analysis of the user needs that the product or service should fulfil. However, there is often a discrepancy between what the designers think the consumer wants and what the consumer actually needs. The concept of user iteration is based on the principle that a project that involves developing something "usable" should be developed progressively in parts. Once each part is complete, it should be shown to potential clients in order to detect early misalignment between the solution and the problem. Evidence and experience in this sector shows that the earlier the problem is identified, the easier they are to correct.

![Usability Engineering Lifecycle](image)

Figure 18 - Usability Engineering Lifecyle Source: Interaction Design Preece 2002

(Preece, Rogers et al., 2002) proposes a cycle of usability engineering that describes a methodology to be followed when undertaking an engineering project. The methodology starts with a phase of requirement analysis, where the project team should understand the
context of the users they are designing for, their tasks, profiles and constraints. Following the usability goals, previously described by the same author, this phase should evolve to the development of a conceptual model which maps the user’s image to the designer’s image of the system. The design/testing/development model should then work its way iteratively to satisfy all usability goals and functionalities, with the help of prototypes and mock-ups from an early stage, avoiding thus flaws in the design phase.

The described cycle provides guidelines to set the cornerstones of the methodology used in this project. As described in section 3, the course of action taken before developing the functional prototype involved users along 4 iterations before the final prototype.

2.4.3 Conceptual Models

According to (Preece, Rogers et al, 2002), conceptual models are “a description of the proposed system in terms of set of integrated ideas and concepts about what it should do, behave and look like, that will be understandable by the users in the manner intended.” With an appropriate conceptual model, users understand the object of interaction as a projection of their actions. They serve as a bridge from what the object’s designer has in mind and what the user perceives.

Two main categories of conceptual models are suggested by (Preece, Rogers et al, 2002):

- Conceptual Models based on activities – models designed to influence a user to use the system in question with a certain activity pattern. Four kinds of activities are further suggested by (Preece, Rogers et al, 2002):
  - Instructing
  - Conversing
  - Manipulating and Navigating
  - Exploring and Browsing
- Conceptual Models based on objects – models designed to use the user’s common knowledge about real-world objects, in order to learn how to interact with the system. For example, if the interface system looks like a book, the user will be inclined to click or touch the right-hand side border of the book to flip to the next page.

Conceptual models are, by definition, a must when trying to map the customer’s actions a frame of thought into an interactive solution. Defining an appropriate system image in an online grocery solution will help the customer use his/her implicit knowledge to improve both experience and efficiency.
2.5 Anticipating customer decisions

Besides the behavioural activities of the customer, it is important to also map the customer’s implicit knowledge and decision patterns into the service solution, in order to have client enjoy a more fulfilling and efficient shopping experience. Product recommendation is at the base of personalized service for the case of online retailers. The following chapter reviews studies about the customer decision-patterns, aiming to better understand how customers decide about their products.

2.5.1 The consumer decision process

Some authors, argue that the decision process of a consumer is described as having five stages, starting with the recognition of the client need for a purchase, searching for information about the product, evaluating the possible alternative, deciding on which product to buy, and finally, evaluating the purchase.

![Figure 19 - Five stages of consumer decision process (UIE study – uie.com)](image)

A study from a usability consultancy on the online buying process assessed that often consumers cannot follow their natural decision process when using online solutions. The study states that “9% wasn’t able to find the products they were looking for because they couldn’t identify the right product category or find product options using the search facility”. Moreover, “8% of the shoppers who succeeded in finding products gave up because the product lists didn’t provide enough information to identify purchase options, or because they were confused by going back and forth between product lists and product description pages in order to decide if the products would fit their basic needs”. These results show a deficiency in the websites analysed, suggestion the existing need to understand the customer’s decision-making process when designing an online service.
As figure 21 illustrates, the problem deepens as the process reaches its final stages, resulting in lost sales due, when the customer had in fact already identified a need for a purchase. The same UIE study shows that out of 100 purchase-ready customers, only 34 actually accomplished their goals.

2.5.2 Decision Models

(Richarme, 2001) describes 3 Models identified throughout the literature, each improving from the shortcoming of predecessors. He further explains that these models yield 7 decisions-making strategies which drill down the models to a more algorithm-like approach.

Being the longest standing decision making model, the Utility model dates 300 years back, and proposes that consumers base their decisions on the expected outcomes of the choice. In this model, consumers are viewed as rational actors, both consistent and constant in their decisions, in order to achieve their desired goals, based on the calculated utility of each option. (Nicholas Bernoulli, John von Neumann, Oskar Morgenstern). However, consumers do not always behave rationally or consistently and often are even not aware of all the factors involved in their decision making. The Utility theory had, therefore, severe shortcoming, when used to predict consumer behaviour.

In the mid-50's Laureate Herbert Simon proposed an alternative, simpler approach, called Satisficing. This model proposed that consumers get approximately to their goal and then stop their decision-making process. While, under the Utility theory a consumer would evaluate all the options and weight exactly their attributes, this new theory proposes that consumers restrict their search using their most valued attribute (i.e. location when searching for an apartment (Richarme, 2001)), then stopping and a "good enough" level, not looking for the "best" option.
In the 70's, Kahneman and Tversky complemented the Satisficing theory, which had shortcoming in matters of prediction, introducing the concept of value (instead of utility, as in the Utility theory). It introduces the concept of gain and loss, evaluated from a reference point set by the decider. It consists of two phases, editing and evaluation. In the editing phase, the decider prunes his/her alternatives based on some heuristic. He/she then sets a reference points and evaluates the relative value of the remaining alternatives.

2.5.3 Decision Strategies

Compensatory decision strategies are ones that allows for the weight of one attribute to compensate the lesser value of another attribute, i.e a car may have a low mileage consumption, which can compensate for the shortage of seating space. The two compensatory decision strategies are called equal weight strategy, when attributes have equal weight; or weighted additive strategy, different attributes have different weights and they are all weighted against each other.

With non-compensatory strategies, on the other hand, attributes are weighted without respect to other attributes, and even though the weight of all attributes might be greater in one product, if it fails another attribute, it is not considered. The first of these strategies is called satisficing, and it considers the first product that meets a defined cut off value for all attributes is the one considered. Elimination-by-aspects sets a cut-off value for the most important attribute, allowing all products that meet this cut-off value to proceed to the next attribute in the hierarchy. Lexicographic evaluates the most important attribute and if a product is clearly superior to others in this attributes, it selects that product and halts the decision process, otherwise it continues to the next most important attribute.

The last two decisions strategies are called partially compensatory strategies, when strategies are matched against each other in a serial fashion. Using majority of conforming dimensions, the first two competing products are evaluated across all attributes and the one with higher value is retained. The winner is then compared to its next competitor in a second iteration of the process. Frequency of good and bad features, is a strategy that simultaneously compares all relevant attributes, flagging whether each of them meets a certain cutoff value. Then the product with most qualified attributes is retained.

2.5.4 Marketing Theories for decision-making

A Marketing theory called Consideration may help to restrict the problem space of the decision making process. For instance, when a consumer is asked where he wants to dine this evening, he has a shortlist of restaurants under consideration, suggesting that the decision making only needs to happen within that subset. Multistage decision-making suggests that consumers make decisions in a series of steps of increasing complexity.

