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ENHANCING SERVICE DELIVERY SYSTEMS THROUGH TECHNOLOGY: A MULTIDISCIPLINARY PERSPECTIVE APPLIED TO INTERNET BANKING

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ABSTRACT

The increased usage of the Internet for service provision to customers has deeply changed the environment in which service marketers and interface designers develop interactive systems. After a first wave of technology adoption in the backstage of service delivery, technology, particularly the Internet, is being progressively used to enhance service interfaces, through which service providers interact with their customers in the frontstage. Customers can now interact with service providers through physical stores, Internet, telephone, or interactive kiosks, in a multi-interface service setting.

The challenges posed by this new environment provided the main motivation for the dissertation research. The study focused on enhancing service delivery systems through technology, analyzing Internet services integrated into multi-interface services, developing methods for a rigorous elicitation of customer experience requirements (CERs) and adopting a multidisciplinary approach.

Based on the study of a Portuguese bank, this dissertation research contributes to understanding the factors underlying customer satisfaction with multi-interface services and provides guidance to design. Through qualitative and quantitative studies of bank customers, the study identified the main CERs influencing satisfaction with the different service interfaces: *usefulness, efficiency* and *personal contact*. The study also contributed to better understanding of how these CERs influenced satisfaction and usage in a multi-interface service setting. It showed that customers use a mix of service interfaces in their general relationship with the bank, from which they then choose the one that is best suited to each specific financial activity at hand. As customers use the different service interfaces in a complementary way, an integrated overall service design is needed.

These results were further applied to the specification of service interface improvements. This final research stage led to the development of a new approach to multi-interface service design: the Essential Use Case (EUC) – Service Experience Blueprint (SEB) approach. This method addresses Internet services integrated in the multi-interface service, incorporates customer experience requirements (CERs) into the design process and joins the contributions of both services marketing and interaction design to enhance technology enabled multi-interface services.

RESUMO

A utilização crescente da Internet na prestação de serviços alterou profundamente o ambiente no o qual os profissionais do marketing e de desenho de interacção desenvolvem sistemas interactivos. Depois de um primeira vaga de adopção de tecnologia no back-office do sistema de prestação de serviços, a tecnologia, em particular a Internet, tem vindo a ser progressivamente utilizada para melhorar as interfaces de serviços, através das quais os prestadores de serviços interagem com os seus clientes. Os clientes podem agora interagir com os prestadores de serviços através de lojas físicas, da Internet, do telefone, ou de quiosques interactivos, num ambiente de serviço multi-interface. Os desafios colocados por este novo meio ambiente forneceram a grande motivação para a realização desta dissertação. Este estudo centra-se na melhoria de sistemas de prestação de serviços através da tecnologia, analisando os serviços Internet integrados em ofertas multi-interface, desenvolvendo métodos para uma rigorosa captação de requisitos de experiência do cliente (CERs) e adoptando uma abordagem multidisciplinar.

Com base no estudo de um banco português, esta dissertação contribui para uma melhor compreensão dos determinantes da satisfação em serviços multi-interface e fornece orientações para o seu desenho. Através de estudos qualitativos e quantitativos dos clientes do banco, o estudo permitiu compreender melhor de que forma os principais CERs (*utilidade*, *eficiência* e *contacto pessoal*) influenciam a satisfação e utilização dos diferentes interfaces de serviços num ambiente multi-canal. O estudo mostrou que os clientes usam um mix de interfaces de serviços na sua relação geral com o banco, do qual escolhem aquela que melhor responde às necessidades geradas por cada actividade financeira a levar a cabo.

Estes resultados foram também aplicados à especificação de melhorias para as interfaces de serviços. A fase final do estudo levou ao desenvolvimento de uma nova abordagem ao desenho de serviços multi-interface, partindo da análise dos Casos de Uso Essenciais (EUC) até ao Blueprint de Experiências de Serviços (SEB). Este método aborda os serviços Internet integrados no serviço multi-interface, incorpora os CERs no processo de desenvolvimento e junta as contribuições do marketing de serviços e do desenho de interacção para melhorar os serviços multi-interface assentes em tecnologias.

RÉSUME

L'usage intensif de l'Internet pour la prestation de services aux clients a modifié profondément l'encadrement dans lequel travaillent les professionnels de marketing et les concepteurs de systèmes interactifs. Après une première vague d'adoption de technologie dans le *back-office* des services, la technologie, particulièrement l'Internet, est progressivement utilisée pour améliorer les interfaces de services, ce qui permet aux fournisseurs de mieux interagir avec leurs clients dans le *front-office*. Les clients peuvent maintenant interagir avec les fournisseurs dans les magasins physiques, l'Internet, le téléphone ou les kiosques interactifs, au moyen d'un service multi-interface. Les défis posés par ce nouvel encadrement ont été la motivation principale de ce travail de recherche. Cette étude est ciblée sur l'amélioration des systèmes de livraison des services, à travers l'analyse de services d'Internet intégrés dans les services multi-interface, du développement des méthodes pour une identification rigoureuse de réquisits d'expérience des clients (CERs), en adoptant une approche pluridisciplinaire.

Le travail de recherche mené dans cette thèse, basé sur l'étude d'une banque portugaise, contribue à une meilleure compréhension des facteurs de satisfaction du client par rapport aux services multi-interface et fournit un encadrement pour leur conception. À partir d'études qualitatives et quantitatives de clients de la banque, les principaux CERs influençant la satisfaction du client ont été identifiés: l'utilité, l'efficience et le contact personnel. Ce travail de recherche a aussi contribué à une meilleure compréhension des influences de ces CERs dans la satisfaction et l'usage d'un service multi-interface. Il a été montré que les clients utilisent plusieurs interfaces de service dans leur relation générale avec la banque, parmi lesquelles ils choisissent la mieux adaptée à chaque activité financière spécifique. En conséquence, il faut une conception intégrée des services, car les clients utilisent les différentes interfaces d'une façon complémentaire. Les résultats de ce travail ont été utilisés pour la spécification des interfaces de services. Dans le cadre de cette étape finale, une nouvelle approche a été proposée pour la conception des services multi-interface: l'approche des Cas d'Usage Essentiels (EUC) – Blueprint d'Expérience de Service (SEB). Cette méthode adresse les services d'Internet intégrés dans les services multi-interface, qui incorporent les réquisits d'expérience des clients (CERs) dans le processus de conception, employant les contributions du marketing des services et de la conception de systèmes interactifs, pour améliorer les services multi-interface.

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LIST OF ACRONYMS

ATM	Automatic teller machine
BB	Branch banking
CERs	Customer experience requirements
CFA	Confirmatory factor analysis
CUC	Concrete use case
EFA	Exploratory factor analysis
EUC	Essential use case
GOA	Goal-oriented analysis
HCI	Human-computer interaction
IB	Internet banking
IS	Information systems
QFD	Quality function deployment
RE	Requirements engineering
SB	Service blueprint
SDS	Service delivery system
SEB	Service experience blueprint
SEM	Structural equation modeling
SST	Self-service technology
TB	Telephone banking
UML	Unified modeling language

1. Introduction

The infusion of technology in services raises challenges for both interaction design and services marketing. From the human-computer interaction (HCI) perspective, the increased usage of Internet technology in the provision of service to customers has radically changed the environment for which software engineers develop interactive systems. Multi-platform Internet based systems are now designed to provide services for a wide and diversified set of users, in a non-controlled environment (Patrício et al. 2004).

At the same time, technology developments have created new opportunities for services marketing, revolutionizing backstage operations and offering new possibilities for service providers to interact with their customers in the frontstage. After a first wave of technology adoption to increase efficiency and productivity in the backstage of the service delivery system (SDS), technology is being progressively used to enhance service interfaces, through which service providers interact with their customers in the frontstage (Rayport and Jaworski 2005). Customers can now interact with service providers through a myriad of service interfaces, such as physical stores, Internet, telephone, or interactive kiosks.

These new challenges have motivated researchers from both interaction design and marketing to better understand the impact of service infusion in technology and technology infusion in services. However, further research is still needed in this area (Chung et al. 2000; Parasuraman and Zinkhan 2002). It is particularly important to improve the understanding of customer satisfaction in the multi-interface service environment, and to better design the different technology enabled interfaces to create a satisfying overall service experience.

This dissertation research contributes to the understanding of the factors underlying customer satisfaction with multi-interface services, providing guidance to the design of technology based service interfaces. Based on qualitative and quantitative studies of the customers of a Portuguese multi-interface bank, the study identified the main experience requirements influencing satisfaction and usage of the different interaction channels. These results were further applied to the specification of service interface improvements. This final study led to the development of a new method of service interface design, which addresses Internet services integrated into the multi-interface service, incorporates customer experience requirements (CERs) into the design process and adopts a multidisciplinary perspective.

1.1. The new multi-interface service environment

Human-computer interaction has deeply changed in the last decades, driven by both technology developments and human usage of interaction systems (Patrício et al. 2003b). Sometimes usage led the way, by creating new challenges to which technology tried to respond, as shown in Table 1-1. Other times technology drove the way, creating new possibilities to perform certain tasks, and finding new ways to better satisfy user needs, as shown in Table 1-2.

Table 1-1: The Evolution of interaction Environment

User interaction environment	Machine environment	Work environment Service backstage	Internet service environment Service interface
Type of environment	Machine	Organization	Market
Openness	Low	Medium	High
Degree of control	High	Medium	Low
Type of users	Technical experts	Office workers	Customers
Diversity of users	Low	Medium	Very high
Technical expertise	High	Medium	Low or inexistent
Training for usage	High	Medium	Inexistent
System purpose	Perform functions impossible or practically impossible to undertake by humans.	Work efficiency Increasing work efficiency of individuals and organizations. Substituting work previously undertaken by humans. Well defined according to job description.	Service provision Providing services and selling products. Creating new alternatives of interaction between customers and service providers. Defined by service provider, but can be changed according to user preferences and usage patterns.

Adapted from, Patrício et al. (2003) “Addressing Marketing Requirements in User-Interface Design for Multiple Platforms”

Table 1-2: Evolution of Interaction Design

Major breakthroughs	Interactive Systems	Xerox's Star, the MacOS and Windows	NCSA Mosaic and the commercial use of the Internet
User interface	Command line interface	WIMP and WYSIWYG	Multimedia and Hypermedia
Design methods	Structured design	Object-oriented design	*several proposals*
Focus on requirements	Basic functional requirements	Functional and usability requirements	*several proposals*
Methods for eliciting and analyzing requirements	Knowledge of technical experts	User centered design (UCD) methods	*several proposals*

In, Patrício et al. (2003) "Addressing Marketing Requirements in User-Interface Design for Multiple Platforms"

Machine environment

In the early stages of computer technology, software developers' major concern was to make the best of the technology available to perform new functionalities. Interacting with computers required expertise and specific knowledge, but the ability to perform functionalities otherwise impossible, outweighed the effort needed to use computers. At this stage, the machine played the dominant role to which users had to adapt.

In this environment, user interface design was not a major issue in software development. The interaction between the system and the user was done through command line interfaces, and all efforts were directed towards responding to functional requirements. This focus on functional requirements is still strongly rooted in the software development culture (Chung et al. 2000).

Work environment

When computers moved from the segment of specialist computer users to the office work context, there was a major shift in the interaction environment for software systems. Although some training was accepted, the new target users were no longer technical experts. To attain the efficiency and productivity gains promised by office software systems, it was necessary to overcome resistance to change and the initial frustrations felt by workers when using computer hardware and software. Non-functional requirements, such as usability, became crucial for software development, as good functionality started to be insufficient to assure the success of software systems.

In requirements engineering, *non-functional requirements* can be defined as software requirements that describe not what the software will do (functional requirements), but how the software will do it, such as performance, external interface requirements, design constraints, and software quality attributes (Tayer and Dorfman 1990). Non-functional requirements can be related to service quality factors in the marketing field, which have been extensively studied (see for instance (Brown et al. 1994). Quality and satisfaction have also become recognized as critical factors for software development success. As stated by (Dertouzos and Solow 1989), "the most critical element is the ability to predict early in the product development cycle that a new product will yield superior customer satisfaction in the actual marketplace".

In this office work environment, the success of interactive systems was strongly leveraged by new approaches to user interface design, such as WYSIWYG (What You See Is What You Get), first used by Xerox's Star, and then further developed in the Apple Macintosh and Microsoft Windows. These interfaces allow the user to interact directly with interface objects that mimic the real objects of the work environment, such as the well known "folder" and "desktop." In this new context, new methods were developed to incorporate the user perspective in software development, such as User Centered Design. Simultaneously, Object-Oriented design methods became the standard.

Internet services and interaction design

The advent of the Internet and its opening to commercial use in the 1990's, radically changed the interaction environment once again. As the Internet is now used for service provision, designers and service providers cannot control the objectives, the place, the situation, or the hardware of the interaction. The interaction can be influenced, but cannot be controlled. Far away from the work environment, where objectives are clearly stated, and a certain pattern of usage is demanded in the Internet service environment, all that service providers and interaction designers can do is make suggestions and provide incentives, which will (hopefully) motivate customers to behave as desired.

On the other hand, in the Internet service environment, the interaction is part of the overall service, and is increasingly integrated in multi-platform offerings. As such, the Web interface is but one interaction alternative of interaction between customer and service provider, complementing, rather than substituting, person-to-person or telephone service interfaces. As Internet usage spreads across a broader set of users in a multi-interface service context, where the same service functionality is provided through different interaction platforms, customer experience requirements (CERs) determine the success of interactive system's design. For a customer who can get current account information through the bank branch, the Internet banking or the Automatic Teller Machine (ATM), channel choice will depend, normally not on the system's main functionalities, but on desirability of the experience provided by each service interface.

The commercial use of the Internet represents an important change in the evolution of interaction systems, as shown in Table 1-1. The response to the challenges of this new environment is still a work in progress, as shown in Table 1-2. Some authors advocate the inclusion of experience goals and requirements in the elicitation process (Patrício et al. 2004; Preece et al. 2002), as well as emotional requirements (Norman 2004). Other authors propose a goal-oriented design (Mylopoulos et al. 1999). Several proposals have been made to cope with the complexity and diversity of Internet services, but there are still no well defined standards.

Internet services and marketing

If the usage of Internet for service provision has changed the interaction environment for interface designers, the infusion of technology in services has also changed the context for which marketers design services (Bitner et al. 2000). For marketers, technology has deeply changed the service delivery system (SDS), which is concerned with where, when and how the service product is provided to customers (Lovelock 2001). The impact of technology on customer interaction experience can be better understood using the services theater framework, which views service provision as a performance (Grove and Fisk 2001). From this perspective, the service delivery system comprises a frontstage (where activities that are visible to customers are performed) and a backstage (where the activities invisible to customers are performed that support the service performance in the frontstage).

In the first wave of technology infusion in services, technology was used to improve backstage operations, as machines substituted for people in dealing with repetitive and standardized tasks that required fast, accurate database-driven responses in the backstage. However, with the widespread usage of the Internet and other interactive systems, technology is now changing the way customers interact with service providers. In a multi-interface service, customers can use a set of different service interfaces, supported by a common back-office system (Rayport and Jaworski 2005). Technology infusion in services has moved from a support component of backstage operations to a critical component of frontstage interactions between customers and service providers in a multi-interface environment.

Technology-free customer contact, such as in traditional retailing and banking, has been replaced by multi-interface service offerings where technology plays a central role and generates different types of customer-firm interactions (Froehle and Roth 2004). In both retailing and banking, customers can now interact with the service provider through both technology-facilitated customer contact (where technology enables the service representative to provide a better service, such as in modern bank branches), and technology-generated customer contact (where the human customer service representative is entirely replaced by technology, such as online banking and Automatic Teller Machines - ATMs). This technology generated customer contact can also be viewed as a Self-Service Technology (SST), which is a technological interface that enables customers to produce a service independent of direct employee involvement (Meuter et al. 2000).

1.2. Challenges posed by the technology enabled multi-interface service environment

Internet services create new challenges for marketers, interface designers and software engineers. However, although this area has been subject to extensive research in the recent past, considerable knowledge gaps still exist between the practice of Internet-based marketing and interface design, and the availability of sound, research-based insights and principles for guiding that practice (Parasuraman and Zinkhan 2002). In particular, the three areas described below deserve further attention.

Multi-interface service integration

First, in spite of the idea that became popular in the early years of the Internet boom, when it was thought that technology would replace traditional personal contact, the Internet has gradually become used as part of an overall multi-interface service delivery system (Kalakota and Robinson 2003). This service delivery system (SDS) may include a diverse set of service interfaces, such as physical stores, Internet using a PC, interactive kiosks, ATMs, traditional telephone or mobile phones. As different customer segments may have different service delivery preferences (Bitner et al. 2000), it has been advocated that service providers should think of the service interface mix rather than focusing on one dominant interface (Thornton and White 2001). Designing Internet services within this multi-interface offering therefore requires an integrated approach that addresses the Internet, not in isolation, but as a new interaction channel that must complement and add value to the overall service.

Extensive research has addressed Internet service quality and satisfaction, but few studies have examined the Internet from a multi-interface service context. In services marketing, some studies have analyzed different Self-Service Technologies (SSTs), investigating the impact of global attitudes towards SSTs and firm's employees on satisfaction and usage of specific SSTs (Curran et al. 2003; Keen et al. 2000; Meuter et al. 2000). Montoya-Weiss et al. (2003) modeled the determinants of online channel use and satisfaction with a relational, multi-channel service provider, where they analyzed the impact of the physical channel overall service quality on online channel service quality. This study showed that the different service interfaces are interrelated and have a complementary effect on overall satisfaction.

However, further research is needed to address Internet services, not as a stand-alone operation, but as an integrated component of a multi-interface service.

In this context, it is particularly important to understand customer satisfaction and usage of Internet services within multi-interface environments. This understanding can further serve as the basis for designing each service interface, not in isolation, but to enhance its contribution to the overall multi-interface service experience.

Customer Experience Requirements (CERs)

Second, in the Internet service and multi-platform context, where users have a higher degree of autonomy and have access to the same functionalities across different service interfaces, user experience becomes ever more important. For a customer who can make a financial transaction through several different interaction channels, such as the bank branch (BB), Automatic Teller Machine (ATM), Internet banking (IB) or telephone (TB), service interface choice will depend, not on the system main functionality, but on the experience provided by each service platform. Therefore, interaction experience requirements determine the success of service interface systems.

Customer Experience Requirements (CERs) are defined as customer perceived attributes of the interaction with the service provider that contribute to satisfaction and usage of the service (Patrício et al. 2004). The term *customer requirements* reflects the focus on customer needs and perceptions, which are important determinants of adoption and usage of interactive systems. The term *experience requirement* reflects the inclusion of both outcome (what) and process (how) attributes of the interaction between customer and service provider, as the process of interaction becomes more important in the Internet service environment. The definition of experience requirements as attributes of *interaction*, instead of attributes of software, reflects the proposed multi-interface service approach, in which experience requirements should first be captured for the overall service, in a platform independent way, in order to better guide concrete experience requirements specification for each service interface. Using the requirements engineering framework, CERs can be viewed as a more customer centric, service oriented type of non-functional requirements.

However, in spite of the increased attention paid to non-functional requirements, especially with regard to software quality, it is well recognized that this type of requirements is more difficult to deal with, both at the elicitation and design stages (Chung et al. 2000). Although previous research has investigated the main software quality dimensions and metrics (ISO 1991), user experience goals are gaining importance, but are still under-researched and deserve further attention (Preece et al. 2002).

In services marketing, although service quality has been extensively studied (Brown et al. 1994), the most well known quality scales, such as SERVQUAL (Parasuraman et al. 1988), focus primarily on interpersonal service interfaces. The growth of the Internet motivated several researchers to find new quality measures that are better adapted to the Web environment, such as e-SERVQUAL (Parasuraman et al. 2005) and eTailQ (Wolfinbarger and Gilly 2003). However, marketing is also paying more attention to the role of experiences in service provision. As the differentiation of goods and services has become more difficult, enhancing the customer experience has become the new source of differentiation and value creation (Pine and Gilmore 1999). Whereas satisfaction has been traditionally outcome-oriented, (evaluating the results (what) of service provision through the comparison of expectations and performance), experience is process-oriented (how the service was provided, how it made customers feel and their emotional associations) (Schmitt 2003).

Although recognized as crucial for the success of interactive systems, customer interaction experience factors are difficult to deal with for both interface designers and marketers. Customer perception measures even tend to be avoided by requirements engineers for their “subjective” nature (Lauesen 2002). However, with the widespread use of the Internet for multi-interface service provision, CERs can no longer be relegated to a secondary role. To enhance the service interface experience in this context, it is particularly important to improve the methods of eliciting and translating CERs into service interface design.

Multidisciplinary perspective

Finally, in the technology enabled, multi-interface service context, requirements engineers and interface designers have to deal with customer needs and preferences, and marketers have to deal with the technology infusion in services. As the Internet has the potential to alter almost every aspect of business operations, it is necessary to adopt a multidisciplinary approach for understanding the impact of this technology on businesses (Parasuraman and Zinkhan 2002). This multidisciplinary perspective should be followed from the study of customer satisfaction factors, to the translation of CERs into multi-interface service design.

Being a technology enabled service, Internet service design requires the integration of requirements engineering (RE), human-computer interaction (HCI) and services marketing. However, if marketers tend to believe that they are not sufficiently included in the early stages of customer interface design (Fisk et al. 2004), software engineers believe that the information received by analysts on user requirements is generally incomplete (Browne and Rogich 2001). In fact, it is recognized that poor requirements definition is one of the most frequent factors underlying software failures (Lauesen 2002), and the growth of Internet services only increases the importance of joint work.

Marketers also consider that an overwhelming cause of service design failures is a lack of understanding of customer needs, which is often rooted in poor market intelligence (Roth and III 1995). In the face of the development of technology enabled service delivery systems, services marketing researchers have pointed out the need to adopt a multidisciplinary approach (Parasuraman and Zinkhan 2002).

1.3. Research objectives

In the face of the challenges posed by the new multi-interface service context, the dissertation research was developed with the objective of enhancing service delivery systems (SDS) through technology, focusing on the three areas presented above, which form the core research vectors of the study.

1. The study approaches Internet services, not as a stand alone operation, but integrated within multi-interface services. It analyzes customer satisfaction and usage of Internet services in a multi-interface service offering, focusing on the evaluations of customer interaction experience with the online channel in relation to other alternative service interfaces.

2. The research focuses on customer interaction experience requirements (CERs), as they become particularly important for the success of service interfaces in a multi-platform environment. As a consequence, the study concentrates on the interaction component of the service delivery. Although a successful Internet service requires sound management of back-office operations, the study focuses on the visible component of the service provision, where customers and service providers interact to co-create the service experience.

3. The study adopts a multidisciplinary approach, both in the study of customer satisfaction and in the design of multi-interface services. This multidisciplinary perspective integrates the contributions of the research areas most relevant for understanding and designing technology enabled multi-interface services, with the objective of bridging the gap between these complementary fields. These areas include services marketing, human-computer interaction (HCI) and requirements engineering (RE).

These study objectives led to the following research questions:

- Which experience factors influence customer satisfaction and usage of Internet services in the context of a multi-interface service offering?

- How do the different service interfaces contribute to satisfaction with the overall service offering?

- How can Internet services be designed to best contribute to the overall multi-interface service experience?

- What new methods can be developed to integrate HCI, RE and services marketing perspectives in the design of integrated multi-interface service experiences?

To address these questions, the dissertation research focused on a multi-interface Portuguese bank, which provides services through bank branches (BB), Internet banking (IB), telephone banking (TB) and Automatic Teller Machines (ATMs). This service industry has traditionally invested heavily in technologies and has evolved to a multi-interface service system. For these reasons, financial services have been considered a rich ground for the analysis of e-services (Curran et al. 2003).

1.4. Research method

To address the above research questions and pursue the proposed objectives, the study involved four stages, as shown in Figure 1-1, starting with the problem identification and research design. This first stage involved literature review of the different fields related to technology enabled service interfaces, in order to follow a multidisciplinary approach from the beginning.

Conceptual background

The literature review provided a diversified but complementary perspective of technology enabled service interfaces, as will be further detailed in the Conceptual background of Chapter 2. However, it also showed that some knowledge gaps still existed in the three areas that are the focus of the research, namely: the study and design of Internet services integrated in the multi-interface service delivery system, the elicitation and specification of CERs, and the adoption of a multidisciplinary perspective.