Another theory called Involvement suggests that the cognitive effort necessary to make a decision directly depends on the importance placed by the customer in the acquisition of a product, i.e. when it comes to quality of life, or buying presents for others. This importance can come from personal reasons or social/peer influence.
2.6 Categorizing Product Data

Product Categorization refers to the aggregation of products into groups that allows maintaining the retailer’s assortment in a logical manner. This categorization can be done for a number of reasons, the most frequent of which being the separation of business strategies and resource allocation for different product segments.

2.6.1 Product Typologies

One form of aggregation of products is into typologies. Typologies describe different types of products in the way they are consumed. Although there have been several suggestions for product typologies (Campbell Stonehouse Houston, 2002), some of which currently being used, the most enduring has been one separating products into convenience, shopping and speciality good (Coopeland, 1923):

- **Convenience Goods** are products whose purchase is relatively frequent, at low prices, and where the customer sees little interest or risk in the purchase, such as batteries or low carbonated drinks (Campbell Stonehouse Houston, 2002). As a consequence, these are the kind of products that a supplier will need to make available in the most number of outlets, since the shopper will usually buy it at the most convenient location.

- **Shopping Goods**, unlike convenience goods, are normally more expensive and the consumer perceives more risk and has more interest in the purchase, and therefore will most likely compare prices between different locations before making a decision. Examples of these are cars, or personal computers. In these products, there is an increased importance of availability of product information, since most often they require some technical knowledge, for an informed decision.

- **Speciality Goods**, are at the edge of customer preference, often carrying so much prestige, that customer may insist on buying only one brand. Usually these products speak only to a niche market, like professional photography.

Most grocery items fall under the convenience goods category, although suppliers often widen their range to provide both, low-risk decision products, and fine-taste items to the consumer in given categories. In fact, clients have different ways of looking at a category, and one could speculate that inside the grocery department, we have all three kinds of types of products, at a smaller scale (i.e. wine could be considered a shopping goods, for instance).

2.6.2 Category Definition and Merchandise Hierarchy

Category Definition is an essential part of the planning process for any retail business. It consists on the grouping of the entire assortment of a business typically into departments, categories, sub-categories, segment and sub-segments; however, each retailer often tailors its category definition to the specific business needs.
Agreeing upon a category definition is a timely process that often is re-iterated over time and speaks directly to the retailer’s business strategy and counts with the active collaborative participation of suppliers and should always revolve around the perceived consumer needs. Some key benefits of an appropriate category definition are:

- better alignment of retailer/supplier with the consumer – by defining the strategies for categories around the consumer needs,
- better aligned relationship between retailer and supplier – by having a common vision for the main subject of their business together,
- new perspectives of category strategies – re-evaluation of category definition often leads to new perspectives on business planning.

2.6.3 Consumer Decision Trees

Consumer Decision Trees (CDTs) are a tool often used by retailers to assist category definition and plan their assortment. In fact, a study Meyers Research Center stated that 84% of major retailers inquired use consumer decision trees with the purpose of building more efficient product assortments. An instantiation of consumer decision tree for a given category consists on weighting the attributes of the category’s products, placing those with greater importance to the consumer decision above those with lesser importance below. Each level of a CDT represents a different attribute, whereas each branch inside a level represents an attribute value for that attribute. Figure 23 shows a sample CDT for the beer category. Creating a CDT also includes defining which levels of the priority systems are “switching” levels and which are “walking” levels (i.e. “walking” levels are alternatives which the consumers are unlikely to be willing to switch from the initially desired product, whereas “switching” levels are those which consumers may be willing to switch from the initially desired attribute if unavailable).
CDTs also serve as tools to assist the creation of planograms, which define the layout of products in the store shelves within a category - i.e. if type of beer (regular or light) is the highest-priority attribute for the beer category, then products are likely to be grouped by type before any other attribute (having light beers grouped together and separate from regular beers).
3 Methodology

The methodology for the research project was carefully constructed and divided into 4 different stages, each of which took inputs from the preceding ones.

Figure 23 - Methodology

The following diagram describes the timeline in which the project was projected, considering the available time for the research:

Figure 24 - Project Timeplan
The subsections of this chapter describe the in more detail each of the project phases, and how they fit the proposed research objectives.

3.1 Phase 1: Preparation

3.1.1 Review of Literature and Studies

The review of previous literature and recent studies is important for any research project with a well defined theoretical ground. While on the one hand market studies and reports confirmed assumptions and supported the decisions taken in an investigation, the review of other work on the several areas that affect this project provided an insight of best practices and conclusions from other authors, some of which were considered very important for the development of the research projects.

The main areas of reviewed literature were:

- Usability and Interaction Design
- Service Quality and Service Experience
- Service Innovation
- E-Commerce Best Practices and Trends
- Category Management
- Decision Theory

3.1.2 Unstructured Interviews

As a form of project initiation, it felt important for the researchers to get acquainted with the subject of research in an exploratory manner. Seen as understanding the customer mindset when shopping for grocery was one of the objectives of this dissertation, 6 participants were interviewed in an unstructured manner, mainly to understand how they thought their shopping experience could improve with the help of technology.

3.1.3 Collection of shopping lists

Starting from an assumption supported by previous studies and observation that grocery shopping lists are an important assistant for grocery shopping for many customers, 20 shopping lists were collected. The main intention behind this task was to understand how they were constructed; the level of detail of each list item, and to what level the contents of the shopping list matched the actual shopping.

3.1.4 Review of Previous studies at Wipro

Previous research projects existed at Wipro, and were also taken into account for this research project. The studies consisted on a series on unstructured interviews and researched
what drivers and patterns of behaviour were implicit in consumer decision-making when grocery shopping. It also included some conclusions on online grocery shopping, namely, the reasons for satisfaction/dissatisfaction when using an online solution and proposed improvements based on their past experience.

3.1.5 Current Online Solutions: Benchmarking

During this task, five grocery online solutions were benchmarked for their main features and usability. This task was performed only by the researcher and not by a sample of participants, although in some occasions, participants were asked how they felt about a certain functionality of a website they had never used. The purpose of this step was to evaluate the tools used in grocery e-commerce websites, their strategies and the main faults.

3.2 Phase 2: Analysis of Consumer Behaviour

3.2.1 Online Grocery E-Commerce

This stage consisted of asking five participants who normally used the Internet to shop for grocery to simulate their shopping while being recorded by screen-recoding software and a microphone. The participants were also asked to express their frustrations and comment on their decision as they found suitable. This phase would allow the researchers to assess the main frustrations that affected the customer experience when shopping online for groceries and listen to suggestions made by the customers while experiencing the shopping process.

3.2.2 Grocery shopping at the store

Also important to understand how the customer mindset might be mapped into an electronic solution, was to observe shoppers in their physical shopping environment – the grocery store. During this stage, seven participants were accompanied by a researcher during their grocery shopping process. The supermarket chosen was Continente in Matosinhos, and participants were asked to express their frustrations and comment their decision-making when suitable.

3.3 Phase 3: Solution Concept Development

From the data gathered and theoretical framework chosen and analyzed, the solution began to be drawn. The process of phase 3 was not linear, but iterative, meaning that each of the steps taken was repeated, with the assistance of input from selected participants, which were explained how the solution would work assisted by the tools described in the following sections. The participant group was slightly modified in each of the iterations to allow some fresh perspectives on the solution.
3.3.1 Development of Conceptual Model

The conceptual model explained how the system could be understood with the help of the client’s common sense. In the first stage, it consisted of a verbal description of how the interface could be interpreted, and then evolved to a diagram which showed the users how the solution could be interpreted.

3.3.2 Low-Resolution Prototyping and Iterations

Low-Resolution prototypes aimed to show to users the layout and appearance of the screen. Prototypes were all developed in MS-Office PowerPoint, allowing thus move change the position of elements, according to user suggestions. The prototypes reflected the main changes in the screen, in order to reflect transformations on the appearance.

3.4 Phase 4: Functional prototype and User Evaluation

The final stage of the project was the development of a functional prototype to allow users to test and experiment with and evaluate the proposed solution and its suitability to the objectives. The specific objective of the phase of the prototyping was to evaluate the user’s reaction to the proposed features with the functionality and collect feedback. Although it was not feasible to have a full product range available in a mock solution, some data was inserted in this stage of the prototype. The prototype was developed using javascript web libraries and server-side Java Server Pages querying an Oracle Express database.

The development of the prototype had 3 essential parts:

1. Design of Data Model
2. Recommendation Algorithms and Model
3. Interface Development

The questionnaire to evaluate the solution was based on the ES-QUAL standard for efficiency, in order to attain a sense of how efficient the users felt the customer experience was.
4 Study of client needs and context

4.1 Client activities at grocery store

As a part of the data gathering phase of this project, clients were observed and interviewed while making their usual shopping in supermarkets. This phase of the research included the accompanying of seven participants in their grocery shopping routine. A description of the participants can be found in annex 4.

Only one of the participants did not use a shopping list. When inquired why they used the shopping list, the reasons provided coincided with the findings of previous research on the subject:

- Case 1: To avoid forgetting items that one normally does not buy
- Case 2: To follow a scripted behaviour, hence accelerating the shopping process
- Case 3: To make sure the order stays within budget

As for the participant that did not use a shopping list, she explained that she goes shopping very often (2/3 times a week) and buys only for a few days, hence very few products, being thus able to remember everything and having no need to write it down.

All participants used a shopping cart, and all cross-compared their shopping lists with the contents of the cart to check completeness. The order in which the participants picked up their products did not match the order in which the shopping list was written. Instead, participants chose an aisle or a section (i.e. Frozen Food) and picked up all items they needed from that section. At this point it was noticeable that many impulse purchases happen due to adjacency to a desired product, for example, stain-remover next to laundry detergent, which is a more common purchase. Very seldom did a participant return to an aisle previously visited, since before leaving an aisle or section, participants scanned the list to account for missing items from that area.

Another relevant observation was that when participants went to pick up a product they did not commonly buy, they were often overwhelmed with the product range available to their choice, hence unsure of which one to buy. At this stage it was possible to observe the participants narrowing down the product range according to their needs. In most cases, the narrowing consisted of the exclusion of one or two attributes and then the choice was made either by lowest price or by most trusted brand. When asked about how many products they finally considered, the answers ranged from 2 to 5 products.

On the other hand, it was very clear that when the product category is a very common category was being chosen, the product chosen was decided beforehand. In most cases, participants even justified their choice with some insider knowledge, such as family household members’ preferences or hidden product attributes. In this case, there was also the case where participants stated that they “always buy” one of two or three preferred products.
Figure 27 shows an activity map of the process taken by the customer from the preparation phase, to the order payment at the store. This map breaks down each activity into subtasks, giving a sense of what exactly is performed by the customer in their shopping habits.

The activity map drawn shows a similarity with the generic customer decision process presented in section 2. The grocery shopping activity starts off with a preparation, where clients evaluate their household needs, by scanning their house for missing items. This step can occur progressively or all at once, before going to the grocery store. After choosing their shopping method (either at the store or online), clients choose their products based on their identified needs. Important to notice is that clients narrow down their selection to products that match their identified needs. This suggests that it may be very important for the clients to understand the differences between products in the product range, by understanding the range of product attributes available, and which products match which attributes. Each product needs is associated with a different section or shelf of the store, therefore, these areas are duly identified by aisles signs in the store. In the checkout stage, clients often verify the contents of their shopping carts to verify completeness and compare their choices with the items noted on the shopping list.

The customer context (represented in figure 28) shows how clients interact with tools, artefacts and other actors at the grocery store. While at home, the wide range of product containers is verified (fridge, pantry, cupboard, freezer, etc.), at the store clients rely on shelf spaces and their signalization (product labels, aisle signs, shelves, price tags, etc.) to guide their shopping. Also their shopping list is an important tool to assist shopping, both online and at the store. It often defines the next step of the client. The shopping cart serves not only as a container and transportation aid, but is also used to verify which products the customer has already selected, while the shopping list shows which are missing. Shopping assistants can also play a part in this process, by assisting the clients when the signalization is not clear or when the client cannot decide among products.
Figure 28 represents a buying process at the grocery store generalized from observation of clients following their shopping patterns. The buying process at the store is most often planned beforehand. When at the store, clients choose store sections or aisles before products. Sections have therefore to be logically organized to assist customer in their thinking patterns. Inside a section of the store, clients browse the section until identifying their need and search for the desired shelf space containing the products that satisfy it. Once found, clients narrow down their search space and select among a few products based on preference, selecting the product to be purchased. Often comparison between products happens at this stage, based on visual evaluation or product information, but not always. While browsing, it can also happen that clients identified an unanticipated product need, and follow a similar process to select the product to be purchased. This cycle continues until the client decides that his/her shopping needs are satisfied.
Customer activities at the grocery store mostly follow a standard pattern, as described. We observed that customer follow logic when choosing their next item, even if an implicit one. Most often this pattern is guided by item proximity, gathering all items within a certain section. We speculate that this might not only be because of physical restraints of a store layout, but also because consumers aggregate several categories of products into certain needs (i.e. “food” or “drinks”). Next, we will describe our research on shopping lists, a tool that may well assist this shopping sequence decision.

4.2 Use of Shopping Lists

In the course of this research 20 shopping lists were collected with an average of 17 items per list from 7 different participants. The purpose of this phase was to evaluate how shopping lists were constructed to gain a sense of how this tool could be mapped in an online interface.

Our research showed that the degree of detail in each item of a grocery list varies: some elements can be a specific product that the user is sure he/she will buy, some represent categories like "snacks" and some even represent a client goal that cannot be mapped into the retailer’s merchandise hierarchy, such “dinner” or “birthday cake”. The varying level of detail may suggest the level of certainty that a consumer has on wanting to buy a specific product is not constant. Some items in the list are not to avoid being forgotten, but because the customer wants a very specific product which may be difficult to remember, hence writing down all the specifics.

It is also a constant that items are marked off the list once in the shopping cart, and often important missing items are underlined or circled around to avoid forgetting. Another
important factor is that in some cases, not all items in the list are written at the same time, suggestion that a shopping list is build progressively as needs in the household become evident. By observation and revision of other studies, several situations of how a shopping list is constructed were noticed. For once, it can be hung up somewhere in the house to be collaboratively constructed by different household members. It can also the written down just before leaving to the store, in an exercise of iterating through all the house compartments and checking what is missing.

In a store, a shopping list is a tool that is not always present. Although it helps the customer organize his/her shopping, it can be checked only a few times during the shopping process, either to check completeness of shopping, or to get a sense of the next step.

As for impulse items, they are most often not added to the shopping list upon sight, but if a customer remembers an item during his shopping process that is not on the list and is not near it, then there were cases where the shopping list was amended in the spot.