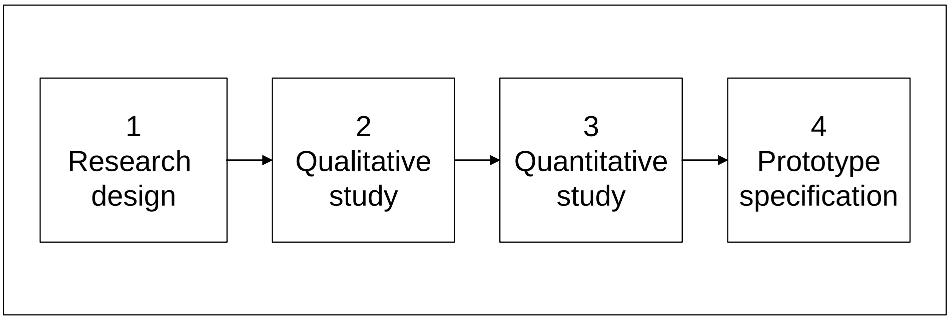

Figure 1-1: The four research stages

Conceptual model and research design

This first analysis served as the basis for the development of the conceptual model and research design presented in Chapter 3. As the literature review revealed some gaps in identifying and measuring experience requirements relevant for Internet service satisfaction in a multi-interface environment, a scale development approach was adopted. This approach was used to identify customer interaction experience requirements relevant in this context and to analyze their relationship with customer satisfaction with the different service interfaces. Following standard scale development methods (Churchill 1979; Churchill and Iacobucci 2002), the research plan involved the definition of the concepts to measure in the conceptual background; a qualitative study to elicit a comprehensive sample of questions that were potentially relevant for measuring the concepts of interest; and a quantitative study to purify and validate the measures, supported by statistical analysis.

Qualitative study

Therefore, the research design stage was followed by a qualitative study, described in Chapter 4. Qualitative research is especially useful to get a deeper understanding of phenomena that are considered under-researched (Parasuraman and Zinkhan 2002), as its more open nature allows the researcher to explore unexpected patterns and issues. This qualitative stage involved semi-structured in-depth interviews and focus groups with 36 bank customers in three Portuguese cities, and in-depth interviews and one focus group with 13 bank personnel working on the different bank interfaces. These interviews were literally transcribed and subject to qualitative analysis.

The qualitative results provided a better understanding of customer satisfaction and usage of the different bank interfaces in a multi-platform context. More specifically, they allowed the identification of potential experience requirements relevant for satisfaction and usage of the different service interfaces, both in general interactions with the bank, and for specific financial activities. This study showed that CERs differ significantly according to each specific financial activity at hand, and these experience requirements strongly influence service interface choice. However, these results did not allow generalization of findings, or quantification of results, which could only be attained through a quantitative study. Nevertheless, this qualitative study was crucial to provide a sound basis for the quantitative stage that followed, as it elicited a comprehensive sample of experience factors that could be relevant for customer satisfaction with Internet services.

Quantitative study

The factors found in the qualitative study were therefore used for the development of two survey questionnaires in the quantitative stage, which is presented in detail in Chapter 5. One survey was administered by telephone to 2142 bank customers (both users and non-users of Internet banking). This telephone survey aimed at understanding CERs for general interactions with the bank, and how each of the four service interfaces (IB, TB, BB and ATM) performed in satisfying those needs. The second survey was administered by e-mail to 1934 bank customers (only IB users). This Web survey aimed at understanding customer specific experience requirements for 12 different financial activities (ranging from current account information gathering to mortgage loan applications) and how IB performed in satisfying those specific needs.

The quantitative analysis of the survey data allowed the identification of service interface satisfaction determinants, through exploratory and confirmatory factor analyzes. The quantitative results showed that three main experience requirements and service interface performance factors emerged in this multi-platform context. These factors were *usefulness*, *efficiency*, and *personal contact*. After assessing the reliability and validity of the scales used to measure these experience dimensions, the quantitative analysis continued with the examination of relationships between the different experience requirements and satisfaction with the different service interfaces, using a structural equation modeling approach.

The structural model analysis showed that all three experience requirements and performance factors influenced service interface satisfaction and usage. The comparison of service interface performance showed that no channel is best in every attribute, but each one makes a contribution to an overall satisfying service experience. Customers tend to use a mix of service interfaces for their general interactions with the bank, but for specific financial activities, they pick the one that best satisfies the specific interaction experience needs generated by the situation at hand. The results of the Web survey also showed that CERs differed significantly according to the specific financial activities at hand and these requirements had a strong influence on service interface use.

The qualitative and quantitative results both supported the idea that customers use different service interfaces in a complementary way. As such, an integrated, multi-interface perspective is needed for a better design of Internet services. The findings also showed that CERs are crucial for understanding and designing Internet services, and that they should be addressed in all stages of service interface design. Finally the contributions of services marketing, HCI and RE all proved to be useful in understanding customer satisfaction with technology enabled service interfaces, and a multidisciplinary perspective could also be useful for service interface design. Therefore, as technology enabled multi-interface services pose new challenges for which traditional methods may not suffice, the final stage entailed the development of a new approach to designing the multi-interface service experience.

Prototype specification: the Essential Use Case (EUC) – Service Experience Blueprint (SEB) approach

Based on the study results, this stage comprised the analysis of CERs and the specification of service interface improvements for the Bank under study. The new approach developed at this stage blends the contributions of both services marketing and requirements engineering to address the intertwined technology and service issues that emerge from the design of multi-interface service experiences. This work is presented in detail in Chapter 6, illustrated with prototype specifications for improvements in both IB and BB for two financial activities: current account information gathering and mortgage loan application.

In the qualitative and quantitative studies, CERs were captured for different financial activities or use cases, but with an *essential* use case (EUC) perspective (Constantine and Lockwood 2001), i.e., independently of the service interface used ("What is important for you when assessing the bank to apply for a mortgage loan?"). This approach differs from the *concrete* use case (CUC) perspective, which studies requirements assuming a specific service platform (Booch et al. 1999) ("What is important for you when assessing the Internet banking service to apply for a mortgage loan?").

However, both EUC and CUC focus on functional requirements, i.e., on what the system should do. To complement this functional focus with the analysis of experience requirements (how the service interface provides the service), a goal-oriented analysis (Mylopoulos et al. 2001) was also undertaken. The goal-oriented analysis provides a means for systematically examining how different functional design solutions (different functional goals for different service interfaces) contribute to satisfaction of experience requirements (softgoals or non-functional requirements).

Again, existing methods do not address the intertwined technology and service issues that emerge from the design of multi-interface services. Therefore, after reviewing both services marketing and requirements engineering methods, a new approach was developed to integrate these perspectives in the design of technology enabled service interfaces: The Essential Use Case (EUC) – Service Experience Blueprint (SEB) approach. This method entails three steps:

1. A rigorous elicitation of CERs at the EUC level and the assessment of service interface relative performance, which was undertaken through the qualitative and quantitative studies.

2. The design of the multi-interface service with a EUC perspective, allocating the different use cases to the service interfaces which can best satisfy customer experience requirements, in order to take advantage of each service interface unique capabilities.

3. The design of each concrete service interface, with a CUC perspective, in order to best contribute to the overall service experience, with a special focus on designing the links among service interfaces. At this stage, a new representation was developed to integrate engineering and marketing perspectives in the design of technology enabled interfaces – the *Service Experience Blueprinting* (SEB).

Research contribution

After detailing the application of this new approach to the specification of improvements for IB and BB for two EUCs in the Bank (current account information gathering and mortgage loan application), the results are discussed, and the conclusion is presented in Chapter 7. This conclusion summarizes the contributions of each research stage as well as the main contribution of the overall study, pointing out limitations and directions for future research.

Overall, the approach developed throughout the dissertation research integrates Internet service design in the multi-platform service, leveraging each service interface capabilities to best contribute to an overall satisfying experience. It offers a deep and rigorous elicitation of customer interaction experience requirements and develops a systematic method to incorporate them in multi-interface service design from the EUC level to the CUC level. Finally, it borrows the concepts and techniques of services marketing, HCI and requirements engineering wherever they bring useful contributions to the design of multi-interface services. The challenges posed by the Internet service environment are still to be fully addressed, but this study makes a contribution to enhance the design of the multi-interface service experience in this new environment.

2. Literature review and conceptual background

The dissertation research aimed at improving service interface design methods in a technology enabled multi-platform service delivery system. To attain this objective, an important research component was the study of customer interaction experience requirements relevant in multi-interface services, to understand how they influence satisfaction and usage of the different service interfaces. These experience requirements under study can be used both to elicit customer needs and to evaluate service interface performance in satisfying those needs. The dissertation study provided the necessary input to the development of new design methods that (1) integrate interface design in the multi-platform service, (2) address experience requirements along the design process, and (3) approach the intertwined technology and service design issues from a multidisciplinary perspective.

Prior to the different research stages, previous work related to technology enabled services was reviewed. Following the standard scale development method (Churchill 1979; Churchill and Iacobucci 2002) briefly explained before, the literature review served to better define the concepts being measured and offered insights into the experience requirements that could be relevant in the context under study. The analysis of the different studies therefore provided a sound basis for the development of the dissertation conceptual model and research design. This literature review constitutes the body of the Conceptual background chapter here presented, and was a fundamental step prior to the qualitative and quantitative stages that followed.

As already pointed out, the study uses a multidisciplinary perspective, covering several research fields related to technology enabled service interfaces. These research fields build upon different theoretical backgrounds, approach service interfaces with diverse lenses and focus on different issues. This diversity of contributions brings a rich and complementary view of the research problem, but increases the complexity of the conceptual background.

Research vectors and conceptual background

To better integrate these diverse contributions, it is important to first clarify in further detail the core vectors of the dissertation research approach, which were already presented in the Introduction chapter, as well as their implications for the study. These vectors cross over the analysis of the different studies covered in the literature review and are:

1. The study of technology enabled service interfaces integrated in the multi-interface service delivery system,
2. The focus on customer interaction experience requirements (CERs), and
3. The multidisciplinary approach.

As already explained, this study analyzes Internet services from a relational, multi-interface service perspective (Montoya-Weiss et al. 2003). In relational exchanges, the service provider has been chosen, and the relational customer evaluates and chooses from the service interface offerings of a single firm. The focus of the study is not the choice between Internet services of different firms (where the Internet is seen as a stand alone service), but the choice of the Internet service interface in relation to the other interaction channels offered by the same service provider.

Another core vector of the study is the focus on customer interaction experience requirements (CERs), defined as customer perceived attributes of the interaction with the service provider that contribute to satisfaction and usage of the service (Patrício et al. 2004). Customer interaction experience requirements concentrate on the interaction and experience nature of technology enabled services, which have become increasingly important in the multi-interface context.

This relational, multi-interface and experience nature of the dissertation research led to a focus on the interaction and frontstage components of technology enabled service delivery systems, for two main reasons. First, in relational, multi-interface service provision, where the different interaction channels may offer the same functionalities, the different interaction experiences provided by each interface have a strong impact on customer satisfaction. This direct interaction between the customer and the service provider has been labeled the service encounter (Shostack 1985). Service encounters are the moments of truth in which customers interact with the firm to jointly produce the service (Bitner et al. 2000), and they are frequently the service in the customer's point of view (Bitner et al. 1990). The service encounter concept was initially applied to personal interaction, but with the infusion of technology in services and the emergence of self-service technologies (SSTs), the service encounter concept was extended to technology generated service encounters, without human intervention from the service provider, such as the Internet (Bitner et al. 2000).

To better understand service delivery, the service delivery process can be likened to a theater performance (Fisk et al. 2004). From this perspective, the service delivery activities may be jointly undertaken by customers, frontstage employees or interaction systems, and may receive the support from other backstage employees or backend systems. The total performance for service provision is the dynamic result of this interaction, which is also influenced by the service setting – the environment where the service provision takes place.

Several studies on e-service quality, such as E-S-QUAL (Parasuraman et al. 2005) and eTailQ (Wolfinbarger and Gilly 2003) consider both frontstage components (e.g. efficiency) and backstage components (e.g. fulfillment) of the service. However, in a relational, multi-interface service context, it is assumed that backstage operations are common to all interaction channels. In such context, major differences emerge, not from backstage operations, but from frontstage interaction experiences. Although crucial for overall service quality, backstage operations do not play such an important role in customer choices between interaction channels from the same service provider, as they would if customers were comparing different service providers. Therefore the study focuses on the frontstage, interaction side of technology enabled services.

The third research vector is the multidisciplinary approach to the study and design of Internet services. Technology enabled services blend technology and services. As such, different fields of knowledge are useful for understanding customer satisfaction with Internet channels, as well as for designing integrated Internet service offerings.

The multidisciplinary approach adopted in the study brought a rich diversity of perspectives, but at the same time posed the challenge of integrating this diversity into a coherent framework. To better integrate the different perspectives, this chapter starts with the analysis of the broad theoretical frameworks that served as the basis for a significant part of the empirical studies reviewed. The analysis of these frameworks led to the identification of three general dimensions of factors influencing customer satisfaction and usage of technology enabled services:

1. Customer characteristics or user profiles;
2. Service characteristics or use case characteristics;
3. Customer Experience Requirements (CERs) and service interface performance.

This general framework guided the subsequent literature review, which covered in more detail each one of these three broad dimensions of factors. As the study's final aim is to improve the design of Internet services, the dimension of Internet service performance, quality and satisfaction deserved particular attention, as they are directly related to CERs. In this area, the contributions of the different fields were analyzed in detail: services quality and financial services quality from marketing, innovation adoption, information systems, human-computer interaction, requirements engineering, and the more recent interdisciplinary work of e-service quality and e-satisfaction.

2.1. Models of customer satisfaction and usage of Internet services

Service quality and satisfaction as attitudes

Perceived quality and satisfaction with Internet services can be viewed as attitudes towards that service interface. An attitude can be defined as "a person's general feelings of favorableness or unfavorableness towards some stimulus object" (Fishbein and Ajzen 1975, p. 6), whether it is a tangible object (e.g. a car) or an intangible one (e.g. technology, or Internet services). Attitudes can therefore be considered conceptually similar to what academics refer to as "satisfaction" (Froehle and Roth 2004).

Attitudes have been extensively studied in marketing and other social sciences, as they were found to strongly influence human behavior. Marketers try to understand how consumer attitudes are formed, such as satisfaction with a service, in order to develop marketing strategies that improve consumer attitudes towards that service and increase customer usage. For interface designers, understanding which attributes or experience requirements contribute to a positive customer attitude towards the interactive system is also a powerful input for a successful design.

As a service or an interface may be composed of many attributes, consumer attitudes can be considerably complex. Different customers may consider that the same service attribute is differently important. Moreover, customers may consider that the service performs well in some attributes, but performs poorly in other ones. The importance given to each of the attributes and the evaluations of service performance all influence customers' attitudes towards the service.

In this context, to measure consumer attitudes, such as quality and satisfaction, a simple response is not enough to understand why consumers have certain feelings towards a product or service (Fishbein and Ajzen 1975; Nunnally and Bernstein 1994). Therefore, multi-attribute models have been widely used in marketing and other social sciences to measure attitudes (Solomon et al. 1999). By using multi-attribute models, marketers can better understand how customer attitudes are formed and how they can be influenced. On the other hand, interaction designers have a more detailed diagnosis for potential improvements in interactive systems, which may lead to desirable attitude changes.

Theory of Reasoned Action (TRA)

From the social sciences literature, the Theory of Planned Behavior (Ajzen 1991), and its predecessor, the Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975) are two of the most influential and empirically supported theories explaining attitudes and consciously intended behaviors (Froehle and Roth 2004). According to Fishbein and Ajzen's work, a person's attitude toward a behavior (A) is determined by his or her salient beliefs (bi) about consequences of performing the behavior multiplied by the evaluation (ei) of those consequences. Applying this theory to Internet service satisfaction, satisfaction with the Internet service (A) will be determined by customers' beliefs about the performance of the service interface in a set of attributes (bi), and the importance given to those attributes (ei).

$$A = \sum bi\ ei$$

Beliefs (bi) are defined as the individual's subjective probability that performing the target behavior will result in a consequence i. The evaluation term (ei) is an implicit evaluative response to the consequence. The attitude (A) that results will drive customer behavioral intentions towards the object, such as the intention to use (BI), as shown in Figure 2-1.

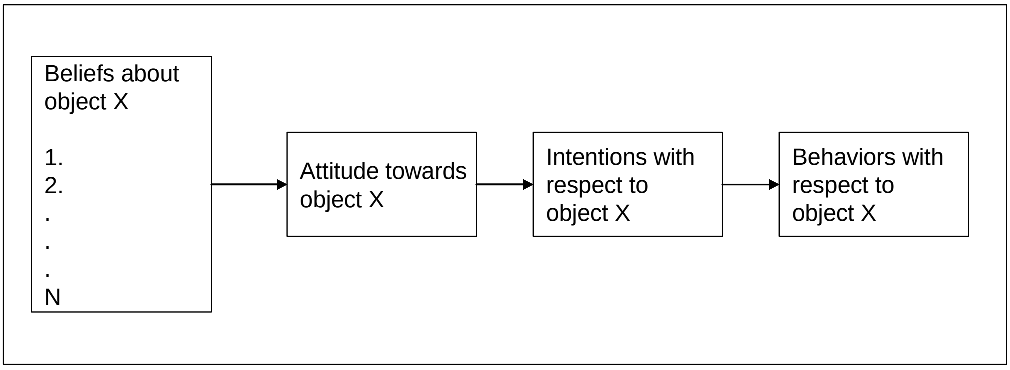

Figure 2-1: Relationship between beliefs, attitudes, behavioral intentions and behaviors (Fishbein and Ajzen 1975)

Applying this framework to the dissertation study, customer perceptions of service interface performance in a set of attributes (such as convenience or speed of delivery) correspond to beliefs (bi). The importance given by customers to the different attributes, or CERs, is the evaluative response (ei). Performance beliefs and experience requirements will determine customer attitudes towards that service interface (A) - satisfaction with the service interface. Finally, attitude will in turn influence behavioral intentions (BI) to use the service interface.

According to TRA, other factors influencing behavioral intentions do so only indirectly by influencing beliefs or their relative weights. Variables such as system design characteristics, customer characteristics, and task characteristics are considered as external variables that only have an indirect influence on usage behavior. If interface designers change the interactive system, this will change customer performance beliefs, and therefore will have an impact on customer attitudes and behavioral intentions.

The work of Fishbein and Ajzen (1975) provided the general theoretical basis to conceptualize the process of attitude formation and behavioral intentions towards Internet services, but it was necessary to adapt it to the specificities of Internet services in a multi-interface context. Particularly, it was important to further specify which beliefs, which attitudes and which behavioral intentions would be analyzed in the model applied to the specific context of technology enabled multi-interface services.

Technology Acceptance Model (TAM)

From the information systems (IS) area, Davis et al. (1989) introduced an adaptation of TRA, the Technology Acceptance Model (TAM), which is specifically meant to explain computer usage behavior. As shown in Figure 2-2 2-2, TAM uses TRA as a theoretical basis for specifying the causal linkages between two key beliefs (perceived usefulness and perceived ease of use) and users' attitudes, intentions, and actual computer adoption behavior (Davis et al. 1989). TAM is considerably less general than TRA, designed to apply only to computer usage behavior, incorporating the findings accumulated from IS research.

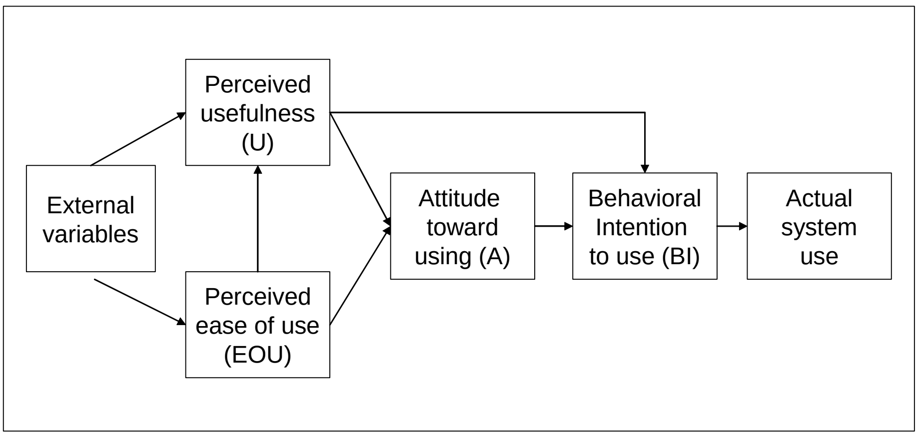

Figure 2-2: Technology Acceptance Model (TAM), in (Davis et al. 1989)

According to these authors, the goal of TAM is to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified. A key purpose of TAM, therefore, is to provide a basis for tracing the impact of external factors, such as system design characteristics, on user beliefs, attitudes, and intentions. As shown in Figure 2-2, TAM posits that two particular beliefs, perceived usefulness and perceived ease of use, are of primary relevance for computer acceptance behaviors.

- *Perceived usefulness* (U) is defined as "the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context".
- *Perceived ease of use* (EOU) refers to "the degree to which the prospective user expects the target system to be free of effort" (Davis et al. 1989).

TAM was initially applied to the work environment, but recent developments have brought new technologies to the service provision context. As technology allowed the emergence of new service interfaces, TAM has been applied to Internet service contexts (Froehle and Roth 2004; Keen et al. 2000). As the dissertation research addresses Internet service satisfaction and usage, TAM provided a useful contribution to the definition of the conceptual model, both in terms of the process and the factors that act as antecedents to service interface satisfaction.

Framework for "participatizing" the service encounter

As any other form of self-service technology (SST), Internet services require a higher degree of participation of customers in the co-production of the service. Therefore, the level of co-production and human contact are important dimensions to characterize the different service interfaces, as well as to understand customer satisfaction and usage of the different interaction channels. Silpakit and Fisk (1985) developed a theoretical framework to "participatizing" the service encounter, where they modeled the factors that may influence the consumer's participation in the service, as shown in Figure 2-3. According to these authors, situational factors, service characteristics and consumer characteristics serve as the inputs for the service encounter, and the evaluative outcomes are the outputs of the service encounter.

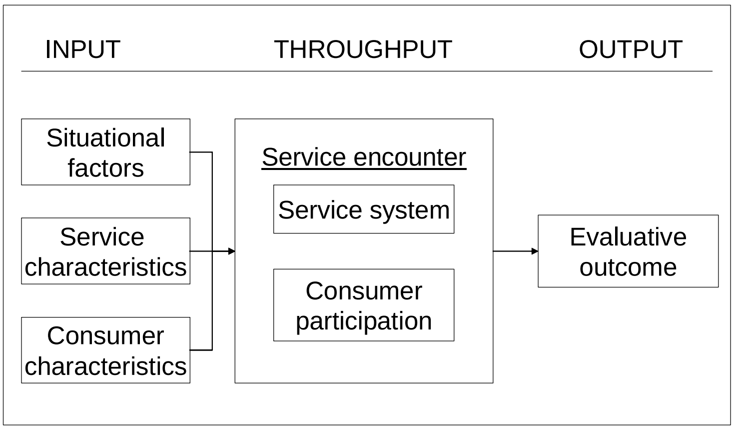

Figure 2-3: Framework for 'participatizing' the service encounter

This conceptualization is consistent with the literature on service quality and satisfaction, as well as attitude formation. In a parallel with TRA, situational factors, service characteristics and consumer characteristics can be viewed as external variables influencing the evaluative outcomes (beliefs) that form the attitude towards "participatizing" the service. Service providers should therefore manage these dimensions to motivate customers to participate more in the service co-production.

The TRA and the frameworks for understanding customer adoption of self-service support the idea that there are four broad dimensions of factors influencing customer attitudes and usage of Internet services. Customer characteristics, service characteristics and situational variables act as external factors. These external factors influence the fourth category: attribute beliefs or evaluative outcomes that are developed in the interaction between the customer and the service provider, which serve as the basis for the formation of customer attitudes towards the service interface.

Integration of marketing and human-computer interaction HCI contributions

From a requirements engineering perspective, CERs may be related to the attributes of the TAM model, such as usefulness and ease of use. Requirements elicitation may involve identifying the relevant CERs, according to the importance given by users to each attribute (user evaluative responses in TRA - e_i). On the other hand, user evaluation of an interactive system may involve the assessment of system's performance in each attribute of the relevant set of experience requirements (beliefs in TRA – b_i).

As stated by Lauesen (2002), "specifying requirements is recognized as one of the most difficult, yet important areas of systems development". In the Internet service environment, where the customer has a higher degree of autonomy in deciding which service interface to choose, understanding which experience requirements are more relevant for customer satisfaction and usage becomes increasingly important (Patrício et al. 2004). These models can help interface designers in understanding which experience requirements are most relevant to better incorporate them in the design of interaction systems.

In the human-computer interaction (HCI) field, the analysis of user profiles and task analysis are considered fundamental steps to identify an interaction system's requirements prior to design (Hackos and Redish 1998). This process involves the development of a clear understanding of the characteristics of each distinct segment of the product's users and the tasks they perform, gathering and analyzing the data to create the product's user requirements (Shneiderman and Plaisant 2005).

Comparing the HCI approach with both TAM and the model for participatizing the service encounter, several similarities can be found. User profiles can be related to consumer characteristics; task analysis can be related to service characteristics. Finally, both user profiles and task analysis can be viewed as external variables, influencing user evaluations and attitudes towards interactive systems. In fact, services marketing and HCI approach Internet services with different perspectives, but many similarities and synergies can be found. The blend of these different contributions can provide a useful help for both marketers and software engineers in managing and designing Internet services.

Services marketing and HCI both share the emphasis on people rather than technology, but approach the multi-interface service with differing perspectives, concepts and methods. Nevertheless, these different approaches can be related and used in a complementary way, as shown in Table 2-1. The Web interaction is a crucial component of Internet service provision, and it is important to join these different, but complementary perspectives to better design Internet services.

Table 2-1 Joining the perspectives of Interaction Design and Marketing (Patrício et al. 2003b)

Interaction Design	Services Marketing
Web interaction	Internet service provision
User requirements	Quality and satisfaction attributes
User profiles	Customer segments
Use cases and task analysis	Service specific needs
Predominance of behavioral meaures of user requirements and behaviors	Predominance of attitude and perceptual measures of customer needs
Expert reviews, usability testing	Interviews, focus groups and surveys

1. While interaction designers focus on user requirements for interactive systems, marketers focus on quality and satisfaction with services. As already noted, these customer requirements attributes can be used both to elicit customer needs and to evaluate the service interface.

2. While interaction designers analyze the profile of the intended users, marketers study the characteristics of the different segments of customers. As already pointed out, user profiles or customer characteristics are important antecedents of customer attitudes towards a service interface.

3. While interaction designers analyze the tasks to be performed by the users when interacting with the system, marketers analyze service characteristics to understand the level of co-production desired. Again, these are important external variables that help explain customer evaluations and attitudes towards a service interface.

4. Both analyses of users/customers and tasks/services feed the identification of interaction system/service's requirements/attributes, which serve as the basis for interaction/service design. Although these concepts are different, they become intertwined in technology enabled service interfaces.

5. HCI research also differs from marketing research in the methods used. Whereas marketing research tends to focus on customer attitudes and opinions, HCI user profile and task analysis concentrate on user behavior. From the requirements engineering perspective, what users may say they need may not be the best solution to the problems that are generating the statement of need (Hackos and Redish 1998), and the reliance on customers opinions and *subjective satisfaction* tends to be risky (Lauesen 2002). Therefore, whereas much of marketing research uses interviews, focus groups and surveys to understand customer attitudes, HCI research favors expert reviews and usability testing to analyze user behavior.

Main dimensions of factors influencing satisfaction and usage of Internet services

The TAM from information systems, the model for participatizing the service encounters from services marketing, and the HCI perspective provided the basis for the study conceptual framework, which will be presented in Chapter 3. This framework guided the definition of the major areas of literature review, focusing on the study of Internet services in the context of multi-interface services. Therefore, the coverage of the factors influencing service interface satisfaction and usage included:

1. Customer characteristics, or user profiles.

2. Service characteristics or use cases.

3. Service interface performance evaluation and customer interaction experience requirements.

As the study aimed at providing guidance to Internet service design, a special emphasis was given to the determinants of service quality and satisfaction, as these are the factors that can be best managed by service designers and interaction designers. Situational variables, although important, were kept for future research.

2.2. Customer characteristics/User profiles

> "Know your customer. Being first, being best, and even being right do not matter; what matters is what the customer thinks" (Norman 1998).

Studying users and understanding their needs is fundamental for creating usable interfaces (Shneiderman and Plaisant 2005). In interface design, user profiling involves understanding users' jobs, the tasks they perform, the tools they use, and their mental models, taking into account their individual differences (Hackos and Redish 1998).

In the services marketing area, there is general agreement that usage of technology enabled service interfaces differs among customer segments (Black et al. 2001; Filotto et al. 1997; Keen et al. 2000; Krishnan and Ramaswamy 1999; Machauer and Morgner 2001). While these new service interfaces may enhance satisfaction for some customers, they may also produce dissatisfaction for other groups of customers (Thornton and White 2001). Clearly, not all customers will be enthused with the infusion of technology in service encounters (Bitner et al. 2000).

Some consumers may prefer the social aspects of interacting closely and developing relationships with service providers or other customers during service encounters. Many people that find human interaction of uppermost importance will not use Internet service channels (Keen et al. 2002). Enabling customers to freely select between technologically and interpersonally based encounters allows them to experience the encounter as desired.

The development of a clear understanding of the characteristics of each distinct segment of users is a fundamental step to design technology enabled service interfaces that are better adapted to customer needs. For service providers, this task also contributes to the development of effective segmentation strategies that allow customers to choose the right mix of service interfaces.

Socio-demographics

From the literature review, different types of customer characteristics appear to influence Internet service satisfaction and usage. On the socio-demographic level, several studies show that Internet early adopters are younger, have higher income, higher education level, and a higher percentage of males when compared to non-adopters (Donthu and Garcia 1999; Sultan 2005). However, the differences between users and non-users have diminished over time as Internet usage spread across a wider set of the population. In fact, as socio-demographics have proven to be relatively poor explanatory variables for predicting Internet adoption (Brengman et al. 2005), the marketing and HCI fields have paid increased attention to customers attitudes and needs.

Personality traits

Based on the diffusion of innovation theory (Rogers 1983), several studies identified consumer personality traits that are positively related with the adoption of technology for service provision, such as e-retailing and e-banking. These personality traits are consumer innovativeness (Donthu and Garcia 1999; Parasuraman 2000; Sultan 2005), opinion leadership (Lockett and Littler 1997; O'Cass and Fenech 2003), buying impulsiveness (Donthu and Garcia 1999; O'Cass and Fenech 2003), and Internet self-efficacy (O'Cass and Fenech 2003). Other studies examined the relationship between customer attitudes and SSTs usage, such as attitude towards technology and computers (Parasuraman 2000; Thornton and White 2001) and attitude towards change (Lockett and Littler 1997; Thornton and White 2001).

Benefits sought

Other research has segmented SST users according to the benefits sought when accessing the service. On one hand, Internet users are more convenience seekers (Donthu and Garcia 1999; Lockett and Littler 1997; Thornton and White 2001). On the other hand, the customer’s preference for social contact and human interaction may prevent some customer segments from adopting the new technology enabled service interfaces (Keen et al. 2000).

Technology paradoxes

These examples show that consumers simultaneously have positive and negative feelings about technology, and the dominance of these two types of feelings is likely to vary across individuals. The final balance between customer positive and negative feelings towards technology has been found to have a high correlation with their propensity to use it (Parasuraman 2000). However, if technology adopters show a more positive balance towards technology, they nevertheless maintain some technology concerns. An illustrative case is the usage of Internet services. Although adopters consider that the balance between advantages and disadvantages of Internet services is clearly positive, some negative feelings still remain after adoption, such as security concerns.

Mick and Fournier (1998) defined eight technology paradoxes associated with customer feelings towards technology: (1) control/chaos, (2) freedom/enslavement, (3) new/obsolete, (4) competence/incompetence, (5) efficiency/inefficiency, (6) fulfills/creates needs, (7) assimilation/isolation, and (8) engaging/disengaging. For these authors, it seems to be shortsighted to assign the characteristics of technology aversion or suspicion only to those consumers who are not at the forefront of adoption and use. Every technology, in view of its paradoxes, includes a sinister side that innovators also dread and seek to manage.

Building on the technology paradoxes, Parasuraman (2000) developed the Technology Readiness Index (TRI), which measures the consumer propensity to use technology. This multi-dimensional construct encompasses both factors driving and inhibiting the use of technology:

- *Optimism:* a positive view of technology and a belief that it offers people increased control, flexibility, and efficiency in their lives.
- *Innovativeness:* a tendency to be a technology pioneer and thought leader.
- *Discomfort:* a perceived lack of control over technology and a feeling of being overwhelmed by it.

- *Insecurity*: distrust of technology and skepticism about its ability to work properly.

The results of this study show that even the technology optimists and innovators experience technology-related anxieties, such as discomfort and insecurity, similarly to the less technology enthusiasts. These findings reinforce the idea of the existence of technology paradoxes (Mick and Fournier 1998).

From the literature review, it seems clear that customer characteristics differ for different segments of service interface users. First, socio-demographics are still different between users and non-users of Internet. However, these differences have gradually lost importance, as the widespread usage of the Internet has diluted these socio-demographic differences. Simultaneously, the development of deeper studies has refined the analysis of online customers with attitudinal and benefit variables.

Building on the innovation adoption theory, recent studies found that Internet adopters are more innovative, opinion leaders and have positive attitudes towards technology. Interestingly, it was found that customers' attitudes towards technology are paradoxical, as customers may be optimistic and innovative but simultaneously feel insecure and discomfortable with technology. As customer characteristics are important external variables affecting the importance given to interaction attributes, as well as customer evaluations of the different service interfaces, it is important to understand the needs of different customer segments in order to best adapt the design Internet services.

2.3. Service characteristics/use case characteristics

If customer characteristics play an important role in the adoption of technology enabled service interfaces, service characteristics also have a strong influence on Internet service satisfaction and usage. In fact, in interaction design, task analysis is a basic step, without which no design can proceed (Shneiderman and Plaisant 2005). To design an effective and satisfying user interface, such as Internet banking, it is essential to make a thorough analysis of the tasks performed by the intended customers, which imply a study of interaction characteristics (Hackos and Redish 1998; Preece et al. 2002). Task analysis traditionally involved a structured and detailed description, decomposing user tasks when interacting with the system (Hackos and Redish 1998).

Use cases in human-computer interaction (HCI)

Task descriptions can take different forms, such as scenarios, use cases or essential use cases (Preece et al. 2002), which can complement each other. A scenario describes activities or tasks in a story that allows exploration and discussion of contexts, needs and requirements. Use cases are widely applied in interface design and software engineering (Nunes and Cunha 2001), focusing on a user-system interaction to accomplish a task, rather than the user's task itself. However, it is important to distinguish Concrete Use Cases (CUC), where a specific interaction technology is already assumed, from Essential Use Cases (EUC), which are technology independent, focusing on user's intentions and system's responsibilities (Constantine and Lockwood 2001), without any pre-assumed technology.

Concrete Use Cases (CUCs) are one of the most important components of the Rational Unified Process (RUP), as this is a use-case driven approach to software development (Kruchten et al. 2001). The main input for the user interface design activities in the RUP is the use case model, which is represented using the Unified Modeling Language (UML). In the UML, CUCs capture the intended behavior of the system being developed, without having to specify how that behavior is implemented (Booch et al. 1999).

The use case model is organized around users of the system and composed of all the use cases that show how the system is used, as showed in Figure 2-4. For each use case, activity diagrams can provide a more in-depth view about the flow of interaction between the user and the system, and usability requirements can be addressed through a textual description, such as maximum execution time or maximum error rate. One example of a concrete use case can be the detailed description of the interaction between a customer and an ATM machine, for gathering current account information.

An Essential Use Case (EUC) is "a single, discrete, complete, meaningful, and well-defined task of interest to an external user in some specific role or roles in relationship with the system, comprising the user intentions and system responsibilities in the course of accomplishing that task, described in abstract, technology-free, implementation-independent terms using the language of the application domain and of external users in role" (Constantine and Lockwood 2001).

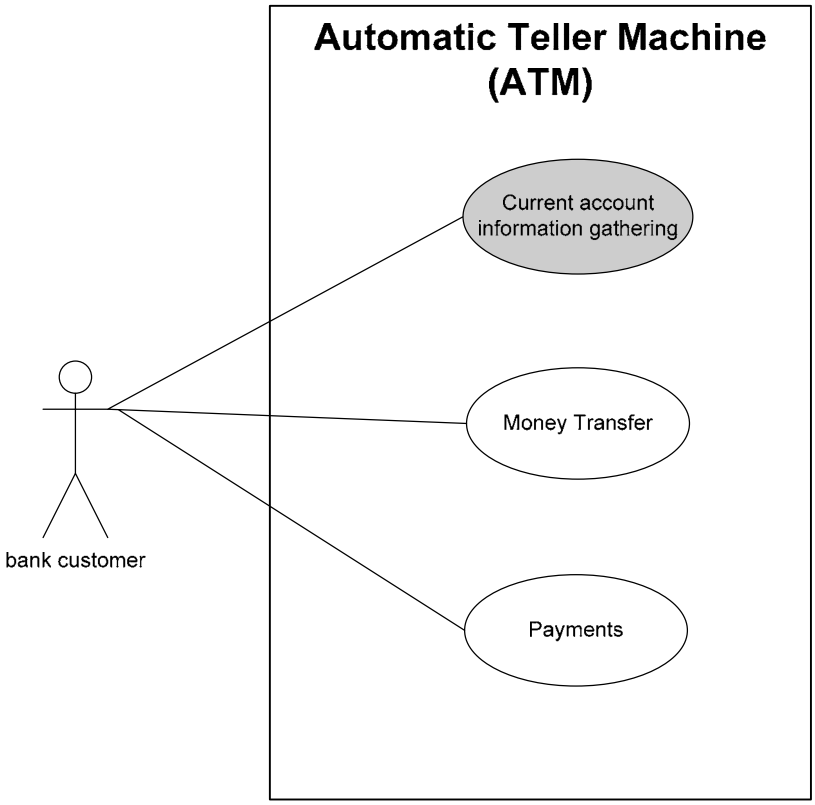

Figure 2-4: Example of use case model for ATM service interface

In a EUC format, the interaction between the customer and the service provider is analyzed without pre-assuming a specific service interface or technology. The EUC for current account information gathering will therefore describe the customer intentions and the service provider responsibilities in providing this service, without defining the service interface or technology being used, as shown in Table 2-2. Therefore, the EUC can be used to design the information gathering service for the ATM, the Internet banking, the telephone banking, or the bank branch.

In interaction design, it is advocated that design must start at an abstraction level that allows designers to make the essential connection between the user's goals and the specific ways of meeting those goals, which may involve finding the best device or program to help users achieve their goals (Hackos and Redish 1998). As EUCs are technology independent and focus on user roles and intentions before any choice of technology is made, they are very useful in eliciting experience requirements, especially when the same service is provided through different interface platforms (Patrício et al. 2004). By analyzing customer overall needs at a EUC level, service providers have a wider set of options, both in terms of channel mix and service interface specific design, to better satisfy customer interaction needs. This approach becomes especially useful in multi-platform settings, to design a consistent and overall satisfying multi-interface service experience.

Table 2-2: Essential Use Case (EUC) for gathering current account information

Customer Intentions	System Responsibilities
Request information of account balance	
	Request customer ID and account number
Provide customer ID	
	Validate customer ID
	Match customer ID and account number
	Retrieve current account information
	Provide current account information
Receive account information	

EUCs and CUCs are modeling techniques that help interface designers in understanding user tasks and the support needed from the system being developed. However, these techniques per se do not offer guidance in terms of which use case characteristics are related to interface experience requirements and to interface satisfaction and usage. Both EUC and CUC concentrate on identifying desired system functionalities, but do not address CERs. However, establishing a relationship between use case characteristics, experience requirements and service interface satisfaction and usage would provide useful guidance for service interface designers.

Service characteristics in marketing

HCI focuses on developing methods and techniques to understand the tasks for concrete cases of interaction between users and systems, but marketing can provide an important contribution. Marketing concentrates on a more general understanding of the specific needs and expectations of Internet service customers and how they vary by product or service category (Donthu and Garcia 1999; Riel et al. 2001), and the results of these studies can be useful for service interface design.

The influence of the type of product or service on consumer decision processes is well studied in the consumer behavior field. Consumers use different rules in their decision processes, depending upon the complexity and the importance of the decision (Solomon et al. 1999). In some cases, the rules are quite simple, but in other cases more effort and thought is put into carefully weighing alternatives before coming to a decision. The extended problem-solving is usually related to decisions involving a high perceived risk, where consumers try to collect as much information as possible, and carefully evaluate the attributes of each alternative, before the decision is made. This is the case of buying a house. On the other extreme, habitual decision-making is made with little or no conscious effort, such as buying a chocolate candy.

This consumer decision framework is very useful for the study of service interface satisfaction and usage, as the distinction between habitual decision-making, limited problem-solving and extended problem solving have proved to influence the adoption and usage of technology enabled self-service delivery. For example, (Vijayasarathy 2001) found that product characteristics influence online shopping attitudes and intentions. Tangible, high cost and infrequently purchased products (like TV sets) may not be ideal candidates for online shopping. On the other hand, a low cost, intangible product such as a music CD is well suited for the digital environment (Peterson and Balasubramanian 1997; Vijayasarathy 2001).

In a study of retail of durable goods, Sweeney et al. (1999) also found that consumers engage in risk reduction strategies when buying durable products, and seeking salespeople assurance is an important component of this strategy. According to these authors, the advice of salespeople is seen as a risk reducer, while mail order or Web-based shopping may increase performance/financial risk due to the remoteness of the transaction. Although these conclusions are related to the shopping of durable goods, they may suggest that consumers will tend to rely on a service interface with a higher degree of personal interaction for financial products or interactions with higher perceived risk, while using self-service delivery for simpler, low risk products or interactions.

Based on an empirical study Keen et al. (2000) also support this idea. These authors found significant differences in customers' decision processes when comparing service interface choice for travel insurance (considered low risk) and loan applications (considered high-risk). In this study, customers showed a strong preference for human interaction in all services, but this preference was stronger in the case of high-risk services.

Krishnan and Ramaswamy (1999), in a study of financial services, found that routine transactions may be provided over the telephone or other electronic means. However, important (or complex) services are still provided through direct contact with customers in the branch offices. These more complex services range from opening an account, changing account information, investment advice, information about products suited to customer's needs, and resolution of problems.

These findings are consistent with the results of other studies in the banking industry. Filotto et al. (1997) found that the importance given to attributes of perceived quality and satisfaction differs between products. For payments, cheapness and friendliness of bank teller are the most important ones (besides speed, availability, autonomy, and help). For investment and borrowing services, customers value staff expertise and price of service (besides friendliness of staff and direct access to information).

Beckett et al. (2000) also found that service uncertainty and involvement with the financial service were important factors determining individual contracting choices and service interface use. Based on focus group discussions of consumers, these authors found that when dealing with high involvement and complex financial operations, customers tended to seek personal financial advice.

Meuter et al. (2000), in a study of SST usage, identified three broad categories of customer purposes when using these service interfaces:

- Customer service, such as information, order tracking and bill payment.
- Transactions, such as ordering and buying.
- Self-help, referring to technologies that enable customers to learn, receive information, train themselves, and provide their own services. An example is the simulation of a mortgage loan.

Again, if customers use SSTs for customer service, transactions and self-help, 83% of the study respondents reported that they complained interpersonally, when a SST failure occurred. This shows that for more complex service provision situations, person-to-person interaction is preferred.

The influence of type of service on interaction channel satisfaction and usage has motivated service providers to design their services accordingly. One of the main services provided by e-retailers is a search-and-evaluation facility that ostensibly saves customers' time and effort and reduces their risk of post-purchase dissatisfaction (Kolesar and Galbraith 2000). However, in the banking sector, although a significant part of financial services is being migrated and delegated to technology, newly-emerging advisory tasks are increasing (Yakhlef 2001).

The result is a more explicit division of labor: machines deal with repetitive, rote, or standardize tasks that require fast, accurate database-driven responses. Humans deal with unexpected, problematic, or creative challenges that require empathy, interpersonal skills, and an ability to deal with the unexpected (Rayport and Jaworski 2005). Remote exchange of information, communication, transaction and delivery of those financial services that are amenable to digitization are well suited for SSTs. But advisory financial services are interpersonal, communication-intensive, requiring face-to-face interaction.

Hypothesized relationship between service characteristics or use cases and service interface usage

The type of financial service in terms of limited versus extensive problem solving has proven to exert a strong influence on consumer satisfaction and usage of technology enabled service interfaces. Several studies indicate that service complexity, risk, and involvement increase the need to seek personal financial advice. For routine, frequent and well known financial operations, customers are comfortable to use SSTs. Although some of these studies reviewed so far apply to SSTs, or specific technologies such as ATMs, these results may be transposed to the usage of Internet banking in a multi-interface scenario. Table 2-3 presents the hypothesized relationship between buying decision behavior and service interface choice.

According to this table, SSTs may be used more intensively for frequent, routine and simple activities, such as low amount transactions and simple information search. The bank branch may be preferred for more complex and risky financial activities, such as advice on mortgage loan or service recovery. The telephone banking offers an intermediate level of personal contact, and therefore may be suited for limited problem solving situations.

Table 2-3: Modeling the relationship between characteristics of decision behavior and service interface usage

Routine response behavior	Limited problem solving	Extensive problem solving
SSTs	**Telephone banking**	**Branch banking**
Low cost product		High cost product
Frequent interaction		Infrequent interaction
Low consumer involvement		High consumer involvement
Low perceived risk		High perceived risk
Low uncertainty		High uncertainty
High knowledge about the product		Lack of knowledge about the product
Familiar product class		Unfamiliar product class
Little thought, search and time given		Extensive thought, search and time given

Based on Solomon, Michael, Gary Bamossy and Soren Askegaard (1999), *Consumer Behaviour: A European Perspective*, Harlow: Financial Times Prentice Hall, p. 209.

2.4. Evaluation of service interface performance / Experience requirements

In the models for understanding consumer attitudes and behaviors, customer characteristics and service characteristics act as external variables, influencing customer performance evaluation of the service interfaces, which in turn influence customer attitudes and behaviors towards that service interface. Therefore, an important part of the research study was the identification of CERs, the evaluation of service interface performance in satisfying those requirements, and their relationships with interface satisfaction and usage. As the study's final aim is to improve the design of Internet services, the dimension of Internet service performance, quality and satisfaction deserved particular attention, as they are directly related to CERs. In this area, the contributions of the different fields were analyzed in detail: services quality and financial services quality from marketing, innovation adoption, information systems, human-computer interaction, requirements engineering, and the more recent interdisciplinary work of e-service quality and e-satisfaction.

2.4.1. Quality, Value and Satisfaction

Attitudes, such as quality and satisfaction, have been widely studied in marketing, as they proved to strongly influence consumer behavior. Consumer attitudes and their antecedents provide important information for identifying service improvements. Attitudes can be complex, as a product or service may be composed of many attributes. For this reason, marketing researchers have used multi-attribute models, which assume that a consumer's attitude (evaluation) of a product or service will depend on the beliefs he or she has about several or many attributes of the product or service (Solomon et al. 1999).

Service quality

Service quality and satisfaction can be considered as attitudes towards a service (Parasuraman et al. 1988). In fact, service quality is one of the most researched attitudes in services marketing (Brown et al. 1994). Using multi-attribute models, researchers have studied the main dimensions of service quality, which can be used to evaluate the service and to identify improvements. Given the distinctive characteristics of services (intangibility, heterogeneity, and inseparability of production and consumption), service quality cannot be measured objectively, and the appropriate approach to measure the quality of a firm's service is to measure consumer's perceptions of quality.

The most well known study on service quality was developed by Parasuraman et al. (1985). According to these authors, quality evaluations are not made solely on the outcome of the service; they also involve evaluations of customer experience during the process of service delivery. Service quality is measured as the perceived difference between service performance and customer expectations, in a disconfirmation approach. This disconfirmation service quality measure, defined as the difference between what is expected and what is received by the customer, helps in identifying the gaps associated with design, marketing, and delivery of services, that help improving the service.

Perceived value

More recently, perceived value has gained prominence in measuring customer attitudes towards services (Sweeney et al. 1999). Perceived value can be defined as "consumer's overall assessment of the utility of a product (or service), based on perceptions of what is received and what is given" (Zeithaml 1988). Sweeney and Soutar (2001) found that perceived value is better viewed and measured as a multidimensional construct, including not only the quality and price aspects of the service, but also the emotional and social dimensions. Perceived value is determined by product quality, service quality and cost, involving monetary and non-monetary costs (Parasuraman and Grewal 2000).

Satisfaction

Satisfaction has also been considered a fundamental attitude in explaining consumer behavior. Initially, satisfaction was defined as the emotional reaction following a disconfirmation experience, which was consumption-specific (Parasuraman et al. 1988). However, several authors argued that research within customer satisfaction paradigm has likely under-represented the emotional and dynamic aspects of satisfaction (Fournier and Mick 1999). These authors view satisfaction in terms of prolonged product usage, focusing on consumption experiences in the unpredictable course of daily living. This approach contrasts with the traditional customer satisfaction paradigm that has been restricted to the buying condition and the immediate evaluative outcome of that transaction. More recently, satisfaction has been defined as customers' evaluation of a product or service in terms of whether that product or service met their expectations (Zeithaml and Bitner 2000). Although this definition is similar to service quality, satisfaction is considered a broader concept, while service quality assessment focuses specifically on the dimensions of service.

There is a growing consensus that service quality is a determinant of customer satisfaction, which in turn influences behavioral intentions (Bloemer et al. 1998; Dabholkar et al. 2000; Lee et al. 2000). Even some authors that have previously defined satisfaction as transaction specific (Parasuraman et al. 1988) tend to accept the previous statement. To better clarify this relationship between quality and satisfaction, Zeithaml and Bitner (2000) developed a model explaining customer satisfaction that includes the variables used in the current study, as shown in Figure 2-5. Once again, situational factors and personal factors are modeled as external variables influencing customer evaluations of the service.