4.3 Usage of current online solutions

As a part of the study, five participants were accompanied as they performed their regular shopping online. The purpose of this phase was to gain some perspective of the shortcomings of current online grocery commerce solutions, the level of satisfaction of the users and sources of frustration. The exercise was documented using screen-capturing software for later review. The E-Commerce websites used in this study were Continente Online (4 participants) and @Jumbo (1 participant), as for customer preferences.

Both solution analyzed provide the possibility to construct product lists, which users used invariably to add their favourite products. However, none of the participants had more than that one shopping list, which contained in average about 50 products. These lists contained the products that the participants normally bought, as well as alternatives, in case the preferred product was out of stock. In all cases, iterating through this product list was the first step taken by the participants, adding favourite products to their cart.

Although favourite products accounted for most of the products ordered by the customer, this step was only the beginning of the process. Choosing products that were not in the favourites list, required category browsing and product browsing, which in most cases, proved very time-consuming. Two main problems were identified when the customer tried to search for a specific product:

- Finding the desired product category in the category hierarchy provided by the solution was not intuitive for the user, even if he/she had previous knowledge of which product he wanted to buy
- Finding the desired product among the results of the search, due to the extended product range.
In some cases, users preferred to use the product search textbox to look for the desired product. The search results however returned all products that slightly matched the search text, leaving the users frustrate with the amount of undesired results, which made shopping confusing.

One of the main frustrations for participants was the speed of navigation. Each action performed, required a full screen refresh, making users have to wait for the system to compute each action performed, which was not only time-consuming, but often led to buggy situations as well (actions performed while the screen was refreshed were not taken into account).

Another significant source of frustration was when a user wanted to vary from a favourite product or when it was out of stock, in which case, the client had to go through the category tree to find the appropriate category and choose an alternative product.

4.4 Evaluation of other current solutions

In the research necessary to develop a fit solution to a customer mindset, five e-commerce solutions currently available were evaluated, and their functionalities noted: Tesco.com, Walmart Grocery and MySupermarket. The evaluation was performed concerned around the features that are non-specific to the retailer in question.

Tesco.com welcomes users with an overview of the shopping process and a link to the main functionalities of the website. Groceries are separated into 4 main sections: Food&Drink, Health&Beauty, Baby&Toddler and House&Pet, always visible in the header section. These are they unfolded into minor section, containing the specific product categories in an extendable menu. The shopping cart is always visible on a sidebar, provided it has items, automatically calculating the order value as the shopping process goes on. The site provides a clever functionality - Express Shopper - which allows the customer to insert his/her shopping list in natural language, which then is parsed and searched iteratively, presenting options for each list element. Text searches match the search text with the product description.

The navigation of the Walmart grocery website is done mainly through a sidebar navigation that contains the category sections and provides filters to narrow down search. Inside each category section page, Walmart has added specific animated banners that employ a leading role in the user screen. Also noticeable is the “Idea Center” functionality of the website, which suggests recipes or categories to user based on the categories that he/she is browsing. The site provides shopping list creation functionality, which besides allowing adding items to the list in natural language, also suggests common shopping list items to the user.

Mysupermarket.co.uk is a website that aggregates the product range of four major grocery retailers in the UK – ASDA, Tesco, Sainsbury and Ocado. Its main advantage is the comparison of prices amongst the retailers which allows users to have a perception of the price differences for a specific product. Although not associated with any of the retailers exclusively, the website allows users to import favourites from any of the retailer’s websites.
Although the products used coincide with the product range of the retailers, the categorization is uniform among them, making easier for the user to understand where to find the desired products.

Continente Online provides a well-structured division of the product range into sections (Food, Drinks, Health, Cleaning, etc), however, then forces the user to use a category tree to find the desired product, which can be confusing. It allows different kinds of product displays (list, small images, big images), but often has naming inconsistencies and insufficient product information (missing images, no nutritional information, etc). The screen refreshes after almost every user action making the website very difficult to navigate efficiently. Text-based search matches to description of the product, causing searches to often return products which do not meet the needs of the search. It allows the creation of lists of products, however, they are not easy not maintain and require many steps to add a new product to the list.

@Jumbo has an interface very similar to Continente Online. In fact, they have very similar functionalities and navigation. @Jumbo, however has separate sections for product display, category navigation and shopping cart, making it thus easier and simpler to navigate, since not all parts of the screen refresh after every user action. Category Filtering is inexistent, so the user may have to browse the whole category to find the desired product. Product display is also limited, with repeated images for different products. The website also contains a lot of bugs, turning the user experience into a frustrating one when it happens, since it is most often unable to recover, forcing the user the restart the search for a product.

<table>
<thead>
<tr>
<th></th>
<th>Tesco</th>
<th>Walmart</th>
<th>MySupermarket</th>
<th>Continente</th>
<th>Jumbo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Favourites</td>
<td>***</td>
<td>***</td>
<td>****</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Search functionalities</td>
<td>**</td>
<td>**</td>
<td>****</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Shopping List Creation</td>
<td>***</td>
<td>***</td>
<td>N/A</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Customer Intelligence for product recommendation</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Category Filtering</td>
<td>***</td>
<td>***</td>
<td>**</td>
<td>*</td>
<td>N/A</td>
</tr>
<tr>
<td>Detailed Product Information</td>
<td>****</td>
<td>****</td>
<td>****</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Website Navigation</td>
<td>****</td>
<td>***</td>
<td>****</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Shopping Cart</td>
<td>**</td>
<td>***</td>
<td>****</td>
<td>**</td>
<td>***</td>
</tr>
<tr>
<td>Product Display</td>
<td>**</td>
<td>***</td>
<td>****</td>
<td>**</td>
<td>**</td>
</tr>
</tbody>
</table>

Table 1 - Online Grocery Solutions Benchmarking
5 Proposed Solution

5.1 Guidelines

Based on the information collected, we defined a set of guidelines that we believe will drive our solution to better fit the client’s mental framework of shopping:

1. If the system has a way of knowing which products the client is most prone to buy, then it should recommend those products before any others, therefore, product suggestions should be considered for each category, when client data is available. Based on the experience of Wipro Retail in the development of online solution, it was further asserted that these methods of recommendation should be flexible and not time-consuming.

2. When a client knows what product he/she wants, he/she should take the least amount of steps possible to get to it, therefore item categorization should allow the customer to filter the product range conveniently, as well as different forms of navigation should be available.

3. Product display should be image-oriented, letting the users buy “visually”, so attention should be paid to the layout of the website.

4. Most importantly, the service’s interface should allow the customer to easily apply his own mindset when taking the necessary steps to fulfil his/her order.

5.2 Service Concept and Blueprinting

The processes of a business like grocery retail, involve a complex network of resources and activities. Products available in stores are most often not manufactured by retailers, making it thus essential to decide and negotiate with suppliers. The decisions of product assortment usually involve market studies and definition of strategies to satisfy both client expectations and the company’s profit margins. Even after deciding which products to sell, retailers have to negotiate with logistic partners that distribute their merchandise across the stores. Also involved is careful inventory management, that makes sure the trade-offs between possible out-of-stocks and too much inventory are being met. Moreover, information systems that maintain all data from products, customers and resources have to be maintained and their constant availability secured. Indeed, grocery retailers have a lot to deal with when making our products available in store. Apparently, all client needs to do is go to the store and pick the desired items, place them in a cart and pay for them.