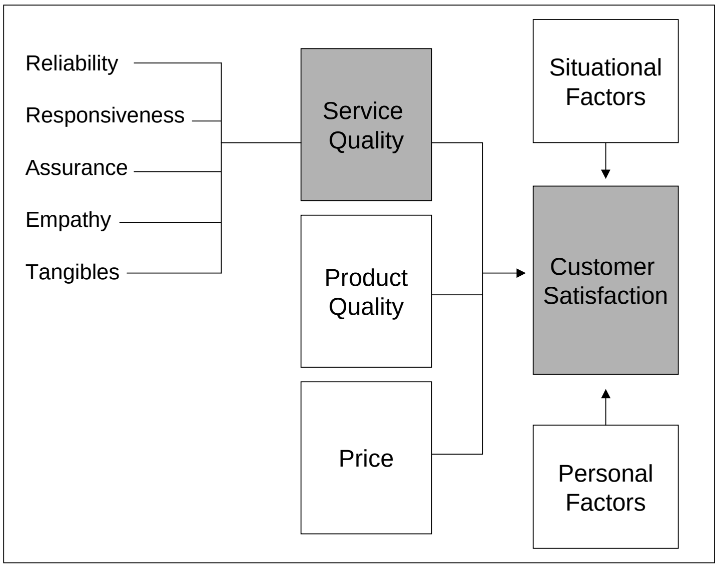

Figure 2-5: Customer perceptions of quality and customer satisfaction

In Zeithaml, Valerie and Mary Jo Bitner (2000), *Services Marketing: Integrating Customer Focus across the Firm*, 2nd edition, p. 75.

After analyzing the different approaches to customer attitudes towards services, customer satisfaction was chosen as the construct used to measure customer global evaluations of each service interface, as well as the overall multi-interface service. Satisfaction was selected as it is central to the marketing concept, with evidence of strategic links between satisfaction and overall firm performance (Fournier and Mick 1999). Satisfaction is also considered an important determinant of bank customer behavior, namely switching intentions and loyalty patterns (Moutinho and Smith 2000). In Information Systems, satisfaction was also found to be critical to the adoption and use of technology (Kekre et al. 1995).

Several studies have shown that customer satisfaction is a much better predictor of behavioral intentions, whereas service quality is more closely related to specific factor evaluations about the service (Dabholkar et al. 2000). Therefore, for prediction purposes, the research should focus on customer satisfaction, whereas for investigative purposes the research should focus on service quality. By measuring customer evaluations of each service interface on a set of attributes and simultaneously measuring satisfaction, the study aims at providing an instrument to understand customer usage of technology enabled service interfaces and simultaneously diagnose service improvements.

In this dissertation research, the final target is not the measurement of the overall satisfaction with each interaction channel, but the understanding of the most relevant drivers of service interface satisfaction, in order to provide guidance for Internet service design. Two different service interfaces (e.g. BB and IB) may be equally rated in terms of overall satisfaction, but may perform differently in each of the service quality dimensions (e.g. responsiveness vs. convenience). Therefore, in identifying the attributes relevant for the study, the research model incorporated quality and satisfaction factors, with the objective of providing diagnostic and design clues to service providers, using satisfaction as the outcome construct to measure overall evaluations of the service.

After defining satisfaction as the outcome variable that measures customer global attitude towards each service interface, the literature review focused on the determinants of quality and satisfaction with technology enabled service interfaces, which will be presented in the following sections. These determinants are incorporated in the attitude measurement model (Fishbein and Ajzen 1975) to measure customer affects (importance given to each attribute or CERs) and beliefs (service interface performance evaluation on a set of attributes). These antecedents of service interface satisfaction are crucial to assess customer evaluations, but also to diagnose improvements that may guide Internet service design.

The theoretical background on the attributes of service interface satisfaction covered different fields of research. As multi-interface services include person-to-person interaction, traditional service quality studies were reviewed, which include quality measures for general services and quality measures specifically developed for financial services (Sections 2.4.2 and 2.4.3). As most technology enabled services are still new to most customers, the innovation adoption literature also provided insights into the factors relevant for the process of Internet service adoption (Section 2.4.4.). Following a multidisciplinary perspective, information systems (IS), requirements engineering (RE) and HCI studies were also analyzed, bringing an important contribution to a more design oriented approach to Internet services (Section 2.4.5). Finally, the literature review focused on the studies specifically addressing technology enabled services (Section 2.4.6).

2.4.2. Service quality and satisfaction research

SERVQUAL

The first work on the development of a multi-item measurement scale of service quality was developed by Parasuraman et al. (1985). These authors conceptualized a service quality model based on the comparison of consumer's expectations and perceptions of the service, in what is known by the gap model, and developed the SERVQUAL measure.

The authors started with an exploratory, qualitative study, identifying ten dimensions relevant for the evaluation of service quality: reliability, responsiveness, competence, access, courtesy, communication, credibility, security, understanding/knowing the customer and tangibles (Parasuraman et al. 1985). Based on this initial battery, the quantitative studies that followed allowed the development and purification of the SERVQUAL measure, which comprises only five dimensions of perceived service quality (Parasuraman et al. 1988):

- *Tangibles*: physical facilities, equipment, and appearance of personnel.
- *Reliability*: ability to perform the promised service dependably and accurately.
- *Responsiveness*: willingness to help customers and provide prompt service.
- *Assurance*: knowledge and courtesy of employees and their ability to inspire trust and confidence.
- *Empathy*: caring, individualized attention the firm provides its customers.

In their studies, these authors consistently found that reliability was the most critical dimension of service quality, followed by assurance, whereas tangibles was the least important construct.

SERVPERF

Despite the wide usage of SERVQUAL, this scale has also been criticized. Several empirical studies found that performance only measures of service quality were superior to disconfirmation measures (Cronin and Taylor 1992; Cronin and Taylor 1994; Dabholkar et al. 2000; Lee et al. 2000). Cronin and Taylor developed SERVPERF, a performance only measure of service quality. Parasuraman et al. (Parasuraman et al. 1991; Parasuraman et al. 1994) revised SERVQUAL in order to overcome some criticisms, eliminating negative worded items, and including importance weights for each attribute. The authors state that, although SERVPERF seems to have greater predictive power, the disconfirmation measure of SERVQUAL has stronger diagnostic capabilities. Cronin and Taylor (1994) and Teas (1993) found, however that weighted models performed worse than unweighted versions.

Other authors (Hemmasi and Strong 1994) argue that importance-performance measures of service quality are more useful in terms of managerial action, as they can provide direction for action, as shown in Figure 2-6. These authors do not contradict the importance of expectations on consumer's perceptions of service quality, but they consider the performance-minus-expectations an inappropriate basis for the measurement of service quality, advocating the use of importance-performance measures such as SERVPERF (Cronin and Taylor 1994; Teas 1993).

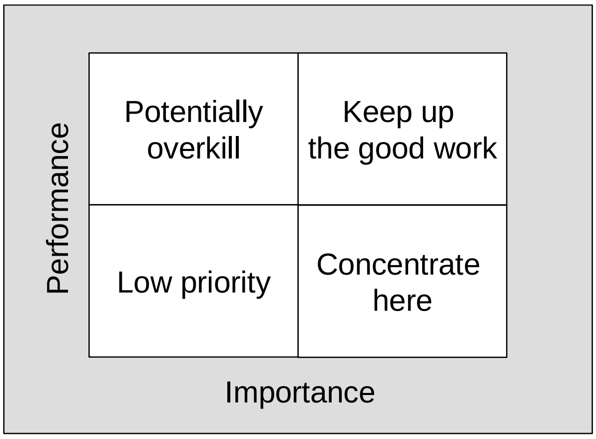

Figure 2-6: Importance-performance grid

The debate around disconfirmation, performance only or importance-performance measures of service quality has not come to a complete end. As there is no definite answer to this issue, it seems that the choice of one measure over another depends more on the research objectives, whether it is to identify gaps, improvement areas or performance evaluation.

SERVQUAL continues to be the major reference in service quality measures. However, it has been developed for application to services in general. When a single service is investigated, it may be desirable to make some adaptations. In fact, several studies showed that service attributes which consumers deem important appear to vary across sectors (Cronin and Taylor 1992; Cronin and Taylor 1994; Ennew et al. 1993). Dabholkar and Thorpe (1996) developed a service quality measure adapted to the retail store environment. In this study, five dimensions of service quality were identified:

- *Physical aspects* – store appearance and convenience.
- *Reliability* – a combination of keeping promises and doing things right.
- *Personal interaction* – inspiring confidence and being courteous/helpful, which are related to the responsiveness, assurance and empathy attributes of SERVQUAL.

- *Problem solving* – which addresses the handling of returns as well as complaints.
- *Store policy* – whether the store's policy is responsive to customer's needs, such as convenient hours, credit and parking facilities.

SERVQUAL was designed to fit all the services under study, including but not specifically adapting to financial services (Parasuraman et al. 1988; Parasuraman et al. 1991). Therefore, to study Internet banking satisfaction and usage, it is important to analyze other scales specifically developed for financial services. The next section covers those studies.

2.4.3. Quality and satisfaction for financial services

Following the emergence of service quality in general, several studies tried to analyze service quality in the specific context of financial services. Krishnan and Ramaswamy (1999) found that for financial services, satisfaction with product offerings is a primary driver of overall customer satisfaction. However, due to the intangible nature of financial products, service delivery becomes an important factor for customer satisfaction. These authors studied the influence of both product factors and service encounter factors on customer satisfaction. In another study, Bloemer et al. (1998) identified six dimensions influencing perceived quality for financial services: *reliability* (which has the most important influence factor), *efficiency, interest rates, procedures, expertise* and *access to money*.

Johnston (1995; 1997) studied personal banking using the Critical Incident Technique. This approach is different from the previous ones, as it aims at identifying satisfiers (attributes that contribute more to satisfaction if present than to dissatisfaction if absent) and dissatisfiers (attributes that contribute more to dissatisfaction if absent than to satisfaction if present). This study identified the major sources of satisfaction as being *attentiveness, responsiveness, care* and *friendliness*. On the other hand, the major sources of dissatisfaction are *integrity, reliability, responsiveness, functionality* and *security*. The results showed that responsiveness was a crucial determinant of service quality, as it appeared to be a key component in providing satisfaction, and the lack of it a major source of dissatisfaction. On the other hand, reliability was predominantly a major source of dissatisfaction.

For this author, attempts to increase satisfaction rather than the removal of dissatisfaction have been the downfall of many quality improvement programs. In fact, according to the experience of a high street bank involved in a service quality program, if hard quality, especially *reliability* of service delivery is low, then soft quality (*responsiveness, empathy* and *assurance*) cannot compensate (Newman 2001).

Bahia and Nantel (2000) constructed the Bank Service Quality (BSQ) scale, based on the previous work of SERVQUAL, which they adapted to the financial services context. The study identified a structure of six factors: (1) *effectiveness* and *assurance*, (2) *access*, (3) *price*, (4) *tangibles*, (5) *services portfolio*, and (6) *reliability*. Although the main dimensions of this measure are in tune with the service quality research, the inclusion of price as a service quality measure can be questioned, as it has been defined as a component of value and not quality (Zeithaml 1988).

In a study of perceived quality in bank branches, (Avikran 1999) developed BANKSERV, a scale that measures banking service quality, comprising four main dimensions:

- *Staff conduct* – responsiveness, civilized conduct and presentation of branch staff that will project a professional image to the customers.
- *Credibility* – ability to maintain staff-customer trust by rectifying mistakes, and keeping customers informed.
- *Communication* – fulfilling banking needs of customers by successfully communicating financial advice and serving timely notices.
- *Access to teller services* – the adequacy of number of staff serving customers throughout business hours and during peak hours.

Among these dimensions, staff conduct (influenced by staff numbers in a branch) emerges as the key variable in BANKSERV (Avikran 1999). For the author, this result highlights the importance of staff-customer contact in the branch, which is seen as the essence of successful customer service, thus arguing against replacing staff with “cost-effective” technologies. An important limitation of Avikran’s study seems to be the focus on the branch side of the relationship between the bank and its customers. BANKSERV does not capture the overall relation between the customer and the bank, which is increasingly established through multiple points of contact.

In these studies of financial services quality, the focus on the bank branch predominates, as this has been the traditional bank interface with its customers. This predominance of person-to-person service delivery was also assumed in the SERVQUAL study. It is interesting to note that, in this context, the quality of personal contact provided in the bank branch appears as a key determinant for service quality perceptions, whether it is treated as a separate dimension, or incorporated in quality dimensions, such as assurance.

2.4.4. Innovation adoption literature

Service quality literature can bring important insights for the understanding of Internet services satisfaction and usage. But the Internet is still a novel technology, and as such it can also be analyzed in the light of diffusion of innovations. Innovation adoption processes are important in understanding technology usage, because having an idea adopted, even when it has obvious advantages, has proved to be very difficult.

The diffusion of innovation was initially defined by Rogers (1983) as “the process by which an innovation is communicated through certain channels over time among members of a social system”. According to this author, the following characteristics of innovations, as perceived by individuals, help to explain the different rates of innovation adoption:

- *Relative advantage:* degree to which an innovation is perceived as better than the idea it superseded.
- *Compatibility*: degree to which an innovation is perceived as being consistent with existing values, past experiences, and needs of potential adopters.

- *Complexity*: degree to which an innovation is perceived as difficult to understand and use.
- *Trialability*: degree to which an innovation may be experimented with on a limited basis.
- *Observability*: degree to which the results of an innovation are visible to others.

Following the work of Rogers, several researchers have used the diffusion of innovations framework to study the adoption of new technologies in banking, such as ATMs. Moutinho and Smith (2000) postulate that the impact of ATMs on consumer behavior depends upon the importance of *ease of use* (associated with ATMs) compared with other criteria, such as *personal advice* (associated with the bank branch). This comparison is interesting as it posits this technology enabled service interface in the context of a multi-platform service, analyzing the impact of performance evaluation of the ATM, not in isolation, but in relation to the alternative interfaces. Rugimbana and Iversen (1994), also based on the framework of Rogers, found in a first study, that *convenience, reliability* and *suitability* were the most relevant attributes in predicting ATM usage. Later, Rugimbana (1995) identified *convenience, ease of use* and *compatibility* (comfort level), as the most important ones.

With the upsurge of Internet services, the innovation adoption framework was also applied to the Internet banking. Black et al. (2001), in an empirical study of Internet banking adoption, identified several perceived attributes influencing this adoption process:

- *Relative advantage,* related to availability (the most relevant in the study of Lockett and Littler (1997)), accessibility and level of service.
- *Customer learning requirements*, comprising compatibility with previous experience and values, trialability and complexity involved when conducting financial services on the Internet.
- *Observability* for other members of the society.
- *Perceived risk* of error and level of security.

The innovation adoption literature has the advantage of addressing Internet services adoption, not as an isolated process, but dependent upon the comparative evaluations between new technologies and traditional ones. As such, it makes an important contribution to the analysis of Internet services and other new technology enabled services in a multi-platform context.

2.4.5. Quality and satisfaction in information systems and human-computer interaction

The first widespread wave of technology usage in the work environment raised new issues to software developers. Instead of being technology oriented, information systems (IS) gradually became more user centered. Satisfaction has become a strategic priority for IS and understanding users has been defined as a critical task for software development (Kekre et al. 1995).

Non-functional requirements and softgoals in requirements engineering (RE)

In the software engineering field, software development efforts have traditionally focused on functional requirements, which specify the functions of the system or what the system should do (Lauesen 2002). As was already explained in the Introduction chapter, in the early stages of computer technology, software developers' major concern was to make the best of the technology available to perform new functionalities. When computers moved from the segment of specialist users to the office work environment, non-functional requirements, such as usability, became crucial for software development, as good functionality started to be insufficient to assure the success of software systems. In software engineering, non-functional requirements can be defined as software requirements that describe not what the software will do, but how the software will do it, such as performance, external interface requirements, design constraints, and quality attributes (Chung et al. 2000).

The increased usage of software systems for business purposes has also led requirements engineers to adopt a more goal-oriented approach. In requirements engineering (RE), goals "model desired states for the users that do not commit on premature design solutions and do not depend on a given style of interactions" (Bolchini and Mylopoulos 2003). Goals are therefore broader than non-functional requirements, in that they are stated in a more business or customer oriented perspective, and they comprise both functional and non-functional goals.

Goals may refer to functional concerns or quality attributes. A *functional goal* typically captures some maximal set of desired scenarios; it can be established in a clear-cut sense. A *softgoal* or quality goal typically captures some preferred behaviors among those captured by functional goals; in general it cannot be established in a clear-cut sense (Lamsweerde 2004). In RE, whereas functional goals can be satisfied, softgoals or quality goals can only be *satisficed*, meaning that they can only be partially satisfied. Requirements, such as ease of use, appearance or other interaction experience needs cannot be completely satisfied in a clear-cut sense. The determinants of satisfaction pertaining customer evaluations of service interface performance, as well as software quality attributes, can therefore be considered as softgoals in the RE sense.

In fact, quality requirements are an important category of what is defined in requirements engineering as non-functional requirements. However, although functional requirements are well known and addressed, non-functional requirements are definitely less understood. Not surprisingly, unmet quality requirements constitute an important failure factor for software development projects (Mylopoulos et al. 1999). This may be due to non-functional requirements complex nature that makes them more difficult to evaluate and test. As stated by Chung et al. (2000), non-functional requirements are subjective, as they can be viewed differently by different people; they are relative, since they often may be only partially satisfied; and they are interacting, as satisfying one type of requirement may hurt or help the achievement of other requirements. Due to these characteristics, non-functional requirements are often treated as *softgoals*, to distinguish them from the more objective *functional goals*.

Quality of software products

IS researchers have developed service quality measures applied to information systems, such as (Pitt et al. 1995). According to these authors, information systems have an important service role, and the measurement of its effectiveness should include service quality. In their study, these authors found that the fundamental concepts of SERVQUAL are applicable to the information systems arena. In a different study, involving IBM customers, Kekre et al. (1995) identified seven drivers of customer satisfaction with software products:

- *Reliability*: the extent of disruption by failures, based on the frequency of disruptions and the time taken to fix them.
- *Capability*: this factor gauges the customer satisfaction with the functionality of the products in terms of the key features offered.
- *Usability*: the initial effort to learn a software product and the recurring effort required to use the product.
- *Installability*: the ease with which customers have installed the software at their sites.
- *Maintainability*: the quality of fixes, vendor service and error diagnosis procedures.
- *Performance*: the response time of an operation, including speed, memory utilization and total memory requirements.
- *Documentation*: the quality of documentation, such as design charts, test documents, general product descriptions, and user manuals.

The results of this study showed that capability and usability were the dominant factors, followed closely by performance. These factors, although specific to software products, were found to be intertwined with the determinants of perceived quality as measured in SERVQUAL (Parasuraman et al. 1988).

The upsurge of quality as a crucial factor for software success has also led the International Standard Organization to develop the ISO 9126 for software product evaluation (ISO 1991). According to this standard (ISO 1998), software quality depends on *internal quality*, which influences *external quality*, which in turn influences *quality in use*. Internal quality is related to the software development process, and is a reflection of the design philosophy and strategy. Software external quality is related to the quality of the delivered product, typically evaluated by testing in a simulated environment. *External quality* attributes are:

- *Functionality*: the capability of the software product to provide functions which meet stated and implied needs when the software is used under specified conditions, including suitability, accuracy, interoperability, security and compliance.
- *Reliability*: the capability of the software product to maintain a specified level of performance when used under specified conditions, including maturity, fault tolerance, recoverability, availability, compliance.
- *Usability*: the capability of the software to be understood, learned, used and attractive to the user, when used under specified conditions, including understandability, learnability, operability, attractiveness and compliance.
- *Efficiency*: the capability of the software to provide appropriate performance, relative to the amount of the resources used, under specified conditions, including time behavior, resource utilization and compliance.
- *Maintainability*: the capability of the software product to be modified. Modifications may include corrections, improvements or adaptation of the software to changes in the environment, and in requirements and functional specifications, including analyzability, changeability, stability, testability and compliance.
- *Portability*: the capability of the software product to be transferred from one environment to another, including adaptability, installability, co-existence, replaceability and compliance.

However, these attributes are viewed from the software developer's perspective. *Quality in use* is the user's view of the quality of an environment containing software, and is usually measured from the results of using the software, rather than the properties of the software itself. Quality in use is closer to the other IS and HCI approaches to studying customer satisfaction with technology enabled service interfaces. *Quality in use* comprises the following dimensions:

- *Effectiveness*: the capability of a software product to enable users to achieve specified goals with accuracy and completeness in a specified context of use.
- *Productivity*: the capability of a software product to enable users to expend appropriate amounts of resources in relation to the effectiveness achieved in a specified context of use.
- *Safety*: the capability of a software product to achieve acceptable levels of risk of harm to people, software, equipment or the environment in a specified context of use.
- *Satisfaction*: the capability of a software product to satisfy users in a specified context of use.

In light of the studies of IS, HCI and marketing, this conceptualization of quality may have two disadvantages. First, it is mostly focused on the software developer's perspective. Second, although quality in use is defined with a user oriented perspective, it mixes the evaluation attributes with the global satisfaction attitude at the same level analysis. Using the Fishbein and Ajzen's framework (1975), this approach mixes beliefs with global evaluation attitudes, which is confusing.

Customer Experience Requirements (CERs)

As Internet usage spreads across a broader set of potential users in a multi-interface service context, where the same service functionality is provided through different service delivery platforms, the experiences provided by the different service interfaces become increasingly important for customer satisfaction and interaction channel choice. Therefore, customer experience requirements (CERs) determine interactive system's design. As already explained in the Introduction chapter, CERs are defined as customer perceived attributes of the interaction experience with the service provider that contribute to satisfaction and usage of the service (Patrício et al. 2004).

According to Preece et al. (2002), user experience goals are concerned with how users experience an interactive product from their perspective and therefore have a subjective nature. User experience goals may be to make products that are *fun, enjoyable, pleasurable, aesthetically pleasing,* and *motivating*. However, by their "subjective" nature, HCI has more difficulty in dealing with experience goals.

In the requirements engineering field a distinction is made between quality factors (management-oriented attributes of software) and quality requirements (software attributes imposed by a formal document) (IEEE 1988). However, for Internet service design, the requirements elicitation process of negotiation between software developer and contractor can be improved through the inclusion of the final customer perspective, as shown in Figure 2-7. As potential customers of Internet services play a determinant role in the success of these interaction systems, it is important to take their interaction experience explicitly into account (Patrício et al. 2004).

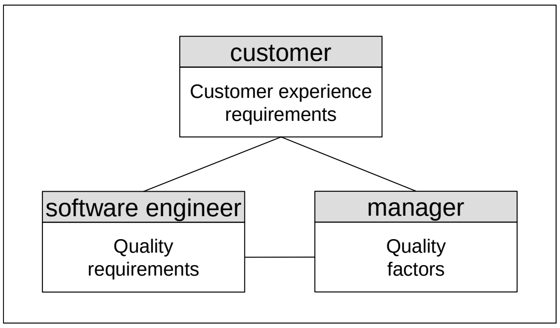

Figure 2-7: Adding CERs to requirements elicitation process (Patrício et al. 2004)

Human-computer interaction and usability factors

The widespread use of technology in services has led software engineers to adopt a more user oriented perspective. Simultaneously, the human-computer interaction (HCI) field emerged and developed a new approach to study and design interactive systems, focusing on the human factors and the usability of the interface. HCI is a multidisciplinary field that began by combining the data gathering methods and intellectual framework of experimental psychology with the tools developed from computer science (Shneiderman and Plaisant 2005), but has gradually incorporated the contributions of other fields, such as graphic designers and marketers.

HCI has traditionally used behavioral measures of interaction systems' performance (Davis 1989), and has developed a very useful work on identifying rules for good interface design, that take usability into account. These usability measures differ from the marketing constructs in that they are usually presented as heuristics derived from experience, and are not measured constructs developed through empirical studies. Focusing on behavioral measures of interface evaluation, Shneiderman (Shneiderman 1998; Shneiderman and Plaisant 2005) has defined the following usability measures:

- *Time to learn,*
- *Speed of performance,*
- *Rate of errors by users,*
- *Retention over time and*
- *Subjective satisfaction.*

With a more design orientation, Shneiderman (1998) also defined the rules for designing usability in interaction systems, with the aim of providing support to interface designers.

- *Strive for consistency*
- *Enable frequent usage shortcuts*
- *Offer informative feedback*
- *Design dialogs to yield closure*
- *Offer error prevention and simple error handling*
- *Permit easy reversal of actions*
- *Support internal locus and control*
- *Reduce short-term memory load*

Following the trend towards a more goal-oriented analysis of user needs, (Preece et al. (2002) identifies usability goals and user experience goals for interaction design. Usability goals are concerned with optimizing the interaction between users and interaction systems, meeting specific usability criteria, such as *effectiveness, efficiency, safety, utility, learnability*, and *memorability*. User experience goals differ from usability goals in that they are concerned with how users experience an interactive system from their perspective. Interactive systems that provide good user experiences are *satisfying, enjoyable, fun, entertaining, helpful, motivating, aesthetically pleasing, supportive of creativity, rewarding* and *emotionally fulfilling*.

Other usability experts such as Nielsen (2000) have defined more specific rules for Web usability that aim at guiding designers in the development of Web sites. These rules or desirable attributes of interactive systems can also be found in other studies in the HCI field. *Error prevention* assumes a special importance in user interface design, as the customer is using a self-service technology (Norman 1998). *Consistency* is also considered a desirable attribute, as it takes advantage of a user's work benign habituation (Raskin 2000).

According to Norman (1998), for early adopters, functionality is the most important. However, when a technology like the computer matures, *ease of use, dependability, attractive appearance, prestige* and *brand* become the key factors. When the technology reaches a point where it satisfies the basic needs, customers begin seeking *efficiency, reliability, low cost* and *convenience*. *Control* and *robustness to errors* are critical for ease of use.

More recently, Norman (2004) has stressed the importance of the emotional components of design, such as *beauty, fun*, and *pleasure* that all work together to produce *enjoyment, a state of positive affect*. According to this author, striving for usability produces products that are easy to use, but may be dull. As much of modern technology is really technology of social interaction, designing interactive systems should take into account the different components of design, including the emotional aspects.

In analyzing the user experience, it is interesting to note that the advantage or disadvantage of *personalization* is not consensual. If this attribute is usually seen as an advantage in the services marketing field, several HCI authors consider that it may make the interface worse (Norman 2004; Raskin 2000). First, interface changes destroy the effect of benign habituation, thus making it difficult and unpleasant to use the system. Second, allowing the user to change the interface design may result in a poorer solution, as customers are not usually good interface designers (Raskin 2000). Third, the mass-customization positive effects may be poor, as they do not create the emotional attachment needed for a great user experience (Norman 2004). Therefore, according to these authors, customization should be done carefully.

Although some of these guidelines are based on extensive research and experience, they usually are presented as heuristics or design recommendations, and are not usually based on validated scale development methods. Although the importance of user satisfaction is recognized, both HCI and requirements engineering researchers consider that "subjective" satisfaction is more difficult to evaluate (Preece et al. 2002), and may lead to high risks for both customers and software developers if used in the requirements contractual document (Lauesen 2002).

Software engineers and interaction designers feel more comfortable working with a requirements document clearly stating objective functional requirements. As user experience goals are subjective and cannot be satisfied in a clear-cut sense, software engineers have somehow avoided them until now. However, with the widespread use of the Internet for service provision, HCI and requirements engineering researchers have gradually accepted the increased importance of user perceptions and user experience requirements in the success of interaction systems.

Information systems (IS) research and the Technology Acceptance Model (TAM)

Although HCI has concentrated on behavioral measures of interface evaluations, other IS researchers have for long studied the impact of user perceptions on the adoption of new technologies. The Technology Acceptance Model (TAM) already presented (Davis 1989), built upon IS research, studied the factors influencing the adoption of computer technologies, using attitude measurement methods that were well validated. In his study, this author identified *usefulness* and *ease of use* as crucial determinants of technology acceptance.

These two constructs measure user beliefs about a system, and were found to have a significant impact on the acceptance of computer technologies. The usefulness construct appeared as the strongest predictor of attitude and acceptance of new technologies. Ease of use is also important, but its influence was exerted in part by influencing usefulness, which acted as a mediator between ease of use and technology acceptance.

This study used perceptual measures, contrasting with the perspective of most of HCI research, which has traditionally focused on behavioral measures, such as task completion time and error rates. This option was taken as several MIS studies observed that there are discrepancies between perceived and actual performance (Davis 1989). In fact, even if an application objectively improves performance, if users don't perceive it as useful, they are not likely to use it. According to Davis, the growing literature of design principles calls for the use of perceptual measures at various points throughout the development and implementation process, from the earliest needs assessment through concept screening and prototype testing to post-implementation assessment.

The technology Acceptance Model (TAM), was designed to understand the causal chain linking external variables to technology acceptance in a workplace (Davis and Venkatesh 1996). These external variables, such as objective system design characteristics, training, computer self-efficacy, user involvement in design, or the nature of the implementation process, are theorized to influence behavioral intention to use, and ultimately usage. This influence is exerted indirectly via their influence on perceived usefulness and perceived ease of use.

The conceptual background of TAM includes theories and empirical studies from different disciplines, such as IS, HCI and marketing. Although TAM was first developed for the work context, it has also been successfully applied to other technology acceptance contexts such as technology enabled service interfaces (Keen et al. 2002). Similarly, other IS studies have adopted a multidisciplinary approach, using the theories, concepts and methodologies of marketing and other social sciences.

With the widespread use of Internet for service provision, TAM has been recently extended with the inclusion of *trust* (Pavlou 2003). Trust can be conceptualized "as existing when one party has confidence in an exchange partner's reliability and integrity" (Morgan and Hunt 1994). In contrast to traditional consumer behavior contexts, on-line transactions have certain unique dimensions, such as (a) the extensive use of technology for transactions, (b) the distant and impersonal nature of the on-line environment, and (c) the implicit uncertainty of using open technological infrastructures for transactions. The open nature of the Internet as a transaction infrastructure creates uncertainty, and this makes trust and risk crucial for consumer acceptance (Grabner-Krauter and Kaluscha 2003; Pavlou 2003). In fact, the lack of trust has been found to be a major factor preventing the adoption of e-commerce (Hoffman et al. 1999).

Pavlou (2003) conceptualizes *trust* as "a salient belief which includes goodwill trust (benevolence) and credibility (honesty, reliability, and integrity)". This definition captures two distinct but non-separable facets of trust in e-commerce. First, it involves the traditional view of trust in a specific party (the Web retailer), and second, it implicitly encompasses trust in the integrity of the transaction medium (trust in the infrastructure). In his study, Pavlou found that trust has both a direct effect on intentions to transact online, and an indirect effect through usefulness, ease of use, and perceived risk.

Based on the review of extant literature on online trust, (Grabner-Krauter and Kaluscha (2003) also distinguish between *system trust* and *transaction trust*. *System trust* is "the belief about the reliability and security of e-commerce systems", and primarily relates to the trust that the technology is free of potential sources of errors and security gaps. *Transaction-specific trust* is the trust in the Internet merchant, is personal in nature, and is related to the benevolence and integrity of the merchant.

From a managerial point of view, the authors conclude that in the early stages of adoption of new technologies such as the Internet, it is important to provide two types of information to increase trust in the e-service. On one hand, it is important to provide information concerning the basic functioning and security of the e-commerce system to reduce system-dependent uncertainty. On the other hand, it is important to provide information concerning characteristics and processes of the Web merchant to reduce transaction-specific uncertainty.

Analyzing the different contributions from IS, HCI and RE fields, two groups can be identified. Traditional HCI and RE researchers are more concerned with identifying concrete guidelines for interface design, and as such prefer behavioral measures and concrete design rules. According to these authors, the use of perceptual assessments of interactive systems is poorly correlated with success and is risky for both customers and software developers (Lauesen 2002). From this perspective, it is safer to have concrete objectives in a software development contract than perceptual measures that can always be under-satisfied.

In spite of the avoidance of perceptual and attitudinal measures of evaluation by software engineers, the widespread use of interactive systems has created the need to study and incorporate experience goals in design, as they are recognized as crucial factors behind successful or unsuccessful interactive systems. In IS, the multidisciplinary work of Davis (Davis 1989; Davis et al. 1989; Davis and Venkatesh 1996) has influenced researchers and practitioners of different fields, from HCI to marketing. However, there is still a lack of correspondence between perceptual measures (that focus on user experience and are well grounded predictors of technology adoption), and the behavioral measures and concrete design guidelines (that designers and software engineers find so useful for). Therefore, further research is worthwhile to improve the methods for translating experience requirements into service interface design.

2.4.6. Quality and satisfaction with technology enabled service interfaces

Research on service quality has traditionally focused on person-to-person service delivery. With the growth of the Internet, the impact of technology on services has been identified as a research priority (Parasuraman and Zinkhan 2002). As such, several research studies have developed new service quality measures for e-services. In studying customer evaluations of Internet services, there is a general agreement that service quality measures applied to person-to-person service delivery may not adapt to the Internet environment (Cox and Dale 2001; Janda et al. 2002; Parasuraman and Zinkhan 2002). Thus, research efforts on the evaluation of e-services have focused on discovering what new quality and satisfaction dimensions would apply in the Internet environment.

Research on Self-service technologies (SSTs)

One stream of research focuses on SSTs. Dabholkar (1996), in an empirical study on the usage of touch screens on fast-food restaurants, identified five attributes determining the perceived quality of technology-based self-service options. These attributes were found to have a strong positive influence on the intentions to use SSTs. Those attributes were: *speed of delivery, ease of use, reliability, enjoyment* and *control.*

This study also found that attitude towards using technology and the need for interaction with a service employee were important determinants of SSTs quality evaluations. For many service encounters, human interaction is extremely important in evaluating the service (Bitner et al. 1990). Especially for services where the customer is present, customers evaluate the quality of the process by the nature of the interaction. Thus, people tend to have different perceptions of automated technologies, based on the importance of retail contact to them. As a result, they develop different tolerances for replacing people with machines in service encounters (Dabholkar 1996). In an extensive critical incident study, Meuter et al. (2000) identified the following SSTs satisfiers and dissatisfiers.

Satisfying categories:

- *Solved intensified need*. Intensified needs were defined as situations in which external environmental factors add a sense of urgency to the transaction. Self-service technologies were seen as having a wider availability and longer, more flexible hours of operation. Because of these characteristics, SSTs were often available to help customers immediately solve a problem.

- *Better than the alternative*. In these incidents, customers perceived that the SST was a better alternative than the interpersonal methods of service delivery, as they were *easy to use*, allowed them to *avoid service personnel*, *saved time*, could be used *when the customer wanted*, and *where the customers wanted*, and *saved money*.

- *Did its job*. These incidents are descriptions of what the SST does when it is working properly.

Dissatisfying incident categories:

- *Technology failure*, related to breakdowns of delivery at the point at which the customer interacts with the technology.
- *Process failure*, when the SST functioned as designed, but there was a breakdown or failure in the process after the customer-technology interaction occurred.
- *Poor design*, related to problems involving the design of the service experience. These problems could be technology design problem: the SST was functioning as designed, but the technology performed is such a way that the user was unhappy with the encounter. Another sub-category was service design problems. In these situations, SST interface functioned as planned but there was some other aspect of the design of the rest of the service that respondents did not like.
- *Customer driven failure*, related to problems which were attributed to customer actions.

More recently, Meuter et al. (2005) studied customer trial of SSTs. This model analyzed the influence of innovation characteristics (SSTs) and individual differences on consumer readiness to try SSTs. The innovation characteristics under study were based on the diffusion of innovations' research, including *compatibility, relative advantage, complexity, observability, trialability*, and *perceived risk*. The study results showed that, from these innovation characteristics, compatibility, perceived risk and trialability had an influence on customer trial of SSTs, which was mediated by consumer readiness to try. Relative advantage had a direct effect on SST trial, which was not mediated by consumer readiness.

E-service quality and satisfaction in specific contexts

Simultaneously, other researchers focused on more specific e-service contexts. Chen and Wells (1999) studied the factors influencing Attitude towards a Site (A_{ST}), which aims at measuring Web surfer's predisposition to respond favorably or unfavorably to Web content in natural exposure situations. They used a pool of judges who evaluated 120 sites, and identified three main determinants, by order of importance:

- *Informativeness*: defining informative, intelligent, knowledgeable, resourceful, useful and helpful sites;
- *Entertainment*: fun, exciting, cool, imaginative, entertaining and flashy sites; and
- *Organization*: defined sites that were not messy, cumbersome, confusing and irritating.

Joseph et al. (1999), in a study of the online customers of an Australian bank, identified six factors of perceived quality of electronic banking service. These factors are, by order of importance: *accessibility, convenience and accuracy, efficiency, feedback and complaint management, queue management,* and *customization*.

Cox and Dale (2001), based on literature review on service quality, proposed a battery of eleven key drivers of perceived quality in e-commerce, some of them similar to service quality, some of them specific to the e-business context. These factors are: *accessibility, speed, communication, credibility, reliability, security, understanding or knowing the customer, appearance, availability, functionality* as fitness to purpose, and *integrity*, the later one viewed as the policies of privacy and security.

As SERVQUAL is an important reference for personal contact services, another stream of research on e-service quality studies has built upon this work. Kolesar and Galbraith (2000) consider that SERVQUAL dimensions can be applied to the service provided through the Internet, although with some adaptations that reflect the intrinsic characteristics of self-service technologies. Riel et al. (2001) propose a reformulation of the SERVQUAL dimensions to the e-service context, as shown in Table 2-4. These dimensions are specifically focused on a portal service, which was the empirical ground of their study.

Table 2-4: Correspondence of SERVQUAL dimensions to the e-service context (Riel et al. 2001)

SERVQUAL dimensions	E-Service quality dimensions
Tangibles	• User interface
Responsiveness	• Company's response to customer's requests • speed of order confirmation
Reliability	• On-time delivery of ordered goods • Accurate supply of information • Error-freeness of links
Assurance	• Safety of on-line transactions • Policy for using personal information by the company
Empathy	• Customization of communications • Service provider's awareness of customer's personal needs.

Janda et al. (2002), based on a qualitative study, identified five themes pertaining Internet retail service quality, which were further tested through a quantitative study.

- *Performance*: how well an online retailer does in terms of meeting a customer's expectations regarding physical fulfillment of an order.
- *Access*: consumer's ability to purchase a wide variety of products from anywhere in the world through a specific online retailer.
- *Security*: which comprises two sub-dimensions: financial and non-financial. While financial security pertains to conveying financial information online, non-financial security relates primarily to revealing personal information.
- *Sensation*: consumer's ability to interact with the product as well as with other individuals during the shopping experience.
- *Information* quantity and credibility: quantity refers to the access of relevant information in a purchase situation, while credibility involves the degree to which consumers trust the information provided by an online retailer.

In this study, the influence of sensation and access on satisfaction and other outcome measures was not statistically significant; security was only marginally significant, whereas performance and information were strong predictors of satisfaction.

In a study of e-commerce loyalty, Ribbink et al. (2004) tested a model where e-quality was assumed to influence e-trust and e-satisfaction, which in turn influenced e-loyalty. The e-quality dimensions used were *assurance, ease of use, e-scape, responsiveness* and *customization*. The results showed that all the dimensions had a significant impact on e-satisfaction, and both e-satisfaction and e-trust had a direct impact on loyalty.

General e-service quality and satisfaction measures

Whereas the studies presented so far focused on specific e-service contexts, other studies have adopted a more comprehensive and broader approach of e-service quality and satisfaction. More comprehensive in the sense that e-service quality and satisfaction is viewed from beginning to end, encompassing both frontstage and backstage components of the service. These studies are also broader in the sense that the measures developed aim at being applicable to a wide set of service contexts.

WebQual

One of the first works on e-service quality was the development of WebQual (Loiacono 2000). This scale was developed from a multidisciplinary approach, involving both services marketing and IS research. WebQual incorporates, not only dimensions related specifically to the Web site, but also other dimensions related to overall service provided by the Internet interface. This scale intends to measure consumer's perceptions of Web site quality, but included inputs of Web site designers in the qualitative stage of the research. The initial WebQual scale comprised four dimensions:

- *Ease of use*: the degree to which a person believes that using the Web site takes little effort (comprising design, interactivity, response time and intuitiveness).

- *Usefulness*: the degree to which a person believes that using the Web site meets his/her needs (comprising information, fit to task, trust and customer services).
- *Entertainment*: the degree to which a person believes the Web site is interesting, amusing, diverting, or pleasurable (comprising flow, visualness and innovativeness).
- *Complementary relationship*: the degree to which a person believes the Web site is a substitute for traditional interactions with the company and reflects the company's image (comprising integrated communication, business process relation and substitutability).

More recently, the WebQual instrument was changed to include 12 dimensions (Loiacono et al. 2002): *informational fit-to-task*, *interactivity*, *trust*, *response time*, *ease of understanding*, *intuitive operations*, *visual appeal*, *innovativeness*, *flow/emotional appeal*, *consistent image*, *online completeness*, and *better than alternative channels*. The methodology used in the WebQual development study has been criticized, as the qualitative analysis was done by students, and the survey was undertaken with students (Zeithaml et al. 2002). However, its multidisciplinary approach, provides an important example of joining the IS and marketing contributions.

SITEQUAL

Yoo and Donthu (2001), based on an empirical study, propose a multi-attribute measure of perceived quality of Internet shopping sites (SITEQUAL). The initial stage of their study produced nine dimensions of Internet shopping quality, which can be divided into vendor-related factors and site quality related factors.

Vendor-Related Factors:

- *Competitive value*: the competitive pricing in comparison to conventional retail stores or competing Internet shopping sites.
- *Clarity of ordering*: the clarity of the ordering process supported by unambiguous pricing and fast delivery.

- *Corporate and brand equity*: the name value of the site owner and the products or services on the site.
- *Product uniqueness*: the uniqueness of the products or services on the site, such that visitors have difficulty finding the products elsewhere.
- *Product quality and assurance*: the consumer's self-assurance of product quality obtained during the interaction with the site and not necessarily associated with direct product purchase or consumption experience.

Site Quality-Related Factors:

- *Ease of use:* the ease of use and ability to search for information.
- *Aesthetic design:* the creativity of a site with excellent multimedia and color graphics.
- *Processing speed:* the promptness of online processing and interactive responsiveness to a consumer's request.
- *Security:* the security of personal and financial information.

Although both groups of factors seem to play an important role in online shopping behavior, the authors removed the vendor-related factors and maintained only the site-quality dimensions. From the study results, *ease of use* and *security* appeared as the most important quality attributes influencing consumers' attitudes and behaviors towards the site.

eTailQ

Building on previous research, Wolfinbarger and Gilly (2003) developed eTailQ to measure the quality of online retailing. This study explicitly addressed the definition of e-service quality boundaries. In this study, online *e-tail quality* is conceptualized as the quality of the service provided from beginning to end of the transaction, including information search, Website navigation, ordering, customer service interactions, delivery and satisfaction with the ordered product. Based on extensive qualitative and quantitative research, these authors identified four dimensions of eTailQ:

- *Fulfillment/reliability*: (a) the accurate display and description of a product so that what customers receive is what they thought they ordered and (b) delivery of the right product within the frame promised.

- *Website design*: all elements of the consumer's experience at the Website (except for customer service), including navigation, information search, order processing, appropriate personalization and product selection.

- *Customer service*: responsive, helpful, willing service that responds to customer inquiries quickly.

- *Security/privacy*: security of credit card payments and privacy of shared information.

The study results show that fulfillment/reliability and Website design are the largest and most consistent predictors of quality. Once again, it is interesting to note that the impact of security/privacy was eclipsed by the other factors.

E-S-QUAL

More recently, Parasuraman et al. (2005), building upon the SERVQUAL measure, developed the E-S-QUAL, a service quality measure for the Internet environment. Based on qualitative and quantitative research, the E-S-QUAL measure comprises two sub-scales. The E-S-QUAL scale measures e-service quality on a regular basis. The E-RecS-QUAL is an e-service quality measure which only becomes relevant when a service problem arises. The E-RecS-QUAL was considered as a separate measure as the study results showed that only the group of respondents who had problems and service recovery answered to a specific battery of questions, which correspond to the E-RecS-QUAL.

E-S-QUAL:

- *Efficiency*: The ease and speed of accessing and using the site.

- *Fulfillment*: The extent to which the site's promises about order delivery and item availability are fulfilled.

- *System availability*: The correct technical functioning of the site.
- *Privacy*: The degree to which the site is safe and protects customer information.

E-RecS-QUAL

- *Responsiveness*: Effective handling of problems and returns through the site.
- *Compensation*: The degree to which the site compensates customers for problems.
- *Contact*: The availability of assistance through telephone or online representatives.

The dimensions of E-RecS-QUAL only emerge when customers have trouble with the service provided by the Web site, and service recovery takes place. This conceptualization of person-to-person contact as a service recovery only factor has been questioned by Wolfinbarger and Gilly (2003). According to these authors, "rather than view customer service as a core element of a typical online purchase experience as other researchers do, they suggest that customer service comes into play only when a customer problem occurs and only after the online transaction is made, ignoring that online consumers sometimes need pre-purchase customer service."

In the E-S-Qual study, the effects of efficiency and fulfillment on all three dependent variables (perceived quality, perceived value and loyalty intentions) were all positive and significant, whereas the effects of system availability and privacy were non-significant. These results were similar to the ones obtained in the eTailQ study, where security and privacy had no significant relationship with the outcome variables. These results reinforce the idea that, although security and privacy are crucial determinants of e-services adoption and use, they act more as dissatisfiers, i.e. they contribute strongly to dissatisfaction if absent, but do not have a significant contribution to satisfaction if present.

E-Satisfaction

Parallel to the work on e-service quality, other studies focused on the determinants of e-satisfaction. Szymanski and Hise (2000) studied the impact of four dimensions on e-satisfaction. These factors were:

- *Convenience,* comprising total shopping time, convenience and ease of browsing.
- *Merchandising*, comprising product offerings and product information.
- *Site design*, comprising uncluttered screens, easy-to-follow search paths and fast presentation of information.
- *Financial security*.

In this study, site design and convenience, followed by financial security and site design, occupy a more prominent role in explaining customer satisfaction with e-services. These results were successfully replicated in the German market (Evanschitzky et al. 2004).

2.5. Conclusion of Conceptual Background

The Conceptual Background covered studies related to technology enabled service interfaces, developed in different research fields. This multidisciplinary literature review enriched the analysis with different but complementary contributions.

- Services marketing contributed with the customer focus, the integration of technology in the overall service provision and well developed and tested methodologies for eliciting customer perceptions, attitudes and behaviors. As perceived quality and satisfaction can be viewed as attitudes, marketing contributed especially to the study of customer satisfaction with technology enabled service interfaces.
- Human-computer interaction (HCI) added insights into the specific issues concerned with the computer mediated interaction between customer and service provider, such as usability.

- Requirements engineering provided the concepts and tools to identify customer goals and translate them into interaction system requirements.

- Interaction design brought the focus on the design of technology enabled interfaces, translating customer goals and system requirements into Internet service design characteristics. In this regard, the distinction between essential use cases and concrete use cases was particularly helpful in multi-interface services.

The TRA model (Fishbein and Ajzen 1975), developed to understand customer attitudes and behaviors, the framework for participating the service encounter (Silpakit and Fisk 1985), and the TAM (Davis et al. 1989), developed to explain computer adoption, provided the broad framework to define the boundaries of the dissertation research and organize the subsequent literature review.

These frameworks posit that customer characteristics/user profiles and service characteristics/use cases act as external variables, influencing customer evaluations and attitudes towards service interfaces. Therefore, the literature covered customer characteristics, service characteristics, and in more detail, service interface quality and satisfaction attributes. This multidisciplinary background was a crucial step prior to the development of the dissertation conceptual model and research design, which will be presented in the following chapter.

3. Conceptual model and Research design

The review of extant literature related to satisfaction and usage of technology enabled services from different fields of study provided a rich and diversified view of the research problem. However, this diversity also increased the complexity of the conceptual background. Therefore, this chapter involves three sections: the integration of extant research contributions, the conceptual model and the research design.

This chapter involves the integration of the different contributions, to understand which service and quality dimensions cross over the different studies covered in the literature review. Building upon this integrated perspective, the initial conceptual model of the dissertation research is then presented. This conceptual model served as the basis for the qualitative stage, and was further refined for the quantitative stage. Finally, the research design is explained, leaving the methodology details dealing with each specific stage of the dissertation research for each subsequent chapter.

3.1. Integration of extant research contributions

The literature review presented in the previous chapter shows that, although extensive research has been undertaken in the recent years on the factors influencing usage of new technology enabled service interfaces, almost all studies analyze each one in isolation. Some studies analyzing multi-interface services have been undertaken more recently (Curran and Meuter 2005; Meuter et al. 2005; Meuter et al. 2000; Montoya-Weiss et al. 2003), but research on the contribution of each one for the multi-interface overall service is still scarce.

The research on Self-Service Technologies (SSTs) analyzed satisfaction and dissatisfaction with SSTs (Meuter et al. 2000), and more recently studied customer trial of different SSTs (Meuter et al. 2005). These studies made important contributions to understanding satisfaction and trial of new self-service technologies. However, they did not analyze the different SSTs as part of an overall multi-interface service.

Curran et al. (2003) studied how global attitudes towards each bank SSTs (ATMs, bank by phone and online banking) influence the global attitude towards SSTs in general and intentions to use each SST. Their study shows that the attitudes towards the different SSTs are intertwined, and that they should not be analyzed in isolation. Moreover, the results show that the attitude towards bank staff also influences the attitudes and intentions to use SSTs. These results provide support to the idea of analyzing Internet services integrated within the multi-interface overall service, as attitudes towards different SSTs are interrelated. But as the authors state, it becomes important to further explore additional factors that contribute to these global attitudes.