When it comes to online grocery shopping, the online interface becomes the store, and the client no longer needs to be physically present in the store, as his/her groceries are delivered to his door. This, however, does not simplify the retailer’s processes. Instead, an employee is sent to do the customer’s job and pick up the items ordered online, place them in
a basket, scan them one by one, and set up the order to be shipped and delivered to the client at the desired location and time.

Managing all these processes that happen concurrently and in real-time is only possible with the help of complex information systems to assist workflow and management indicators to assist decision-making. One would think that retailers are doing everything possible to satisfy clients doing their online shopping. It turns out, however, that although the company’s operations are valued and optimized, the client’s operations are not. Figure 29 represents a blueprint for an online retail service. Although not incorrect, the diagram shows precisely what is wrong with the current approach to the service designed of online grocers.

<table>
<thead>
<tr>
<th>Client Actions</th>
<th>Enter Order</th>
<th>Receive Merchandise</th>
<th>Make Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Actions visible to client</td>
<td>Assist Order</td>
<td>Deliver Merchandise</td>
<td>Execute Payment</td>
</tr>
<tr>
<td>Company Actions invisible to client</td>
<td>Resolve Order</td>
<td>Picking under Inventory</td>
<td>Book/Shipping Date and Time</td>
</tr>
<tr>
<td>Actions by Support Systems</td>
<td>Register Order</td>
<td>Update store Inventory</td>
<td>Send ordering information to products</td>
</tr>
</tbody>
</table>

Figure 28 - Online Grocery Retail Blueprint - oversimplified

The company’s view of the process is that the client merely has to insert the order’s products, when in fact, a more complex flow happens for the final order to become available to the retailer. When it comes to interaction of the user with the system, it is important to break down and predict the user’s action and the company’s response to those actions, making the client’s process visible and therefore correctable. Service Blueprinting is about looking ahead and explaining how the service will work at the eyes of the user, enabling thus a comprehensible representation of the service system, setting ground to a successful service design.

Based on our research of client activities, the client step of entering an order is not as simple as the previous diagram would suggest. The client’s process starts outside the company’s scope with the identification of household needs and planning of shopping (either with a shopping list or mentally). In fact, it is possible that the client has not even chosen a grocery store to perform his/her shopping when the order process starts. As described in section 4, typically a cyclic behaviour happens where clients firstly find the desired location where the product need can be met (shelf or section), then narrow down their choice, evaluate remaining alternatives and finally select the products and respective quantity. The cycle is repeated until the order is complete.

Our proposed solution aims to assist the client in these activities. When a client is deciding which item to look for, the service should suggest based on the client’s history; when a client is browsing a category, the service should recommend based on past preferences and when a client wants to narrow down his alternatives within a category, the service should allow him to eliminate unwanted products from consideration.
Deciding the next item to buy is the beginning of a cycle, which can have a number of approaches by the client, here referred to as decision strategies. The decision strategies identified are described and explained in figure 31.

**Figure 30 - Decision Strategies**

To accurately map the customer mindset, the service must account for assistance to each of these strategies. For instance, having a client browse and look for the desired category from a list can be frustrating if a client already knows what he/she is looking for. Table 2 describes how the solution approaches each of these strategies. Since an order cycle can include more than one decision strategy, access to the service features which allow changing strategy should be visible at all times, providing thus the necessary continuous flow to the client order.
Another important characteristic of the proposed solution is the integration between the customer’s knowledge and the system information. Because grocery shopping is an uses an extensive amount of implicit consumer knowledge, the service described makes an effort to on the one hand deduce that qualitative information from raw data, while on the other hand inviting the client to co-create the service by willingly providing explicit information about his/her preferences.
The idea behind this service concept is to let the client be involved and know that his needs are being addressed. Letting a customer feel that a service is personalized to his behavior tends to increase satisfaction, experience, and loyalty. An online solution that strives and acts to resolve the client needs is no longer a tool, but a service being provided.

5.3 Conceptual Model developed for prototype

The conceptual model designed for this solution is based on the activities of the customers both in the store and online, most resembling a conceptual model based on manipulating/navigating activities, as described in (Preece, 2002). The main idea that the solution pretends to transmit the user is an approximation to a window shop which has only products relevant to the user. Product suggestions are therefore a central feature of this solution. The notion that is intended to be transmitted is that, the users view their favourite products unless they wish to browse the rest of the store. A very important notion transmitted by this conceptual model is the concept of “shelf”. While in many software retail solutions, client browse products inside their categories or sub-categories, according the retailer’s merchandise hierarchy, the idea here is to speak the client’s language and make the analogy of a “product shelf” as a group of products that a client would consider of the same group and that would share a shelf in a supermarket.
The layout chosen for the solution also indicates this notion of a customized shop. While at the centre – the product window - the only thing ever displayed are products and their shelves, the left hand side navigation bar is where the user looks for specific shelves, either by entering text in the search box, choosing a section of the shop, or a product tag (for customized shelves). The header of the layout is logically out of the continuous process of choosing and adding products to cart. Any approach to this section represents a break in the process, either to consult the shopping cart, change the shopping strategy (use shopping list, browse favourite products, or consult product suggestions), or finalize the order.

The conceptual model is based on the assumption of shoppers performing most of their decisions and product browsing visually. Therefore, the intention was to reduce unnecessary elements of the interface, to have users acquire the notion that they are looking at products in a shelf. Functionalities related to the product only appear when the product is in context, and they are displayed in a way that resembles a shelf, having the necessary information for “visual” consideration at sight: price, price/quantity and a short description as well as the product image.
5.4 Solution Data Model

To build a functional prototype, a database model was developed, that incorporates the proposed solution's guidelines. The model consists of 4 parts:

- **Client Specific Data** - This section stores the data referent to client preferences for products and categories and client-specific data, such as favourite products and behavioural indicators.
- **Product Data** - Containing the basic information for products, such as descriptions, images, etc. Important to notice here is the fact that unlike many data models that describe product data, there is no product hierarchy described here. Each product is in one, and one alone category, since the rest of the merchandise hierarchy is not used in this proposed solution.
- **Category Data** - Data describing the product hierarchy into categories and basic information for categories, such as name, keywords, profiling information, etc. Here categories are broken down into attributes, and attributes into values. The idea absorbed here was the one from Consumer Decision Trees, where product attributes are the main distinguisher between products in the same group. Therefore, the definition of a category sets a framework of attributes required and possible values for those attributes (i.e. a common attribute is “Brand” and for the water category, its values could be “Luso”, “Vitalis” and all other possible brands of Water in the system. Products then added to this category, must indicate to which value(s) they correspond for each attribute of the category. This allows breaking up the product data more easily, and in a way that better adapts to the client’s needs (for filtering and searching by these attributes).
5.5 Product Recommendation

As stated before, traditional recommendation systems aim to recommend products which the client has never bought before or didn't even consider. The reality of grocery shopping, however, would prove this method to be unproductive, since grocery shoppers tend to want and need to repeat their choices when buying for the household. And since it is a highly repetitive procedure, which our research showed shoppers want to get over with as quickly as possible, adding recommendations outside the scope of the buyer's intentions, might be counter-productive.

Also, past grocery retail experience at Wipro, asserted that heavy processes such as data mining do not serve the purpose of narrowing down the scope of products according to customer preference, especially when the customer data is sparse or inexistent. A more well-accepted approach was to have a system that recommends products based on past orders, which can be accessed in real-time and not processed overnight.

For these reasons, we propose a set of simple heuristics for product recommendation whose aim is to prioritize products inside each category, and categories by perceived necessity for the client. In the following sections we will proceed to illustrate and describe the algorithms implemented in the functional prototype and suggest how these might be improved with further work.

The complete prototype database model can be found in annex 8.
5.5.1 Proposed Heuristics

5.5.1.1 Product and Category scores

The algorithms work as a point-adding system based on the client’s order history. They analyze the client’s past orders, category by category, product by product, and return a classification of products and categories in order of perceived preference for a given client.

For the classification of products in a category for a given client, for example, the algorithm would first award points to those products which were previously bought by the client, weighted by the amount of time elapsed since the order date, so that products in recent orders have better results than those in old orders. Then, for each of these items the resulting classification would distribute evenly among all other products with similar attributes, for each attribute of the products (meaning that if the client normally buys a product of the brand “Luso”, then all products of the brand “Luso” would their points uplifted). The result of this is that when a product that a client normally orders is out of stock or the client want to vary, the system would have a notion of which products best fit the client’s implicit preferences. This computation would occur each time a client submitted a new order.

![Figure 36 - Deriving Product Preferences and substitute suggestions](image)

A second part of this algorithm would occur when the client logged in. Because product pricing and promotions are always being updated by retailers, the second part of the algorithm takes the current day into context. The purpose is to uplift the score of products which are priced lower than usual and those which are in promotion, based or the client’s price sensitivity and promotional sensitivity.

The algorithm to score categories works in a similar manner. It also is subdivided into two parts, the first of which is executed when a new order is submitted and the second when the client logs in.

For the first part, the scoring of categories is based on the buying frequency of a given category. If a client buys an item over a certain percentage (Baseline Threshold) of times he orders products, then this category is called a baseline category. We also defined another threshold that separates sporadic categories (categories that a client buys following his consumption rate, but not often) from impulse categories (categories bought by a client in the past, but not often). The consumption rate computes the ratio between the average quantity bought and the number of times bought, i.e if a client has 2 orders in the period of a month, in each of which he bought 2 bottles of 1.5L of water, we assume his consumption rate is 3L per
month. Categories’ scores are also uplifted when they are related to baseline categories, i.e. baby meals will be uplifted, if the client normally buys baby diapers.

The second part of the category ranking algorithm, activated when a client logs in, uplifts sporadic categories in which consumption rates match the date of the last order’s bought quantity. It also uplifts categories according to their seasonality (i.e. the beer category could be uplifted during the world cup).

Both category seasonality and category relatedness are defined manually by the systems and do not infer from client behaviour. The solution also accounts for manually defined product and category scores. These will be consulted when the client’s data is sparse or incomplete (the system cannot infer any preferences if it has no client data). The pseudo-code for each of the algorithms described can be found in annexes 2 and 3.

The simplicity of the algorithms served both the scope of the investigation and the need to have preference data accessed in real-time. However, there have been a number of other methods which could prove to be a useful addition to the described ones, without changing the process.

5.5.1.2 Information Flow

The following diagram represents the information flow within the proposed solution. The solution’s data model and algorithms were conceived to grant the client’s interface the necessary information in real-time, avoiding unnecessary delays by the system. Once a client logs in and all recommendation algorithms are computed, then the user interface has all the data needed to recommend the client products based on his/her history. By having a simplified model based on product attributes, the system only needs the category data to filter and list the contents of a category, as opposed to searching all products in that category for possible attributes. As one can see from the diagram, the solution breaks down data, in order to make it useful for use, turning “data” into “information”, especially regarding client-specific information.
In a real-world implementation, this solution would have to be fine-tuned with the retailer’s information system, to make sure all product history, order history and product information would fit the simplified model proposed. Undoubtedly, a lot of work would have to be put into classifying all products and categories, however, this practice would open new perspective into client information and product classification, especially in regards of data mining.

5.6 Functional Prototype

The functional prototype developed had its main purpose to evaluate the reaction of users to the conclusions of this study. During the course of this investigation, several shortcomings where identified in online solutions and room for improvement was detected, especially while assisting clients to find the desired product and ease of use. While not serving as a complete solution, the proposed prototype employed a series of features, which can be used as examples to improve current online assistants or develop new ones based on the suggestions.

This section describes the features worth noting, that differ from what is currently available for online shoppers. Figure 39 illustrates the aspect of the proposed interface.
Figure 38 - Functional Prototype’s Initial screen

One can notice that an effort was made to reduce the amount of text on the screen, allowing thus clients to shop visually and focus on the aspects of their shopping process which are relevant to improve efficiency and experience. The prototype starts by suggesting the user to browse his most frequent categories and display 6 products which are perceived as the most relevant for the user. These include not only products that the client has previously bought and explicit favourites, but also products with similar attributes or promotional. Products are displayed in a shelf to give the user a sense of familiarity with the context of a store. When a product is in context (when user rolls the mouse over it), context functionalities become visible. The user can then add products to the cart, mark them as favourites, see further product information, or add a custom tag to those products allowing a user-defined interpretation of that product.

Figure 39 - Bringing a product into context

These context functionalities are all usable using a direct manipulation paradigm, that is, they appear close to the product in context and respond immediately on activation, notifying the user of the change, without losing focus of the action.
The text-based search functionality works in a similar approach to that of Google suggest, recommending what product families the user might be looking for as the user types in the search text. Suggestions are based on the matching of the search text not only with category names, but also on their attributes, and keywords associated with the category. For instance, whatever the category name, a keyword might be associated with it, indicating that a search text matching that keyword should also return the category (i.e. the keyword “breakfast” could be associated with the Cereals category). This becomes very useful to resolve ambiguity in category naming, which in many cases is the reason why customers can’t find their desired products.
Section browsing can be done by choosing one of the sections on the sidebar, which lists the categories on that section. Once identified the desired category, the user can view the recommended products for him/her, or choose to view the rest of the shelf, where are products of the category are displayed, aided by the filter section to assist the user in narrowing down his choice. Ordering is also allowed, by name, price, price/quantity or perceived customer preference.

5.7 Prototype Evaluation and Results

As described in the methodology section, users were involved in the iterative development of the solution. While some features and guidelines were identified in previous Wipro studies and during the evaluation of current solution, others were actually suggested by users and added to the final prototype (the iterations of the prototype are visible in annex 7). Although most features described in the previous section were implemented in the prototype, the amount of mock data was not enough to simulate a real-world visit to the shopping store. The evaluated counted with a sample of 3 participants, 2 of which usually shop online, and one who does not. 3 of the participants were asked to supply their latest grocery orders, to be inserted in the prototype. The objective was to have the system infer preferences from those orders. For the evaluation of the final prototype, participants were shown the interface and explained the basic features. The interviewees were then asked to navigate through the prototype and picture a typical visit to an online grocery store. At the end of the interaction, participants were asked to answer a series of open questions:

- Have you ever shopped for groceries online?
- How was using this prototype different from your usual experience of grocery shopping? (Online or at the store)
- What aspects did you enjoy least?
• What aspects did you enjoy most?
• If you provided previous orders, were the alternatives suggested to you sensible?
• What aspects of this prototype would you consider important to include in an online grocery retailing solution?
• From 1-4, how would you evaluate the relevance of this solution to the market?