More recently, Curran and Meuter (2005) analyzed the adoption of three technologies: ATM, bank by phone and online banking, modeling *ease of use, usefulness, need for interaction* and *risk* as antecedents of attitudes towards each SST. However, the study results are somehow difficult to interpret: in the case of the ATM, ease of use and usefulness were found to have a significant positive impact on the attitude towards that service interface, whereas the other two dimensions had no significant impact. In the case of banking by phone, only usefulness was found to have a significant positive impact on the attitude towards that interaction channel. In the case of online banking, risk was the only significant factor. Ease of use and usefulness had beta weights of 0.304 and -0.179, but they were not statistically significant.

Montoya-Weiss et al. (2003) examined the drivers of online channel use in a relational, multi-channel environment. As already mentioned in the Introduction chapter, the conceptualization used in this study is very useful for the dissertation work. In a relational exchange, the service provider has been chosen, and customers choose to use each service interface in relation to the alternative service interface of the overall service provider's offering. These authors analyze online channel design perceptions in terms of *navigation structure, information content* and *graphic style*, and their influence on online service quality perceptions. Their model hypothesizes that online service quality perceptions and alternative channel service quality perceptions are interrelated and both influence online channel use.

The results of this study showed that online service quality perceptions had a significant positive impact on online channel use, and alternative channel service quality perceptions had a significant negative impact on online channel use. Once again, although this work represented an important contribution towards the conceptualization and study of Internet services in the context of multi-interface service offerings, it did not address how the relative performance of the different interaction channels in each service quality dimensions influenced channel use.

In the face of this limited guidance from previous research on evaluating Internet services in the context of multi-interface service offerings, the conceptual background of the study was based on the contributions of the different fields addressing each service interface in isolation, from different perspectives. However, this diversity of perspectives has a downside in terms of complexity. To better integrate these contributions, Table 3-1 summarizes the different studies of quality and satisfaction with technology enabled service interfaces covered in the conceptual background.

Table 3-1: Summary of the different contributions for identifying the determinants of satisfaction/experience requirements for Internet Services

Services Marketing

Concepts studied	Dimensions	Authors
SERVQUAL (Marketing)	Tangibles, reliability, responsiveness, assurance, empathy.	(Parasuraman et al. 1988)
Service quality in retail stores (Marketing)	Physical aspects, reliability, personal interaction, problem solving, store policy (convenience and responsiveness).	(Dabholkar and Thorpe 1996)

Financial Services Quality

Concepts studied	Dimensions	Authors
Perceived quality of financial services	Reliability, efficiency, interest rates, procedures, expertise, access to money.	(Bloemer et al. 1998)
Satisfaction with personal bank	Satisfiers: Attentiveness, responsiveness, care, friendliness. Dissatisfiers: Integrity, reliability, responsiveness, functionality, security.	(Johnston 1995; Johnston 1997)
Bank Service Quality (BSQ)	Effectiveness and assurance, access, price, tangibles, services portfolio, reliability.	(Bahia and Nantel 2000)
Perceived quality in bank branches (BANKSERV)	Staff conduct, credibility, communication, access to teller services.	(Avikran 1999)

Innovation adoption

Concepts studied	Dimensions	Authors
ATM adoption	Ease of use	(Moutinho and Smith 2000)
ATM adoption	Convenience, reliability, suitability, ease of use, compatibility.	(Rugimbana 1995; Rugimbana and Iversen 1994)
Internet banking adoption	Relative advantage, customer learning requirements, observability, perceived risk.	(Black et al. 2001; Lockett and Littler 1997)

Requirements Engineering

Concepts studied	Dimensions	Authors
Software external quality	Functionality, reliability, usability, efficiency, maintainability, portability.	(ISO 1991; ISO 1998)
Software quality in use	Effectiveness, productivity, safety, satisfaction.	(ISO 1991; ISO 1998)

Human-Computer Interaction

Concepts studied	Dimensions	Authors
Usability measures	Time to learn, speed of performance, rate of errors by the users, retention over time, subjective satisfaction, strive for consistency, enable frequent use of shortcuts, offer informative feedback, design dialogs to yield closure, offer error prevention and simple error handling, permit easy reversal of actions, support internal locus and control, reduce short-term memory load.	(Shneiderman and Plaisant 2005)
Usability goals	Effectiveness, efficiency, safety, utility, learnability, memorability.	(Preece et al. 2002)
User experience goals	Satisfaction, enjoyment, fun, entertainment, helpfulness, motivation, aesthetics, support of creativity, reward, emotionally fulfillment.	(Preece et al. 2002)
Invisible design	Efficiency, reliability, low cost, convenience, control, robustness to errors, ease of use.	(Norman 1998; Norman 2004)
Emotional design	Beauty, fun, pleasure, enjoyment, positive affect.	(Norman 2004)

Information Systems

Concepts studied	Dimensions	Authors
User adoption of computer technologies	Usefulness, ease of use.	(Davis 1989; Davis et al. 1989)
User adoption of e-services	Usefulness, ease of use, trust.	(Pavlou 2003)
Adoption of e-commerce	System trust, transaction-specific trust.	(Grabner-Krauter and Kaluscha 2003)
Satisfaction with software products	Reliability, capability, usability, installability, maintainability, performance, documentation.	(Kekre et al. 1995)

E-service quality and satisfaction

Concepts studied	Dimensions	Authors
Perceived quality in e-commerce	Accessibility, speed, communication, credibility, reliability, security, understanding or knowing the customer, appearance, availability, functionality or fitness to purpose, integrity (policies of privacy and security).	(Cox and Dale 2001)
Perceived quality o e-banking	Accessibility, convenience and accuracy, efficiency, feedback and complain management, queue management, customization.	(Joseph et al. 1999)
Service quality of a portal site	User interface, company's response to customer's requests, speed of order confirmation, on-time delivery of ordered goods, accurate supply of information, error-freeness of links, safety of online transactions, policy for using personal information by the company, customization of communications, service provider's awareness of customer's personal needs.	(Riel et al. 2001)
e-quality and e-satisfaction	Assurance, ease of use, e-scape, responsiveness, customization.	(Ribbink et al. 2004)
Perceived quality of technology based self-service options	Speed of delivery, ease of use, reliability, enjoyment, control.	(Dabholkar 1996)
Quality of Internet shopping sites (SITEQUAL)	*Vendor related factors:* Competitive value, clarity or ordering, corporate and brand equity, product uniqueness, product quality and assurance. *Site quality related factors:* Ease of use, aesthetic design, processing speed, security.	(Yoo and Donthu 2001)
Attitude towards the site	Informativeness, entertainment, organization.	(Chen and Wells 1999)
Web site quality (WebQual)	Informational fit-to-task, interactivity, trust, response time, ease of understanding, intuitive operations, visual appeal, innovativeness, flow/emotional appeal, consistent image, online completeness, better than alternative channels.	(Loiacono et al. 2002)
Internet retail service quality	Performance, access, security, sensation, information quantity and quality.	(Janda et al. 2002)
Quality of online retailing (eTailQ)	Fulfillment/reliability, Website design, customer service, security/privacy	(Wolfinbarger and Gilly 2003)
e-Satisfaction	Convenience, product information, site design, financial security.	(Evanschitzky et al. 2004; Szymanski and Hise 2000)
E-Service Quality (E-S-QUAL)	*E-S-QUAL:* Efficiency, fulfillment, system availability, privacy. *E-RecS-QUAL:* Responsiveness, compensation, contact.	(Parasuraman et al. 2005)

Integration of different contributions on drivers of e-service quality and satisfaction

In order to identify potential dimensions of e-service quality and e-satisfaction, the different contributions were integrated as presented below, building upon the SERVQUAL five dimensions: *tangibles, reliability, responsiveness, assurance* and *empathy* (Parasuraman et al. 1988). As this measure has been mostly associated with person-to-person service provision, the contributions of other fields were also incorporated, trying to transpose and adapt each scale's dimension to the new online context. The IS and HCI contributed with the focus on user requirements and usability (Dertouzos and Solow 1989; Norman 1998; Preece et al. 2002; Shneiderman 1998). From IS, the Technology Acceptance Model (TAM) (Davis et al. 1989), contributed to explain computer technology adoption through usefulness and ease of use, which has been recently extended to also include trust (Pavlou 2003). As new factors emerge in the evaluation of online services that do not have a correspondence with SERVQUAL factors, some new dimensions were added when relevant.

The studies of Internet services concur in the conclusion that the drivers of customer satisfaction may be different in the Internet and in person to person interaction (Parasuraman and Zinkhan 2002). However, comparing the dimensions used in SERVQUAL with the ones identified by recent studies on customer evaluations of Internet services, it seems that the two types of dimensions have some similarities, although they assume a different form in the personal and the Web service context.

Tangibles

Several studies have shown that **tangibles** and physical aspects are important in person-to-person service delivery in the traditional physical environment (Bahia and Nantel 2000; Dabholkar and Thorpe 1996; Parasuraman et al. 1988). In the Web environment, several other related dimensions emerge, such as *appearance* (Cox and Dale 2001), *aesthetics* (Preece et al. 2002; Yoo and Donthu 2001), *beauty* (Norman 2004), *visual appeal* and *consistent image* (Loiacono et al. 2002). However, this **visual and aesthetics** dimension does not seem to have such an importance in the Web environment as in the physical environment, as it is absent in many studies of online service use. Some studies use the site design dimensions, but their construct indicators show that they are more related to how the site is organized and is ease to use.

Reliability

Reliability has been identified as a key determinant of service quality and satisfaction both in interpersonal services (Bahia and Nantel 2000; Bloemer et al. 1998; Dabholkar and Thorpe 1996; Johnston 1995; Parasuraman et al. 1988) and technology enabled services (Cox and Dale 2001; ISO 1991; Kekre et al. 1995; Norman 1998; Rugimbana and Iversen 1994; Wolfinbarger and Gilly 2003; Zeithaml et al. 2002). However, in the e-commerce environment, as the order is delivered after the interaction between the customer and the Web site, **fulfilment** may also become an important dimension (Parasuraman et al. 2005; Wolfinbarger and Gilly 2003).

Responsiveness

Responsiveness has been identified as an important factor underlying person-to-person service provision both in general and in financial services (Dabholkar and Thorpe 1996; Johnston 1997; Parasuraman et al. 1988), in the technology enabled service environment this concept seems related to other e-service dimensions. On one hand, responsiveness can be related to service interface **efficiency** (ISO 1998; Joseph et al. 1999; Norman 1998; Parasuraman et al. 2005; Preece et al. 2002; Zeithaml et al. 2002), including **convenience** (Joseph et al. 1999; Norman 1998; Rugimbana and Iversen 1994; Szymanski and Hise 2000), **accessibility** (Cox and Dale 2001; Janda et al. 2002; Joseph et al. 1999), and **speed of performance and delivery** (Cox and Dale 2001; Dabholkar 1996; Janda et al. 2002; Kekre et al. 1995; Loiacono et al. 2002; Riel et al. 2001; Shneiderman and Plaisant 2005; Yoo and Donthu 2001). On the other hand, it can be related to overall service **responsiveness to customer requests or customer support**, which can be handled through the online service interface or other ones, such as telephone or personal interaction (Joseph et al. 1999; Loiacono 2000; Parasuraman et al. 2005; Riel et al. 2001; Wolfinbarger and Gilly 2003).

Assurance

Assurance in the Web environment cannot be attained through the knowledge of employees and the ability to inspire trust. However, service providers have made strong efforts to enhance Web trust (Ceaparu et al. 2002), as several studies stress the importance of **trust** for e-commerce success (Hoffman et al. 1999). Trust in e-services encompasses two distinct facets (Pavlou 2003): (1) **trust in the Internet service provider**, and (2) **system trust**, which is defined as "the belief about the reliability and security of e-commerce systems" (Grabner-Krauter and Kaluscha 2003). In Internet service provision, assurance and system trust can also be related to **security and privacy** (Cox and Dale 2001; ISO 1998; Janda et al. 2002; Loiacono et al. 2002; Parasuraman et al. 2005; Preece et al. 2002; Szymanski and Hise 2000; Wolfinbarger and Gilly 2003; Yoo and Donthu 2001; Zeithaml et al. 2002). As customers play a more direct role in service provision, other aspects may also arise, such as **control** (Dabholkar 1996; Norman 1998; Shneiderman and Plaisant 2005) and **error prevention and handling** (Norman 1998; Shneiderman 1998).

Empathy and personal contact

Empathy and quality of personal contact are important dimensions of service quality in personal interaction (Dabholkar and Thorpe 1996; Parasuraman et al. 1988) and assume a particular importance in branch banking (Avikran 1999; Bahia and Nantel 2000; Johnston 1995; Johnston 1997). In the Web environment, the care and individualized attention may be attained differently, through **customization**, and awareness of customer needs (Cox and Dale 2001; Joseph et al. 1999; Riel et al. 2001). However, the benefits of customization in technology enabled services are still under debate, as they may have conflicting impacts on the customer experience. Customization may conflict with ease of use (Raskin 2000), and mass-customization may not create the emotional attachment needed for a great user experience (Norman 2004). Due to the conflicting perspective, it is not surprising that customization is absent in many e-quality and e-satisfaction studies covered in the literature review. It therefore seems that, at least with the current technology available, empathy is still much the domain of person-to-person interaction.

The results of several e-service studies that include dimensions of **e-service recovery** (Joseph et al. 1999; Parasuraman et al. 2005), **customer service** (Wolfinbarger and Gilly 2003), and **complementary relationships** with other service interfaces (Loiacono 2000), indicate that as high quality customization is still difficult to attain through the Web, the **existence of complementary service interfaces that can provide the personal contact** when needed is a very important aspect contributing to e-service satisfaction. These findings support the idea that Internet service quality is intertwined with the service quality of other service interfaces of the overall offering. Although personal contact may still be an attribute of the physical store, it may also be essential for a satisfying service provided through SSTs.

Usefulness

Besides the traditional SERVQUAL dimensions, and their correspondence to new dimensions in e-services, new factors arise which are specific to the Internet service environment. Although not applicable to personal interaction, new dimensions were found to influence customer evaluations of Internet service, both in services marketing, IS and HCI studies. One of the most important factors is **usefulness,** which has been found to be the strongest predictor of computer technology usage (Davis 1989; Davis et al. 1989; Pavlou 2003).

Usefulness was defined by Davis as “the degree to which a person believes that using a particular system will enhance his or her job performance” (Davis, 1989) but has also been successfully applied to e-service contexts. Other factors related to usefulness have also been used in other e-service studies, such as **functionality** (Cox and Dale 2001; ISO 1998; Kekre et al. 1995; Loiacono et al. 2002), **effectiveness** (ISO 1998; Preece et al. 2002), **suitability** (Rugimbana 1995; Rugimbana and Iversen 1994), and **product offerings and information** (Szymanski and Hise 2000; Wolfinbarger and Gilly 2003; Yoo and Donthu 2001).

Ease of use

The concepts of **ease of use** and **usability** have been subject to extensive research in the recent past, especially in HCI, as they strongly influence the adoption and usage of computer interfaces and e-services. The importance of ease of use in the success of an interface has been pointed out by researchers from different fields of study, such as IS (Davis 1989; Davis et al. 1989; ISO 1998; Kekre et al. 1995; Pavlou 2003), HCI (Nielsen 2000; Norman 1998; Preece et al. 2002; Raskin 2000; Shneiderman 1998), innovation adoption (Black et al. 2001; Lockett and Littler 1997; Rogers 1983; Rugimbana 1995; Rugimbana and Iversen 1994) and services marketing (Dabholkar 1996; Loiacono et al. 2002; Yoo and Donthu 2001). In some of these studies, usability and ease of use are defined as a Web site design construct, but their indicators are related to ease of use (Montoya-Weiss et al. 2003; Szymanski and Hise 2000; Wolfinbarger and Gilly 2003).

3.2. Research conceptual model

The multidisciplinary literature review provided a rich and complementary view of satisfaction and usage of Internet services in the multi-interface service context. However, it also revealed that some knowledge gaps still existed in the study and design of multi-interface service context. As already presented, these knowledge gaps led to the definition of the dissertation research vectors:

- The study and design of Internet services integrated in the multi-interface service,
- The focus on customer experience requirements, and
- The multidisciplinary approach.

First, the great majority of the reviewed studies approach quality and satisfaction in personal and e-service provision separately. Although a few of them address the complementarity between online and offline services (Loiacono 2000; Parasuraman et al. 2005; Wolfinbarger and Gilly 2003), they focus on customer evaluations of each service interface in isolation, and do not analyze Internet service provision integrated in the overall multi-interface service.

SERVQUAL is focused on person-to-person service delivery, as this was the main service interface available at the time this scale was developed. With the emergence of new technologies, IS, and RE researchers have studied the factors influencing adoption and success of interactive systems, but they have concentrated on providing concrete guidelines for software developers and interaction designers, with a strong focus on the technology and functional side of the interaction.

With the emergence of new technologies such as ATMs, marketing researchers also studied its adoption in light of the diffusion of innovation theory, including factors such as relative advantage and learning requirements of the new technology in relation to the existing ones. The diffusion of innovations approach already takes into account that new technologies are not evaluated and adopted in isolation, but in a context where other technologies exist. However, this theory does not address the integration of new technologies in the overall context after adoption. In other words, diffusion of innovation helps in understanding how Internet services are adopted in the context of existing technologies, but does not address the relative contribution of the Internet service interface to the overall multi-interface service after adoption.

The e-quality and e-satisfaction research also focus on the evaluation of Internet services in isolation. Some studies have included customer service and service recovery as part of e-service quality and e-satisfaction, but do not address how service quality in the different interfaces is interrelated (Parasuraman et al. 2005; Wolfinbarger and Gilly 2003). Other studies address how overall quality perceptions and attitudes of different service interfaces are related, but do not drill down to the quality factor level (Curran et al. 2003; Montoya-Weiss et al. 2003).

Due to differences in the underlying dimensions, it may be difficult to develop a measurement scale which captures service quality in online and off-line interfaces simultaneously (Zeithaml et al. 2002). However, it seems very important for multi-interface service management to compare the performance of the different service interfaces, and to understand how each one can best contribute to the satisfaction with overall service provision. Therefore, as already explained, the dissertation research approached Internet services integrated within the multi-interface service.

Second, in many e-service studies, the boundaries of what is being evaluated are poorly defined. In some cases, the studies concentrate on interaction issues, deliberately leaving aside the back-office components of the e-service, such as order fulfillment. This is the perspective of HCI and most of IS and RE studies. In other cases, e-service quality and e-satisfaction comprise the overall service experience, from beginning to end, which may include order fulfillment, customer service, or service recovery. This is the case of E-S-QUAL (Parasuraman et al. 2005) or ETailQ (Wolfinbarger and Gilly 2003).

The dissertation focuses on customer interaction experience requirements, and as such is concentrated on the frontstage component of the service for several reasons. One of the application research objectives is to help bridge the gap between e-service design and interface design, and therefore the HCI focus on the interface and front-office operation prevails. In a multi-interface service setting, such as a multi-interface bank, it is assumed that the backstage operations are shared by all service interfaces, and what makes the difference is the customer interaction experience provided by each interface. Therefore, in the relational multi-interface service provision, the backstage components of the service are less relevant to the decision to opt for one service interface over another, although they remain extremely important for the evaluation of the overall service.

Third, although e-service satisfaction has been subject to extensive research from the diverse fields, such as services marketing, HCI, IS and RE, most of the studies approach Internet services within the field's framework. Some examples of interdisciplinary work do exist, such as HCI research, the Technology Acceptance Model (TAM), or the attempts to transpose SERVQUAL to the IS environment. However, this interdisciplinary approach should also be taken to the multi-interface service environment in all stages of service interface design, as technology and service issues become increasingly interrelated. Therefore, the dissertation research adopts a multidisciplinary approach, from the study of satisfaction and usage of Internet services to the design of technology enabled multi-interface services.

Dissertation conceptual model

The dissertation research aimed at understanding customer satisfaction and usage of Internet services in the multi-interface service context, and as such, a first model of analysis was designed to address this issue. The conceptual model builds upon the (Fishbein and Ajzen 1975) multi-attribute model for measuring attitudes, and their Theory of Reasoned Action (TRA), as shown in Figure 3-1. This conceptual model served as the basis for the qualitative stage, and was further refined in later research stages.

In this conceptual model, customer characteristics and service characteristics are viewed as external variables that influence the process of attitude formation, similar to the framework for "participatizing" the service process (Silpakit and Fisk 1985). Satisfaction with the service interface depends upon CERs (the importance given by customers to a set of attributes) and service interface performance (customer beliefs that the service interface possesses the set of attributes).

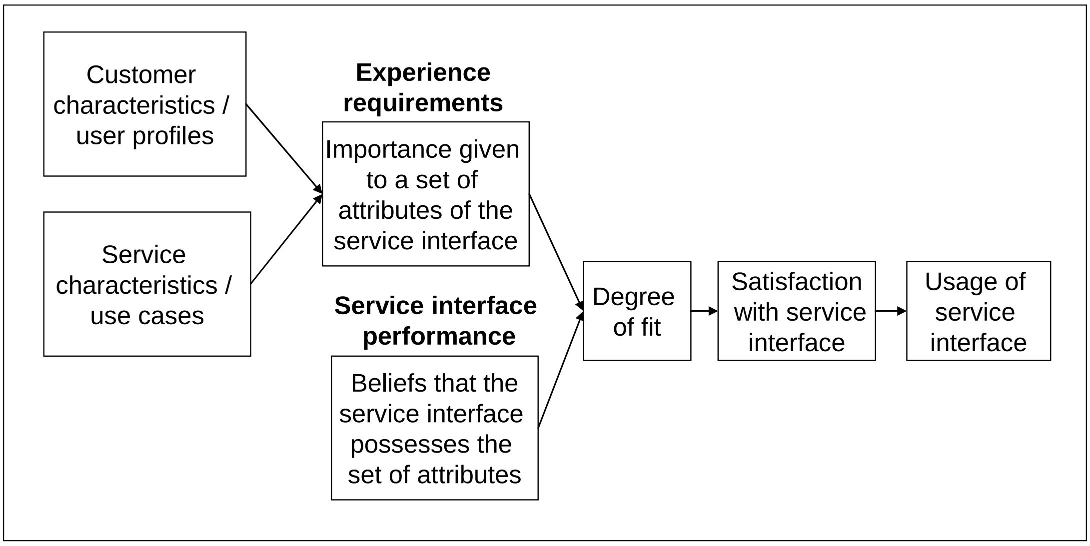

Figure 3-1: Conceptual model for qualitative analysis

From literature review, there is strong evidence that service characteristics or use cases (e.g. complexity and risk) play an important role in the type of contact preferred by customers. There is also evidence that customer characteristics or user profiles influence technology adoption (whereas some consumers are eager to adopt new SSTs, others will always prefer human contact). Satisfaction with the service interface, viewed as an attitude towards each interaction channel, is the result of the fit between the importance given to a set of attributes and the performance of each service interface with respect to those attributes. If personal contact is very important for some customers, they will have a more positive attitude towards the service interfaces which best perform in that attribute. Satisfaction with the service interface will in turn influence usage.

The dissertation research aimed at enhancing multi-interface service delivery systems through technology, concentrating on the three research vectors presented above. As the aim was to provide guidance for interaction and service designers, service interface experience requirements and performance evaluation attributes deserved special attention.

It is important to note that, in the above model, experience requirements or customer needs were gathered independently of the service interface used, with an Essential Use Case (EUC) approach. Customers would be asked to state the importance given to a set of experience attributes when interacting with the bank, without referring to a specific interface. By analyzing each service interface performance in satisfying CERs, the model allows the assessment of service interface relative performance, and how they can contribute to the overall service provided. This information will help service managers identify which interfaces in the overall service are best suited to satisfy the different customer needs, and therefore improve each service interface in a way that best contributes to the overall multi-platform service.

3.3. Research design

According to the dissertation study objectives, the research design involved four stages, as shown in Figure 3-2. The chosen empirical ground was a multi-interface Portuguese bank, which offers financial services through bank branches (BB), Internet banking (IB), telephone banking (TB) and ATMs. Being a multi-interface service provider and an intensive user of technology, the Bank was considered a rich ground for the research.

The study started with the research design stage, involving the literature review, the development of the conceptual model and the definition of the study methodology. At this stage, the literature review presented in Chapter 2 provided a sound basis for the development of the conceptual model, structuring the initial study into three broad dimensions: (1) customer characteristics, (2) service characteristics, and (3) experience requirements. As the study objective was to enhance service delivery systems through technology, a special emphasis was given to CERs, and the correspondent attributes of service interface performance evaluation.

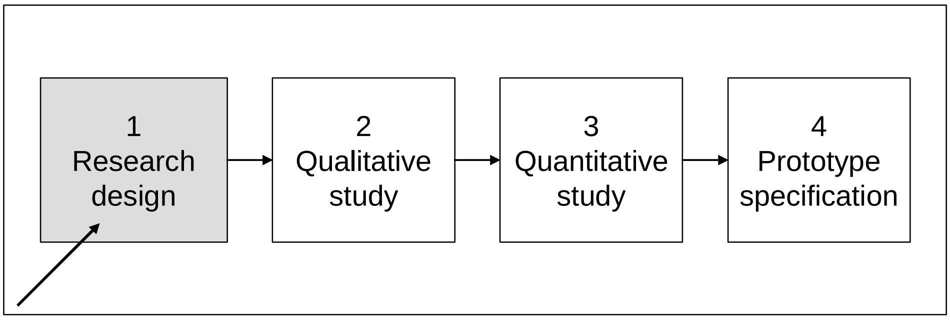

Figure 3-2: The four stages of research design

However, if reviewed empirical studies and theoretical developments provided a sound framework for the conceptual model, they revealed a lack of previously developed scales to measure performance and experience requirements for technology enabled multi-interface services. Most of the reviewed studies developed quality and satisfaction scales for person-to-person, SSTs or Internet services in isolation and did not address the different service interfaces as part of a multi-platform service. To better assess how each service interface satisfied CERs in a comparative way, it was necessary to have the same battery of attributes for both experience requirements and service interface performance, but no previously developed measures addressed this issue. Therefore, the study involved the development of measurement scales for the determinants of satisfaction with technology enabled service interfaces in a multi-interface context.

Scale development approach

As was already explained in the previous chapter, attitudes, such as satisfaction, are better measured with multi-attribute models. To the extent that satisfaction is abstract and latent rather than concrete and observable, it is called a "construct" in psychometrics terms. Such a variable is literally something that scientists "construct" and which does not exist as an observable dimension of behavior (Nunnally and Bernstein 1994). From this perspective, science's two major concerns are (1) developing valid measures of individual constructs and (2) establishing relations between measures of different constructs. In the dissertation research, it was first needed to develop valid measures for experience requirements and service interface performance, in order to understand how they related to satisfaction and usage of service interfaces.

The development of multi-attribute scales to measure attitudes, such as perceived quality and satisfaction, requires extensive work to define an appropriate research design, collect sufficient data and analyze the data rigorously. In order to assure the quality of the results obtained, Churchill (Churchill 1979; Churchill and Iacobucci 2002) suggests that the development of attitude measurement scales should involve several steps, such as shown in Figure 3-3.

This method requires a sound theoretical basis to define the research design and the concepts being studied. Therefore, the first stage of research comprised a multidisciplinary literature review that served as the background, already presented in chapter 2, for the development of the conceptual model. This stage also involved the specification of the concepts to be measured, which in this case are CERs and service interface performance relevant for satisfaction in a multi-interface service environment.

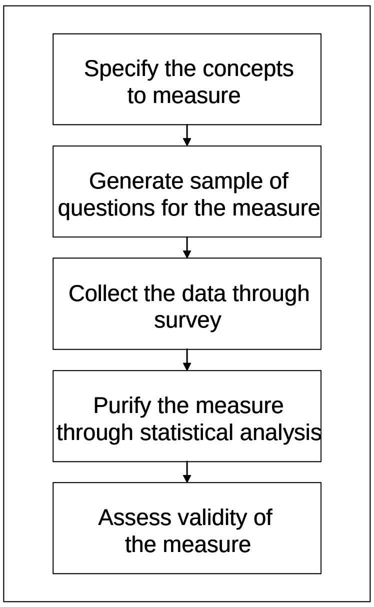

Figure 3-3: Procedure for developing scales to measure customer attitudes

Source: Adapted from Churchill, Gilbert A. and Dawn Iacobucci, Marketing Research: Methodological Foundations, 8th edition, Fort Worth: Harcourt College Publishers (2002) p. 418.

Qualitative study

Having defined the concepts being measured, it is important to elicit the most exhaustive sample of questions that may be relevant for the analysis. In the case of e-service quality and satisfaction, those factors should be all relevant attributes used by customers in evaluating the service interaction experience. At this stage, qualitative methods of data collection and analysis can be useful (Churchill 1979) as their more open nature allows the researcher to explore a large set of attributes and unexpected patterns. These methods may involve in-depth and focus group interviews aimed at eliciting all potential factors that are relevant for the analysis.

Therefore, to get a deeper understanding of the experience factors influencing customer satisfaction and usage of Internet services in a multi-interface context, a qualitative study was undertaken, which will be described in detail in Chapter 4. This qualitative stage involved semi-structured in-depth interviews and focus groups with 36 bank customers in three Portuguese cities, and in-depth interviews and one focus group with 13 bank personnel working on the different bank service interfaces. The interviews focused on the factors underlying customer satisfaction and choice among the different service interfaces, especially with regard to customer experience factors and service interface performance.

These interviews were literally transcribed, and subject to qualitative analysis using NUD*IST (www.qsrinternational.com), involving an iterative process in which the text was coded into concepts and broader categories were developed from emergent ideas (Strauss and Corbin 1998). Then, the analysis of the data structure and the comparison between groups of respondents allowed for a better understanding of the factors underlying customer satisfaction and usage of the different service interfaces in a multi-platform context. More specifically, they allowed the identification of potential experience requirements relevant for satisfaction and usage of the different service interfaces, both in general interactions with the bank, and for specific financial activities.

Although the qualitative studies provide a deeper understanding of customer satisfaction and usage processes, they usually do not allow generalization of the results, due to the lack of sample representativeness. However, the qualitative stage can be used as an exploratory study that serves as the basis for questionnaire design in the quantitative stage. By preceding the quantitative study with a sound theoretical basis and a qualitative study, the researcher reasonably assures that all items potentially relevant for measuring the intended constructs are included in the quantitative analysis.

Quantitative study

Through the administration of the questionnaire to a representative sample of customers, the quantitative study can then provide more general results. In the design of the survey questionnaire, each potential factor identified in the qualitative analysis gives rise to a question that customers answer in a scale, measuring a variable in the quantitative model. Each one of these variables represents an observable indicator that will be used to measure the latent construct, such as satisfaction.

The dissertation quantitative study, presented in detail in Chapter 5, involved two surveys: a telephone survey and a Web survey.

- The telephone survey aimed at measuring CERs for general interactions with the bank, and how the different service interfaces performed in satisfying those needs. This survey was directed to IB users and non-users, and collected 2142 valid responses.
- The Web survey aimed at measuring customer specific experience requirements when dealing with one of a set 12 financial activities, and how IB performed in satisfying those needs. This survey was directed to IB users only, and collected 1934 valid responses.

After several survey instrument pre-tests, the statistical analysis of the data collected in the final surveys provided the input for continuing the process of scale development:

1. An Exploratory Factor Analysis (EFA) with a calibration sample allowed for the identification of the main dimensions of CERs and service interface performance: *usefulness, efficiency and personal contact*.

2. Further statistical analysis of scale dimensionality and reliability allowed for a process of scale purification, in which non-relevant items were dropped from the measurement model.

3. After reaching a stable and acceptable solution for the measurement model for the three constructs previously identified, a Confirmatory Factor Analysis (CFA) was undertaken with the holdout sample. In this confirmatory approach, the measurement model is already defined, i.e. the constructs (usefulness, efficiency and personal contact) and their indicators. At this stage, using LISREL 8.7 (Joreskog and Sorbom 1996), the measurement model fit was assessed, as well as convergent and discriminant validity of the measures.

4. Finally, after validating the measurement model, the relationships between constructs were analyzed, through a structural equation modeling (SEM) approach using LISREL. This model analyzed how CERs and service interface performance in the three dimensions (usefulness, efficiency and personal contact) influence satisfaction and usage of the different service interfaces.

Assessment of measurement scales validity and analysis of structural relationships

The qualitative and quantitative studies followed several steps to validate the measurement model for the intended constructs (CERs and service interfaces performance evaluation). The structural relationships between constructs can only be analyzed after assuring that the measurement instruments are valid, i.e., that they measure what they purport to measure (Nunnally and Bernstein 1994). Validity is central to attitude measurement, as it denotes its utility in scientific and practical terms. The validity of a measurement instrument comprises three forms: *predictive validity, content validity and construct validity*.

Predictive validity is related to the ability of the measure to predict another variable of interest, and can be assessed through the correlation between the measure and a criterion variable (Nunnally and Bernstein 1994). An example is the ability of attitude to predict behavioral intentions. The main focus of the dissertation study was explaining and understanding customer satisfaction with technology enabled service interfaces. Therefore, the analysis of the relationships between constructs were used more to explain than to predict.

Content validity focuses on the adequacy with which the latent construct is captured by the measure (Churchill and Iacobucci 2002). Content validity depends on how the sample of questions or measurement items represents the domain of the concept. As content validity cannot be guaranteed by the researcher's own judgment, one should ensure content validity in terms of a well-formulated plan and procedure of test construction before the actual test is developed, rather than evaluate this after construction (Nunnally and Bernstein 1994). In the dissertation research, the literature review provided a sound basis for the definition of the concepts being measured, and the qualitative study helped in eliciting a large sample of items that could represent the domain of the concepts.

Construct validity is most directly concerned with the ability of the instrument to measure the concept (Churchill and Iacobucci 2002). Constructs are abstract and unobservable, and scale indicators should in fact be measuring the intended latent construct. In the dissertation research, three aspects of construct validity were assessed following Nunnally and Bernstein recommendations (1994):

1. *Specifying the domain of observables related to the construct*. This was pursued by following a careful research design, with an extensive literature review, a qualitative study and several survey pre-tests, that assured that the sample of questions used to measure the construct covers the concept domain.

2. *Determining the extent to which the items measuring the construct are internally consistent*. In this case, it is assumed that if items are highly correlated, measured by its reliability, they are all measuring the same construct. In the first stage of quantitative data analysis, the EFA and the analysis of inter-item correlations allowed for scale purification in order to assure the consistency of the measurement scales. However, internal consistency is a necessary but not sufficient condition to assure construct validity (Nunnally and Bernstein 1994).

3. After specifying the domain, generating a sample of items, purifying the measure and assuring its internal consistency, the final step is to see how well the measure related to other constructs to which the measure should be theoretically related, often referred to *nomological validity* (Churchill and Iacobucci 2002). The construct *nomological validity* is assessed by whether the measure behaves as expected according to theory. This validation also involves the assessment of the constructs convergent and discriminant validity. To assure *convergent validity*, the construct indicators must be highly correlated with the construct, and the construct must be highly correlated with similar measures. To assure *discriminant validity*, the construct must not be highly correlated with measures from which it is supposed to differ. Through the CFA, convergent and discriminant validity were assessed.

After validating the measures of experience requirements and service interface performance, the structural relationships between constructs were analyzed. At this stage, the SEM approach with LISREL allowed for a better explanation of the influence of each experience requirement and performance dimension on service interface satisfaction and usage. The comparison of CERs for different user groups provided a better understanding of the differences between IB users and non-users. The assessment of each service interface relative performance offered a view of the relative contribution of each interaction channel to the overall multi-interface service.

Triangulation

The research design also involved different methods and approaches, in order to triangulate the results. Triangulation is a well known method of capturing and analyzing data through different perspectives, in order to reinforce the construct validity of the results (Yin 1994). If the research findings are corroborated through the use of different data sources, different methods and different theoretical perspectives, then the study results are considered more robust and reliable. This study used three types of triangulation as described by Patton (1987).

1. Data were obtained from multiple sources – *data triangulation*. In order to have a diversified perspective of interaction needs, the study involved interviews with bank personnel working on the frontstage of the different service channels. It also included bank customers, both users and non-users of Internet banking and telephone banking.

2. The research was designed and the data was analyzed through different theoretical perspectives – *theory triangulation*. In particular, the complementary perspectives of HCI, IS, RE and services marketing were important to understanding the technological and service provision sides of the interaction. These perspectives also provided a richer understanding of customer technology enabled interaction in the context of multi-interface service provision.

3. The study used both qualitative and quantitative methods – *methodological triangulation*. The qualitative study allowed a deeper understanding of customer satisfaction and usage, identifying potential factors influencing this process. The quantitative study, built upon the previous research stage, allowed the development and validation of measurement scales for the determinants of service interface satisfaction (confirmatory factor analysis), as well as the analysis of their relationship with satisfaction and usage (structural model analysis).

The quantitative findings indicated that no service interface is best in every attribute, but instead, each one has its own advantages and disadvantages, adding value to the overall multi-interface service. In this context, customers do not use just one service interface, but instead use a service interface mix in their regular interactions with the bank. However, when dealing with a specific financial activity, they tend to choose the service interface that best satisfies their specific needs. The quantitative findings showed how the importance given to interaction experience requirements changed according to the different use cases analyzed. Therefore, the qualitative and quantitative studies provided a rigorous elicitation of CERs for this technology enabled multi-interface service, in general, by user group and by essential use case.

Prototype specification

The study results support the idea that customers use different service interfaces in a complementary way. As such, an integrated, multi-interface perspective is needed for a better design of Internet services. The findings also showed that CERs are crucial for understanding and designing Internet services, and that they should be addressed in all stages of service interface design. Finally the contributions of services marketing, HCI and RE all proved to be useful in understanding customer satisfaction with technology enabled service interfaces, showing a multidisciplinary perspective can also be useful for service interface design.

Building upon the results of the quantitative and qualitative studies, the last stage of the dissertation research consisted of the application of study findings to the design of technology enabled service interfaces, involving the specification of improvements for both BB and IB for specific use cases. At this stage, services marketing, HCI and RE modeling and design methods were reviewed to analyze their contribution to technology enabled service interface design in multi-platform contexts. Again, although these fields developed their own methods and techniques for service design and interface design, they are focused on the service side or technology side of the interaction and do not address the multidisciplinary nature of technology enabled service interfaces.

Service marketers use the Service Blueprint technique (Shostack 1984) and the Quality Function Deployment approach (Stuart and Tax 1996), borrowed from quality management. On the other hand, software engineers develop use case and activity diagrams to model the behavioral components of software systems (Booch et al. 1999), and the RE field has developed the Goal-oriented approach to address non-functional requirements (Mylopoulos et al. 1999). However, some gaps were found in service interface design, related to the three dissertation research vectors: the need for an integrated multi-interface service design, the need to better address CERs throughout the design process, and the need to blend technology and service perspectives to better design technology enabled service interfaces.

Therefore, after reviewing both services marketing and requirements engineering approaches, a new method was developed to integrate the engineering and marketing perspectives in the design a technology enabled service interfaces, which is presented in further detail in Chapter 6. This new approach first addresses CERs at the EUC level, to identify which service interfaces are best suited to offer the different financial activities or uses cases. After this integrated multi-interface perspective, service interface design can then drill down to the concrete level, where each interface is designed to take advantage of its own capabilities to best contribute the overall multi-interface service experience. Blending the contribution of HCI, RE and services marketing, a new approach was developed to address technology enabled service interface design: *the Essential Use Case (EUC) - Service Experience Blueprint (SEB) approach*. This new approach was applied to the specification of improvements for both BB and IB for two specific use cases: current account information gathering and mortgage loan application.

Overall, the dissertation research design was developed to pursue the study objective – enhancing service delivery systems through technology - combining a rigorous method of eliciting CERs, with a strong focus on the application of study results to the design of technology enabled multi-interface services. The rigorous methods used in the qualitative and quantitative stages of research assure the quality of results, and are especially useful when technology is used to provide services to customers in an uncontrolled and complex environment, where traditional HCI methods may not suffice. On the other hand, the strong focus on the design application of results was important to assure that the results obtained are useful for service interface design. Finally, the multidisciplinary perspective applied from beginning to end was also crucial to address the interrelationships between technology and services in the new technology enabled multi-interface service.

4. Qualitative Study

The literature review, covering the different research fields related to technology enabled services, provided a diversified and complementary view of the broad dimensions of factors influencing satisfaction and usage of the different service interfaces. However, it also showed that some gaps still existed in three research areas: the analysis of Internet services integrated in the multi-interface service, the focus on CERs and the need for a multidisciplinary approach.

The conceptual model and research design stages were developed in order to structure the hypothesized factors underlying customer satisfaction and usage of technology enabled multi-interface services, with a special focus on the three areas presented above. The dissertation conceptual model provided a sound basis for defining the domain of the constructs being measured, as well as the hypothesized relationships between them. However, there were no existing measurement scales to address CERs and service interface performance in a multi-interface context. Therefore, as explained in the previous chapter, research design involved the development of measurement constructs to fill in the blocks of the conceptual model. This development process involved the definition of the domain of the concepts being measured, a qualitative study to better understand the phenomenon and to identify a sample of indicators that could measure the constructs, and a quantitative stage. This chapter presents the qualitative stage of the dissertation study, as shown in Figure 4-1.

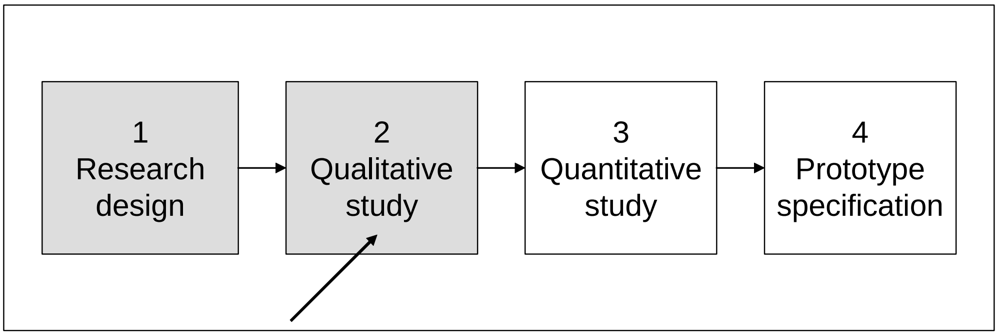

Figure 4-1: The qualitative stage of research

When the phenomena under study are not well known, as it is still the case of Internet services, an exploratory qualitative stage provides enough depth of analysis to identify a large set of potential influence factors that can serve as the sample of measurement indicators for the constructs under study. These findings can be further used to better support the quantitative analysis. As already explained in the previous chapter, by using the qualitative results as the basis for questionnaire design, the researcher reduces the risk of misspecification error, by including a reasonably exhaustive set of potential relevant questions (Churchill 1979). In the dissertation research, the results of the qualitative analysis were therefore used as a starting point for the design of a survey questionnaire, as each factor was turned into one question, representing one variable influencing the process of service interface satisfaction and usage.

One of the major problems of questionnaire design is to identify the right questions to address, and to avoid the misspecification of the model of analysis. The inclusion of non-relevant questions increases questionnaire dimension and the burden on interviewees, but it is more risky not to include relevant variables. Not including all relevant variables has severe consequences, as it may mask important relationships to be found. As Internet service research was only beginning by the time this study started, it was decided to undertake a qualitative study, in order to get a deeper understanding of the phenomena (Parasuraman and Zinkhan 2002).

4.1. Methodology of qualitative study

The qualitative study was based on focus group and in-depth interviews undertaken in June 2002[1]. The bank under study already collected data on

[1] The qualitative results were reported in two articles that provided the basis for this chapter: Patrício, L., Cunha, J.F.e., Fisk, R.P., and Nunes, N.J. "Addressing Marketing Requirements in User-Interface Design for Multiple Platforms," DSV-IS 2003 - the Tenth Workshop on the Design, Specification and Verification of Interactive Systems, Springer Verlag, Funchal, 2003b, pp. 331-345. Patrício, L., Fisk, R.P., and Cunha, J.F.e. "Improving Satisfaction with Bank Service Offerings: Measuring the Contribution of New Delivery Channels," *Managing Service Quality* (13:6) 2003c, pp 471-482.

customer socio-demographics and usage patterns of IB and TB, but a deeper understanding was needed in terms of underlying customer evaluations and attitudes towards each service interface. Although there has been extensive research in the recent past on e-service quality and satisfaction, by that time, studies on this subject were scarce, and research on e-service within a multi-interface environment was virtually inexistent.

4.1.1. Sample design and procedures

From the data collection and analysis made by the bank, it was already known that IB users were more likely to be male, younger, had a higher education level, higher professional status, and a stronger relationship with the bank than other customers. The financial operations most used in the IB service interface were information gathering, transactions of current accounts, credit cards, stocks, and mutual funds investments. Although small in number, stock investors were the most intensive users of IB.

Because IB users still represented a small percentage of bank customers, a stratified sample was chosen to ensure that a sufficient number of elements of the population of interest were studied. Using the information on usage patterns of customers provided by the bank, four groups were defined a priori:

- *Regular users*: those who gathered information and undertook current account and credit card transactions through IB, but who did not perform stock trade operations in this service interface (9 persons);
- *Stock users*: those who made stock transactions through IB (11 persons).
- *Non-users*: those who had never used IB (10 persons); and
- *Ex-users*: those who had used IB, but who had stopped using it in the previous six months (6 persons).

These groupings were later changed according to response patterns that emerged from data analysis and will be presented in the results section.

Focus groups and in-depth interviews were conducted in three Portuguese cities. Using the bank's data, up to five branches were selected in each city, according to the criteria of size and geographical dispersion. For the larger customer segments (non-users and IB regular users), a random sample of 200 customers was selected—spread across the different branches. For the smaller segments (stock users and ex-users of IB), the overall population was used.

To avoid the negative effect of excess diversity within focus groups (Krueger 1994), the under-representation of some segments in the focus groups was balanced through the purposeful selection of cases for in-depth interviews. As some in-depth interviews were made after the focus groups, the final interviews focused on the segments which were less covered in the group interviews. The overall objective was to cover a diverse set of customers who could enrich data collection and analysis, according to the theoretical relevance of cases (Strauss and Corbin 1998).

In this study, 4 focus groups and 14 in-depth interviews were conducted with 36 bank customers, divided into four a priori groups, as described above. All customers used ATMs, and 5 of them used TB regularly. The sample of respondents ranged from 21 to 77 years, with 75% being male and 55% being college graduates.

The final sample dimension of 36 customers might be considered small, but the in-depth interviews (with an average of 45 minutes each) and the small focus groups (with an average of two hours each) allowed the collection of in-depth information about customer experience and usage patterns of different service interfaces. To triangulate the information collected from customers, data were also collected from bank staff. This involved three in-depth interviews with the directors of each service interface (IB, TB, and BB), and one focus group with 10 front-line employees who had direct contact with customers (spread over the three different service interfaces of IB, TB, and BB).

4.1.2. Interviewing procedures and data analysis

As previously indicated, four service interfaces were studied: IB, BB, TB, and ATMs. The interviews with bank customers were semi-structured and focused on the process of service interface use for financial operations, allowing customers to identify the factors that they considered to be influential in making their choice. The issues covered were as follows:

- Please tell me what you think about the different bank service interfaces.
- When you need to access your bank, how do you decide which service interface to use?
    - Influence of personal characteristics.
    - Influence of financial operations.
    - Customer evaluations of the different service interfaces.

The interviews with bank staff followed the same structure, but focused on the bank's perspective of customer attitudes and behaviors. The interviews with channel directors provided a strategic view of the different service interfaces, and the focus group with front-line employees provided an interesting perspective of customer reactions and use of new interaction channels.

The in-depth interviews were tape-recorded, the focus groups were video-recorded, and all interviews were literally transcribed. Data analysis was supported with NUD*IST, which allowed for better organization and structuring of the process of coding and categorization, as well as the cross-analysis of different categories to assess relationships among concepts.

As a first step, the text was coded into concepts developed from emergent ideas and literature review. As the iterative analysis developed, a systematic comparison between the data and the concepts previously identified (Strauss and Corbin 1998) allowed for the development of a broader structure of categories, which aimed to explain the process of service interface choice and its underlying influencing factors. Finally, the data analysis was structured in terms of the factors positively and negatively influencing the use of service interface, as shown in Figure 4-2. This approach followed previous research, which has found that customers have both positive and negative attitudes towards technology use (Mick and Fournier 1998; Parasuraman 2000).

The data analysis focused on customer interviews. The interviews with bank staff offered important insights for the coding and categorization stage, as they helped in better understanding some customer comments. However, as bank employees' interviews represented a different perspective, they were only used as guidance for interpreting the customer data. They were analyzed separately and were not included in the qualitative results presented.