The reaction of participants to the prototype was positive and is detailed in annex 9. Although this evaluation does not mean to be representative, it suggests that the approach makes sense and is needed in the market.
6 Conclusions

6.1 Limitations and Difficulties

One of the limitations of this investigation was the time in which it was carried out. Using an iterative user-centred approach proved very time consuming, despite fruitful.

The investigation relied on several past quantitative studies; however, most conclusions drawn were made from qualitative evaluations with exploratory patterns. Those which were quantitative lacked in sample size and extent.

The dimension a grocery retailer’s product assortment was also a relevant difficulty. Inserting mock data for product information, including images, descriptions, pricing, etc., would have been most efficient if integration with a real-world retailer were possible.

The heuristic algorithms suggested could be improved with further concepts (i.e. customer demographic profiling, product seasonality, browsing intentions, etc.), however, further customer data would be needed, and attention had to be paid to the increase in computing effort. Testing and calibrating these would only be possible using significant amounts of data, preferably real-world data.

6.2 Contribution

This research addressed the problem of customer experience when shopping for groceries online, namely efficiency and personalization of the shopping process.

Oddly, grocery retailers seem unwilling to invest in efficiency of their online component. Statistically, the more time a customer spends inside a store, the more items is he/she prone to buy. Online, however, the location of a store is no longer a competitive advantage, being clients able to switch between retailers at the click of a button. Therefore, the online grocer who manages to turn the shopping experience into a pleasant, hassle free journey is sure to have a major advantage over his online competitors.

We argue therefore, that the online grocery retail service should leave behind the retailer’s mindset, to focus on the customer mindset. As such, we studied the clients’ context when shopping for groceries, and presented systematized schemes and detailed descriptions that, besides supporting and explaining our decisions could possibly guide other investigations to follow that work in a similar area.

On a more technical perspective, we described a product-recommendation model specific for grocery shopping and its particular characteristics, which takes from many important theories (some related to grocery, some from other fields), and serves the purpose of being both simple and adaptable through the calibration of thresholds. This model is
supported by a set of product-scoring heuristics and a generic database model (i.e. not specific to any grocer).

Finally, the study carried out provided a functional prototype that allowed carrying all these ideas into a mock solution, which allowed participants, even if only with the help of their imagination, foresee a future where grocery shopping can be only a matter of refilling their needs, and still be given a choice – their own private supermarket.

6.3 Future Work

The investigation carried out and the prototypes developed were well accepted within the innovation department of the company. There is a potential to integrate the conclusions and methods of this study into future Wipro implementations of online grocery stores.

Suggestions for future work:

- The functional prototype developed should be completed with further mock data. Once this is done, another evaluation should be done with a larger sample and a quantitative analysis of ordering time, and decision strategy choices, hence quantifying the real potential improvement of shopping efficiency. Also, general customer satisfaction should be evaluated.

- The prototype developed is meant to be illustrative of the concept, and for that reason, not a lot of attention was given to the relevant categories inserted. An effort should be made, therefore, to decompose the product assortment into categories which are relevant to the user and speak the “client’s language”. Also, for each category defined, attributes that drive customer choice should be identified, in order separate the category correctly into relevant attributes.

- The algorithms suggested can be calibrated using significant amount of data. This would allow better defining the relevance of specific attributes, and other variables used (i.e. promotional sensitivity, price sensitivity, time coefficient). This calibration would test the flexibility of the heuristics. Provided that significant amounts of client data could be used to test the prototype, the variables could be calibrated using real orders from clients.
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Figure 45 - Service Design Tools - Source: martin-kose.de
### Annex 2 – Product Raking scoring heuristics Pseudo-Code

#### (1) Category Rankings by necessity (Trigger after new order)

<table>
<thead>
<tr>
<th>Category Coefficient to BCC</th>
<th>Category Relatedness Coefficient to CRC</th>
<th>Default Baseline Coefficient to DBC</th>
<th>Default Baseline Threshold to DBT</th>
<th>Default Sporadic Coefficient to DSC</th>
<th>Default Sporadic Threshold to DST</th>
<th>Default Impulse Coefficient to DIC</th>
</tr>
</thead>
</table>

- Get all orders for Client A, aggregated by category
- For each category N
  - Time coefficient = (today-date of order)/today
  - Average consumption rate = times bought/quantity bought
  - Buying Frequency (BF) = total orders / total orders with category N
  - If (BF > DBT) Set category necessity to DBC
  - Else If (BF > DST) Set category necessity to DSC
  - Else set category necessity to DIC

- For every category N in baseline
  - For every category R related to N
    - If (R is not baseline) Increase necessity by CRC

- For every behaviour category BC of Client
  - For every category C in BC
    - If (C is Impulse) Increase necessity by BCC

#### (3) Category Rankings by necessity (Trigger on Logon)

- Get Today
- Get Category Consumption Rate CR for Client

- For all categories
  - Get Seasonality Coefficient SC for Today
  - Increase necessity of category by SC
  - If (today – date of last order > CR) Increase necessity by Consumption rate coefficient
## 10 ANNEX 3 – Product Raking scoring heuristics Pseudo-Code

### (2) Product Ranking by preference value (Trigger on New Client Order)

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>For each order where Client A bought Category 1</td>
</tr>
<tr>
<td>2</td>
<td>Time coefficient = (today-date of order)/date range since first purchase</td>
</tr>
<tr>
<td>3</td>
<td>Check inventory on date of order for category 1</td>
</tr>
<tr>
<td>4</td>
<td>Increase bought items’ preference value by N * time coefficient</td>
</tr>
<tr>
<td>5</td>
<td>If (Item was not out-of-stock) then</td>
</tr>
<tr>
<td>6</td>
<td>Decrease non-bought items’ preference value by N * time coefficient</td>
</tr>
<tr>
<td>7</td>
<td>For each product P with preference value</td>
</tr>
<tr>
<td>8</td>
<td>For each other product in same category as P</td>
</tr>
<tr>
<td>9</td>
<td>Uplift preference by attribute multiplier</td>
</tr>
<tr>
<td>10</td>
<td>Normalize results</td>
</tr>
</tbody>
</table>

### (4) Product Ranking by Preference Value (Trigger on Logon)

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Product Raking by preference value (on logon)</td>
</tr>
<tr>
<td>2</td>
<td>For each category</td>
</tr>
<tr>
<td>3</td>
<td>For each promotional item in category</td>
</tr>
<tr>
<td>4</td>
<td>Uplift preference by client promotional indicator</td>
</tr>
<tr>
<td>5</td>
<td>For each product</td>
</tr>
<tr>
<td>6</td>
<td>Calculate average price</td>
</tr>
<tr>
<td>7</td>
<td>Adjust preference value by client price sensitivity and price difference</td>
</tr>
</tbody>
</table>
## Annex 4 - Participant Description: Observation at Store

<table>
<thead>
<tr>
<th>Participant</th>
<th>Uses Shopping List</th>
<th>Household</th>
<th>Shopper Gender</th>
<th>Age Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant 1</td>
<td>Yes</td>
<td>3 members</td>
<td>Female</td>
<td>28-35</td>
</tr>
<tr>
<td>Participant 2</td>
<td>Yes</td>
<td>3 members</td>
<td>Male</td>
<td>28-35</td>
</tr>
<tr>
<td>Participant 3</td>
<td>Yes</td>
<td>3 members</td>
<td>Female</td>
<td>&gt;55</td>
</tr>
<tr>
<td>Participant 4</td>
<td>Yes</td>
<td>2 members</td>
<td>Male</td>
<td>22-28</td>
</tr>
<tr>
<td>Participant 5</td>
<td>Yes</td>
<td>N/A</td>
<td>Female</td>
<td>28-35</td>
</tr>
<tr>
<td>Participant 6</td>
<td>Yes</td>
<td>1 member</td>
<td>Female</td>
<td>22-28</td>
</tr>
<tr>
<td>Participant 7</td>
<td>No</td>
<td>5 members</td>
<td>Female</td>
<td>&gt; 55</td>
</tr>
</tbody>
</table>
12 Annex 5 – Guidelines for Online Shopping Observation
A preencher pelo entrevistador:

- Nome Participante:
- Idade:
- Agregado Familiar:
- Pessoa habitual de compras: Sim/Não
- Experiência em compras de mercearia online: Nenhuma, Pouca, Alguma, Muita
  o Qual o site:
- Contacto com computadores/navegação na Internet:

Perguntas:
Sentiu algumas dificuldades de interacção na sua compra simulada? Se sim, por favor elabore.
Sentiu alguma dificuldade em encontrar os produtos que pretendia? Se sim, porquê?
Como compararia esta experiência com aquela que sente na compra numa loja física?
Que melhorias proporia a este sistema?

A ANEXAR:
Lista de Compras inicial
Compras efectuadas
### Annex 6 – Frameworks to evaluate electronic service quality

<table>
<thead>
<tr>
<th>Authors</th>
<th>Dimensions of online service quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aladwani and Palvia (2002)</td>
<td>Content quality; appearance</td>
</tr>
<tr>
<td>Chen and Wells (1999)</td>
<td>Entertainment; informativeness; organization</td>
</tr>
<tr>
<td>Cheskin Research (1999)</td>
<td>Web site design; ease of navigation; quality of order fulfillment; delivery</td>
</tr>
<tr>
<td>Cho and Park (2002)</td>
<td>Product information; customer service; purchase result and delivery site design; purchasing process; product merchandising; delivery time and charge; payment methods; ease of use; additional information service</td>
</tr>
<tr>
<td>Cox and Dale (2001)</td>
<td>Accessibility; communication; credibility; understanding; appearance; availability</td>
</tr>
<tr>
<td>Kim and Stoel (2004)</td>
<td>Informational fit-to-task; transaction capability; response time</td>
</tr>
<tr>
<td>Kuo (2003)</td>
<td>Online quality; information safety; web site design; content</td>
</tr>
<tr>
<td>Liu and Arnett (2000)</td>
<td>Accuracy; completeness; relevance; security; reliability; customization; interactivity; ease of use; speed; search functionality; organization</td>
</tr>
<tr>
<td>Loiacono et al. (2002)</td>
<td>Informational fit-to-task; interactivity; trust; response time; ease of understanding; intuitive operations; visual appeal/ innovativeness; flow/emotional appeal/ consistent image; online completeness; relative advantage</td>
</tr>
<tr>
<td>Madu and Madu (2002)</td>
<td>Web site performance; features; structure; aesthetics; reliability; storage capability; serviceability; security; trust; responsiveness; product differentiation; product customization; policies reputation; assurance; empathy</td>
</tr>
<tr>
<td>Montoya-Weiss et al. (2003)</td>
<td>Navigation structure; information content; graphic style</td>
</tr>
<tr>
<td>Ranganathan and Ganapathy (2002)</td>
<td>Information content; design; security; privacy</td>
</tr>
<tr>
<td>Santos (2003)</td>
<td>Reliability; efficiency (ease of web site use); support (technical help, personal advice); communication; security; incentive</td>
</tr>
<tr>
<td>Srinivasan et al. (2002)</td>
<td>Customization; contact interactivity; care; community; cultivation; choice; character (web site design)</td>
</tr>
<tr>
<td>Szymanski and Hise (2000)</td>
<td>Convenience; site design; financial security</td>
</tr>
<tr>
<td>Trochcia and Janda (2003)</td>
<td>Performance (delivery fulfillment and transaction efficiency); access; security (trust and assurance); sensation (aesthetic aspects of the web sites); information (credibility considerations)</td>
</tr>
<tr>
<td>Wolfinbarger and Gilly (2003)</td>
<td>Web site design; fulfillment/reliability; privacy/security; customer service</td>
</tr>
<tr>
<td>Yang et al. (2000)</td>
<td>Product cost and availability; customer service; online info systems quality</td>
</tr>
<tr>
<td>Yoo and Donthu (2001)</td>
<td>Ease of use; design; speed; security</td>
</tr>
<tr>
<td>Zeithaml et al. (2000)</td>
<td>Access; ease of navigation; efficiency; flexibility; reliability; personalization; security/privacy; responsiveness; assurance/trust; site aesthetics; price knowledge</td>
</tr>
</tbody>
</table>
14 Annex 7 - Prototype Iterations

Figure 46 - First Iteration of Low-Resolution Prototype

Figure 47 - Second Iteration of Low-Resolution Prototype

Figure 48 - Third Iteration of Low-Resolution Prototype

Figure 49 - Fourth and Final Iteration of Low-Resolution Prototype
15 Annex 8 – Functional Prototype Database Model

Figure 50 – Database model for functional prototype
<table>
<thead>
<tr>
<th>Questions</th>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you ever shopped for groceries online?</td>
<td>Yes (often)</td>
<td>Yes (often)</td>
<td>No (never)</td>
</tr>
<tr>
<td>How was using this prototype different from your usual experience of grocery shopping? (Online or at the store)</td>
<td>-More efficient</td>
<td>-Different (very accustomed to usual shopping solution)</td>
<td>- Quicker</td>
</tr>
<tr>
<td></td>
<td>-Simpler</td>
<td>-Did not feel he had a real shopping experience</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What aspects did you enjoy least?</td>
<td>-Choice of colors</td>
<td>-Browsing by section</td>
<td>-Category Filtering (too many filters)</td>
</tr>
<tr>
<td></td>
<td>-User-defined tags (not useful)</td>
<td></td>
<td>-Decision of product quantity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What aspects did you enjoy most?</td>
<td>-Product Recommendation</td>
<td>-Shopping List</td>
<td>-Shopping List</td>
</tr>
<tr>
<td></td>
<td>-Suggestion List</td>
<td>-Visual Shopping</td>
<td>-Search Box</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Product Recommendation</td>
<td>-Visual Shopping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Category Filtering</td>
<td>-Product</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Recommendation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If you provided previous orders, were the alternatives suggested to you sensible? (Yes, very much) (Yes, in general) (No, seldom) (Not at all)</td>
<td>Provided Orders. Yes, in general.</td>
<td>Provided Orders. Yes, very much.              Did not provide orders, but liked generic suggestions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What aspects of this prototype would you consider important to include in an online grocery retailing solution?</td>
<td>-Product Recommendation</td>
<td>-Product Recommendation</td>
<td>-Product Recommendation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Shopping List</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Alternatives on product favourites</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluation (1-4)</td>
<td>***</td>
<td>****</td>
<td>****</td>
</tr>
<tr>
<td>Relevant comments</td>
<td>“I wish XXXX (usual online solution) would have this (shopping list)”?</td>
<td>“How does it (the system) know which products I prefer?”</td>
<td>“Why can I only add four items to my basket”?</td>
</tr>
<tr>
<td></td>
<td>“This looks cool, but most categories I want are not here”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>