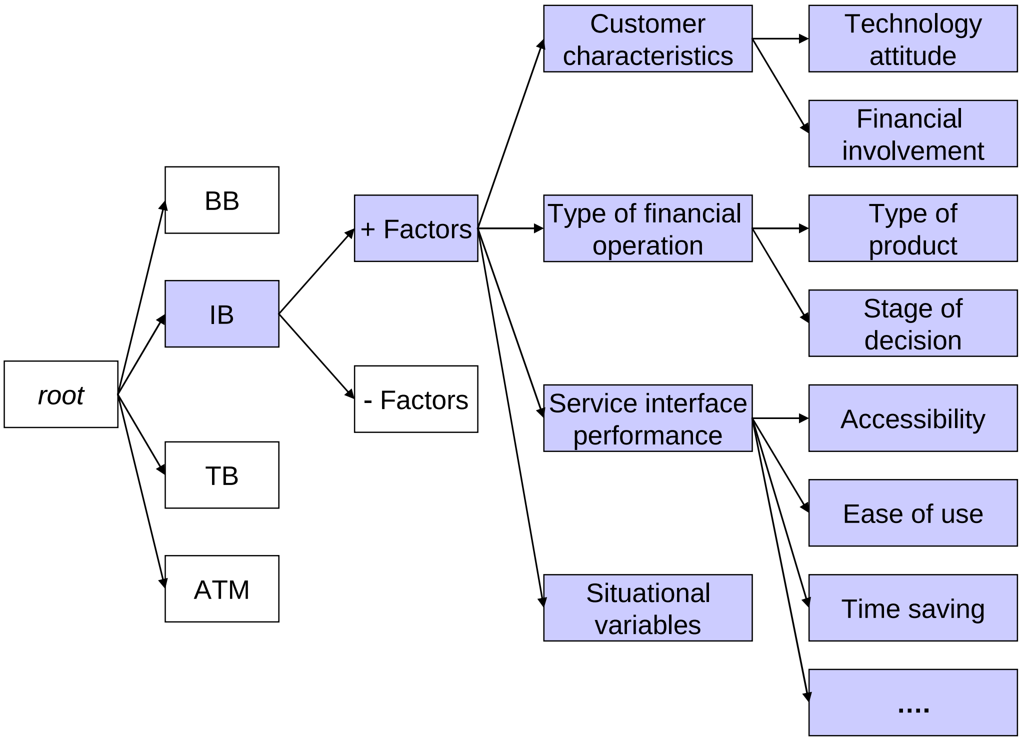

Figure 4-2: Structure of categories resulting from data analysis (Patrício et al. 2003c)

4.2. *Qualitative Results*

As can be seen in Figure 4-2, four main categories of factors were found to influence service interface satisfaction and use:

1. Customer characteristics;
2. Type of financial operation;
3. Service interface performance; and
4. Situational variables.

Because customers were asked to talk about the different bank service interfaces they knew, the analysis allowed a comparative evaluation. Even non-users of IB and TB had heard about them and were able to provide information on their evaluations of the four interfaces under study. This information was important in understanding the reasons for both use and non-use. All the interviewees used more than one service interface (at least BB and ATM), which they chose according to the different financial operations required. This is not surprising, as the ATMs penetration rate in Portugal is above 90%. These results also indicate that customers do not use only one service interface, but rather use a set of different interfaces according to their needs.

The results of data categorization and analysis showed that each service interface had its own advantages and disadvantages, and that customers tended to use them in a complementary way. In Table 4-1, the most commonly mentioned advantages and disadvantages of the experience provided by each service interface are presented, as well as the corresponding percentage of customers who talked about them during the interviews. The analysis of customer evaluations by each service interface will be presented in the following sections.

Table 4-1: Customer evaluations of different bank's service interfaces (Patrício et al. 2003c)

Advantages of each service interface

Internet Banking	% of cust.	Bank Branch	% of cust.	Telephone Banking	% of cust.	ATM	% of cust.
Accessibility	67%	Mutual knowledge	75%	Human contact	19%	Usefulness of available operations	39%
Time saving	64%	Individualized attention	72%	Convenience	14%	Accessibility	39%
Ease of use	61%	Professional knowledge	56%	Accessibility	11%	Time saving	31%
Information capabilities	53%	Empathy and courtesy	44%	Ability to answer questions	11%	Convenience	14%
Feed-back control	53%	Ability to solve, clarify and decide	44%	Courtesy	11%	Feed-back control	14%
Usefulness	47%	Completeness of functionalities	44%				
Convenience	44%						
Autonomy	36%						

Customer evaluations of different bank's service interfaces (cont.)

Disadvantages of each service interface

Internet Banking	% of cust.	Bank Branch	% of cust.	Telephone Banking	% of cust.	ATM	% of cust.
Security concerns	64%	Time loss	72%	Lack of feed-back control	25%	Security concerns	39%
Unavailability of operations	53%	Lack of accessibility	42%	Lack of mutual knowledge	22%	Technical failures	36%
Lack of information quality	47%	Lack of convenience	22%	Lack of personalization	22%	Unavailability of operations	22%
Lack of personalization	28%			Lack of value-added	17%	Lack of back-office response	19%

4.2.1. Customer evaluations of IB service experience

As shown in Table 4-1, IB is seen as a more efficient interaction, with higher accessibility, convenience, and time saving. As a female college graduate aged 61 who was an IB user explained:

Internet [banking] has everything, in the end, and we have all at hand.

IB also performed well in terms of ease of use, adequate functionalities, deepness of information, autonomy and feedback control. As a male, aged 36, college graduate, and IB regular user explained:

> That's how I see the Internet [banking], to see my account at my own will, and for people who like it, and have some money and want to save it or invest it, to go to the Internet, see what are the best interest rates, make it, at mid-night or 1 a.m.

Feedback control is related to IB's visual and printing capabilities. This is an important reason for customer preference of IB when compared with TB. A female aged 54, a college graduate and user of IB observed:

> I have access to the IB service in my mobile phone, but usually I do not use it, because it is much more practical to go to a PC. Things are more visible and I get a sheet of paper.

However, security concerns are still a major disadvantage of IB, crossing all segments of users and non-users. A male aged 31, a college graduate and IB user noted:

> Even in the bank, I am always suspicious that there may be a hacker with bad intentions, watching what I am doing.

IB perceived experience was not the same across the different user groups. As shown in Table 4-2, users generally made more positive evaluations of IB than non-users. Regular users especially valued the efficiency of IB, and were less critical of the deficiencies of this service. Stock trade users were more intensive users, and were more demanding—especially in terms of functionalities, technical failures, and back-office response.

Table 4-2: Evaluations of IB service experience across different user groups (Patrício et al. 2003c)

Advantages associated with Internet Banking by user group

	% of IB regular users	% of IB stock users	% of IB technology non-users	% of IB low involvement non-users
Accessibility	100%	73%	20%	83%
Time saving	100%	73%	20%	50%
Ease of use	100%	64%	38%	67%
Feed-back control	78%	73%	25%	17%
Adequate functionalities	67%	64%	20%	33%
Information quality	56%	64%	30%	67%
Convenience	44%	73%	20%	33%
Autonomy	56%	36%	30%	17%
Customization	0%	55%	0%	0%

Disadvantages associated with Internet Banking by user group

	% of IB regular users	% of IB stock users	% of IB technology non-users	% of IB low involvement non-users
Security concerns	78%	64%	50%	67%
Unavailability of functions	67%	82%	20%	33%
Lack of information quality	78%	73%	0%	33%
Technical failures	22%	55%	0%	50%
Lack of personalization	33%	18%	40%	17%
Process complexity	22%	36%	10%	33%
Lack of back-office response	11%	55%	0%	0%
Lack of value added	0%	0%	30%	67%
Lack of IB knowledge	44%	0%	70%	50%

In sample design, non-users and ex-users of IB were treated separately. However, when analyzing the data, the differences between these two groups were not significant. Instead of a division between non-users and ex-users of IB, the qualitative data analysis revealed a significant different between two other groups of non-users of IB, as shown in Table 4-3: *technology non-users* and *low involvement non-users*.

- *Technology non-users* justified their avoidance of IB on the basis of technology. These customers felt uncomfortable with technology, and some of them showed a purposeful avoidance of technology. They were worried about problems of depersonalization and possible social problems. This group had the oldest customers, with an average age of 56.

- *Low involvement non-users* justified their behavior on the basis of a lack of financial involvement with the bank. They felt that IB added little value to the service interfaces they already used. These customers were technology users, and in terms of attitude towards technology and evaluation of IB, they had strong similarities with the group of users. This group had the youngest customers, with an average age of 31.

Table 4-3: Personal characteristics associated with non-usage of IB by user group (Patrício et al. 2003c)

	% of IB regular users	% of IB stock users	% of IB technology non-users	% of IB low involvement non-users
Avoidance of new technologies	11%	0%	60%	0%
Insecurity and lack of privacy	56%	9%	50%	50%
Discomfort and lack of knowledge	22%	18%	60%	33%
Depersonalization /social problems	11%	9%	50%	33%
Lack of financial involvement	22%	18%	20%	67%
Average age of respondents	42	40	56	31
% of college graduates	77%	64%	40%	33%

Perceived performance appeared to be a key determinant of IB use. Security concerns and the negative issues associated with new technologies in general seemed to be the main reasons for non-technology customers avoiding it. However, IB's positive performance in terms of accessibility, convenience, time saving, and ease of use seemed to motivate time-poor, technology-oriented customers to use it, in spite of security concerns and a certain degree of depersonalization.

For IB users, service interface choice was a matter of fit between the operation at hand and the ability of IB to satisfy the needs so generated, as shown in Table 4-4. Financial operations that were considered routine, unimportant, low risk, and well known by customers—such as current account transactions—were usually undertaken in the IB or another automatic interaction channel.

Table 4-4: Financial operations associated with IB and BB (IB users) (Patrício et al. 2003c)

	Bank Branch	% of total	Internet Banking	% of total
Type of product	Current account deposits (not available on any other channel)	60%	Current account transactions and monitoring	85%
	Loan operations	50%	Stock operations	45%
	Financial investments	45%		
Stage of decision process	Evaluation of alternatives	60%	Transactions	90%
	Problem resolution	50%	Information search	60%
	Contracting	50%	Loan information	35%
Type of decision process	Extensive problem solving	55%	Routine operations	40%

For complex operations—such as mortgage loans—customers preferred personal interaction in the bank branch. Although IB users were willing to search for loan information through the Internet, when it came to evaluation of alternatives and contracting, they preferred the BB. As a woman aged 54, college graduate, and regular user of IB observed:

> For a mortgage loan, or for financial applications, the Internet is used more for information purposes. Because, if we want to make one of these things, we have to talk with someone, preferably someone we know personally, someone who gives advice, so we don't make big mistakes.

As Solomon et al. (1999) state, both the type of product and the stage of decision process seem to be important factors influencing the choice between automatic and personal interaction.

4.2.2. Customer evaluations of BB service experience

From the customers' perspective, the great advantage of BB is the experience of person-to-person interaction, which is expected to bring mutual knowledge, individualized attention, professional competence of employees, and responsiveness in non-routine situations.

The mutual knowledge that is created between the customer and the persons in the bank branch seemed to be an important factor underlying BB use for both users and non-users of IB. It seemed that mutual knowledge created the basis for mutual trust, which was seen as fundamental in the relationship between the customer and the bank. The relationship between the customer and the bank branch was then built on individualized attention, professional competence, and responsiveness in terms of decision making and problem solving. A non-user of IB – a male aged 45 and a college graduate – observed:

> The advantage of the bank branch is the personal contact, the knowledge we have of the persons who are on the other side of the branch. I don't say they make miracles, but in some circumstances, we know each other and we can use that capital of trust.

However, the bank branch had a negative side in terms of lack of convenience, lack of accessibility, and time loss. Given these disadvantages, customers tended to use the bank branch only when the need for personal interaction outweighed the inefficiency of this type of interaction. A woman aged 36, elementary school education, and IB regular user noted:

> I think the biggest disadvantage of the bank branch is the time loss. I go there only when I cannot take care of my financial matters in any other way.

BB performance evaluations also differed between users and non-users of IB, as shown in Table 4-5. Non-users of IB were more prone to point out the advantages of BB in terms of individualized attention, courtesy and mutual knowledge. On the other hand, IB stock users were particularly less enthused with these BB advantages, which may reflect the fact that these customers belong to a more demanding segment. It is interesting to note that low involvement non-users of IB were also less aware of BB advantages, which may reflect their lower involvement with the Bank.

Table 4-5: Evaluations of BB service experience across different user groups

Advantages associated with Branch Banking by user group

	% of IB regular users	**% of IB stock users**	**% of IB technology non-users**	**% of IB low involvement non-users**
Individualized attention	89%	45%	100%	50%
Courtesy	56%	0%	90%	33%
Mutual knowledge	67%	73%	90%	33%
Decision and resolution capabilities	44%	27%	60%	50%
Professional knowledge	78%	36%	50%	67%
Completeness of functionalities	44%	55%	40%	33%

Disadvantages associated with Branch Banking by user group

	% of IB regular users	**% of IB stock users**	**% of IB technology non-users**	**% of IB low involvement non-users**
Time loss	78%	64%	80%	67%
Lack of accessibility	44%	27%	60%	33%
Lack of courtesy	44%	0%	50%	50%
Lack of personalized attention	67%	0%	30%	30%

IB non-users were well aware of the time loss and lack of accessibility of the BB, and also pointed out the lack of courtesy and personalization of some bank branches. It therefore seems that IB users and non-users differed more in terms of their perceptions of BB advantages than BB disadvantages. As IB non-users valued more the personal contact dimension of BB, this advantage seemed to outweigh the time loss and lack of accessibility of this service interface.

4.2.3. Customer evaluations of TB service experience

Only five of the interviewees used the TB service regularly. For these customers, TB had the advantage of convenience and accessibility, as well as an intermediate level of personal service. The human contact provided by the operator was seen by these customers as an advantage in itself, and this was associated with the ability to provide answers to some questions or to solve some simple problems. A woman aged 36, elementary school education, and IB regular user noted:

> I think that the TB complements the IB service, because when I cannot get all the information I want in the Internet, I call the TB service, and they clarify my questions quickly, and I don't lose time going to the bank branch.

However, for the great majority of interviewees, TB performed poorly when compared with both the BB and IB. When compared with IB, TB seemed to bring little value in terms of functionalities. In addition, it did not have the feedback control provided through the IB visual and printing capabilities. Moreover, customers felt that they could not control the pace of the interaction as they could do with IB. IB users therefore preferred to undertake transactions and routine information monitoring through IB. A male aged 48, college graduate, and IB regular user observed:

> First, in the Internet I can take my time. Second, I can access the Internet banking at all time, day or night. Regarding telephone banking, I don't like to talk with someone who is telling me things that I have to write down. I prefer to see things on the screen, and I print them if I want to.

Compared with BB, TB lacked mutual knowledge, relationship continuity, and personalization—all of which seemed so important in building the mutual trust attained through personal interaction in the BB. Most customers therefore preferred to call directly to the BB if possible, especially for more important matters. A male aged 36, college graduate and IB regular user noted:

> [It is] one thing to contact my bank branch, where I have my account, and I know that answering on the other side, is person A, B or C, whom I know . . . [but it is another] thing to call something impersonal, to whom I give my password, and that

> person gives me all the information I need, but I have no idea who I am talking with.

It is interesting to note that situational variables appeared to be an important factor driving TB use. Situational variables were rarely mentioned to justify IB or BB use, but they appeared as a factor driving TB usage for 47% of interviewees. A woman aged 61, a college graduate and IB regular user noted:

> The telephone is useful [for some situations]. For instance, if I was using the Internet and wanted to do something, and it crashed, at a time when I could not go to the bank branch, and I really needed to know something.

A male aged 34, elementary school, technology non-user of IB, observed:

> Imagine that I go on vacation, and I cannot go directly to a bank branch, on weekends. In those situations I can use the telephone banking. It's one of those things: when I cannot go to the bank branch, I have to find someone who can attend me.

For most customers, TB was not a preferred service interface if other alternatives were available, such as IB or BB. However, the superior accessibility and convenience of TB made it the only interface available under some circumstances. Customers frequently associated TB use with situations of unavailability of other interaction channels, especially in urgent situations.

4.2.4. Customer evaluations of ATM service experience

Although customers considered that an ATM provided a narrow set of functionalities, they seemed to agree about the usefulness and adequacy of ATMs to undertake the available financial operations. Major advantages of ATMs were accessibility and speed of performance. A male aged 20, high-school graduate and IB non-user noted:

> Usually, we have an ATM nearby . . . As it offers all services, except for the special cases, when we need to go to the bank branch to talk with a person, we avoid going to a bank branch.

Security concerns and technical failures were mentioned as disadvantages of ATMs. However, security concerns in ATM use were more related to physical security issues, and not so much to the possibility of violation of information systems, as in the case of IB.

4.3. Discussion and implications for services marketing

The qualitative results showed that customers' attitudes towards technology and the intensity of their relationship with the bank influence the set of service interfaces regularly used, especially those that are technology-enabled, such as IB. The type of financial operation creates specific needs, which influence the choice of the service interface for each concrete operation. The performance evaluation of each service interface strongly influences its choice, and customers tend to use the one that performs best in satisfying the general and specific interaction needs that they have.

These results showed that customers generally use more than one service interface, reinforcing the need for an integrated approach to Internet service design. From the interviewees' perspective, no service interface satisfies all their needs, and each one has its advantages and disadvantages. When faced with a multi-interface service, customers tend to use the different interaction channels in a complementary way. A male aged 38, high-school graduate and IB stock trade user put it this way:

> I am a great fan of the IB service, but . . . the experience I have with the BB makes me think that the account manager in the BB is still an important person, at least for me.

Finally, the quality of each service interface depends on the service it provides, but also on the service other interfaces provide. Most IB users don't seem to be very bothered by the fact that IB is a less personalized interface. They use it in situations when personalization is not an issue (such as current account transactions), because they know that they can go to a BB whenever they need to have person-to-person interaction.

Furthermore, they are more likely to accept a lack of employees in the BB available for money transfers and deposits if they know there are self-service alternatives, even if these alternatives are located inside the branch. A male aged 53, high-school graduate and stock trade user of IB made this observation:

> The personalized service has no comparison with the relationship established through a computer, with the new technologies available. On the other hand, I understand that, if people didn't have those means, the branches would be packed with customers, and the service provided would be poor. So, we have both things, and each person chooses the one that is more advantageous.

It therefore seems that service providers should direct their efforts to a more integrated management of multi-interface service offerings. Managing Internet services with a multi-interface perspective helps service providers to design this service interface to better contribute to the overall service.

4.4. Discussion and implications for interaction design

As the results of the qualitative study showed, it is clear that customers do not express their preferences for each service interface with technology features and functionalities, but with the service experience they can get (Patrício et al. 2003b). In the customers' perspective, IB is usually seen as a more efficient interaction in terms of higher accessibility, convenience, ease of use and time saving. However, the view of IB as more efficient appears to be just one side of the overall perspective of the interviewees. IB also performs well in terms of usefulness of functionalities, quality and depth of information, autonomy and feedback control.

It is interesting to note that customers enjoy the control and autonomy of the service experience provided by IB, as they feel in charge of the interaction, which they can lead at their own pace. Feed-back control is also seen as an advantage of IB, which is related to its visual and printing capabilities, especially when compared with TB. Security concerns are still a major disadvantage of IB, both for users and non-users. IB users are still concerned with this problem, although it seems that IB advantages outweigh this issue.

The perceived service experience appears to be a key determinant of IB usage. IB perceived insecurity and the negative issues associated with new technologies in general seem to be the main reasons why non-technology customers avoid it. On the other hand, its positive performance in terms of accessibility, convenience, time saving, and ease of use, seem to motivate time poor, technology oriented customers to use it, in spite of security concerns and a certain degree of depersonalization.

The great advantage of BB interaction experience is the possibility of having person to person interaction, which is expected to bring mutual knowledge, individualized attention, and professional competence of employees, responsiveness in non-routine situations, and even some social interaction. On the other hand, the bank branch has a negative side in terms of lack of convenience, lack of accessibility, and time loss. However, not all customers have the same perceptions or the same needs. Data analysis showed that the importance given to certain attributes, such as efficiency or personalization, depends both on customer profiles and the type of financial operation being undertaken. As such, it is important to understand how Customer Experience Requirements (CERs) change according to different customer segments and use cases.

4.4.1. Experience requirements for different customer profiles

The customer groups found in the qualitative data analysis can be used to define user profiles, which is an important task of the interaction design process (Preece et al. 2002; Shneiderman and Plaisant 2005). As expected, user profiles appear as an important factor influencing IB use. Different customer groups have different service requirements and as such, they tend to define different patterns of service interface usage. Data categorization led to the identification of four user groups, according to the factors used to justify interviewees' usage or non-usage of the different interfaces. From this analysis, two dimensions of user profiles were found to exert a strong influence on the usage of Internet Banking: customer's openness to technology and intensity of relationship with the service provider. According to these two dimensions, four groups of customers were identified, with different interface requirements, as presented in Table 4-6.

Table 4-6: CERs for different segments of bank customers

Customer segments / user profiles	Most valued experience requirements
Regular Internet banking users (9 customers)	Ease of use Accessibility Time saving Convenience Autonomy Feedback control Usefulness of functionalities Information capabilities
Stock trading users (11 customers)	Completeness of functionalities Back-office response time Deepness of information
Technology non-users (10 customers)	Personalization Mutual knowledge between customer an the bank Individualized attention Courtesy of employees Responsiveness to customers' questions and requests.
Lack of involvement non-users (6 customers)	Ease of use Accessibility Convenience Time saving

- *Regular Internet banking users*: These customers use the Internet service mostly for information search and transactions, which are strongly associated with current accounts. Regular IB users value the efficiency side of IB interaction, but also its feedback control and information capabilities.

- *Stock trading users*: These customers use Internet banking intensively, especially for financial market's operations. These customers value the efficiency attributes of the Internet banking service, but as intensive users, they have strong demands for functionalities, information and back-office response. Stock trading users are more demanding customers, and value the completeness and deepness of information of IB.

- *Technology non-users*: In this group, IB non-usage is strongly associated with a negative attitude towards technology. These customers seem worried about the insecurity, loss of liberty and privacy, depersonalization, social problems, discomfort and lack of knowledge about new technologies. These customers value most the personal side of the interaction with the bank.

- *Lack of involvement non-users*: This group of non-users is very similar to IB users in terms of attitude towards technology and performance evaluation of technology enabled service interfaces, but their lack of involvement with financial products, or with the bank in particular, does not create the need to use IB. They even consider using IB whenever their relationship with the bank becomes stronger. This group is associated with younger customers, but also with non-loyal customers, who deal with most of their financial matters in another bank. In this case, the adoption of IB is not an interface issue, but a bank's involvement issue.

These qualitative results indicate that customer profiles influence customer general preferences for a certain service provision experience, and this seems to determine the set of service interfaces considered for regular usage. If cash-rich, time-poor customers give priority to the efficiency of the Internet, older customers favor the personal interaction provided in the bank branch.

Understanding experience requirements for the different customer segments can be useful both for interface design and service management. Service providers may customize each interface, in order to adapt to the specific needs of each segment and increase customer satisfaction with each service interface. But on the overall service level, service providers can also offer a combination of interaction channels to each customer, in order to attain a high overall satisfaction level.

4.4.2. Experience requirements for different essential use cases (EUCs)

From the analysis of the interviews, the type of financial operation seemed to be a key determinant of service interface use. If customer profiles defined the set of interfaces regularly considered for use, each customer then tended to choose a specific interaction channel according to the fit between the needs generated by the operation at hand and the ability of each service interface to satisfy those needs.

As already explained in Chapter 2, essential use cases (EUC) are particularly useful to understand customer interaction needs as they are independent from the platform through which the service is provided (Constantine and Lockwood 2001). As EUCs are technology independent, they are especially useful to elicit experience requirements when the same service is provided through different interface technologies. With EUCs, interface designers can identify customer requirements and make design alternatives at a stage when they have a more open set of design options, which may include the choice of the platforms or service interfaces that will offer the desired use case (Patrício et al. 2004).

Again, the marketing framework, especially in the consumer behavior area, provided tools to categorize and understand experience requirements for the different essential use cases. Previous studies point out that the Internet may be more suited for search and evaluation functions (Kolesar and Galbraith 2000; Peterson and Balasubramanian 1997), as well as transaction processing (Yakhlef 2001). As such, identifying the stage of the consumer decision process to which a use case belongs may help in identifying the most relevant experience requirements.

On the other hand, use cases may be further characterized in terms of the type of decision process, which is related to perceived risk, complexity, and frequency (Solomon et al. 1999). Self-service interfaces are usually associated with a higher degree of participation and autonomy by the user, and as such, decision process characteristics, such as perceived risk (Beckett et al. 2000; Keen et al. 2000), complexity and frequency (Krishnan and Ramaswamy 1999), are expected to influence Internet banking usage.

Data analysis results indicate that each essential use case is associated with different experience requirements, which influence strongly interaction choice (Patrício et al. 2003b). In the interviewees' perspective, financial operations which are considered routine, unimportant, low risk, and well known by customers – such as current account transactions - are usually undertaken in the IB, or other self-service technologies, although they are also available in the bank branch. For these kinds of financial operations, customers give priority to the efficiency attributes of the Internet, such as convenience, ease of use, time saving and accessibility, as shown in Table 4-7. A woman aged 54, college graduate and IB user put it this way:

> I make almost all my payments through the Internet. It's faster, I don't have to go anywhere, I don't have to send a fax or a letter. (…) I use the Internet because it is easy, I save time, I don't have to go to a bank for a money transfer or a cash withdrawal.

Table 4-7. Essential use case for gathering information of account balance

Essential use case	Basic functional-requirements Customer Intentions	 Bank responsibilities	Most important experience requirements
Gathering information about account balance	Request information of account balance	Provide information of account balance	Speed of delivery Accessibility Ease of use Convenience

For complex, unknown, important operations - such as mortgage loans - customers prefer the personal interaction in the bank branch, which is associated with mutual knowledge, individualized attention, and professional competence of employees that customers value in these situations, as shown in Table 4-9. A man, aged 48, college graduate and regular user of IB made this observation:

> When I apply for a loan of 30,000€, I like that a physical person is on the other side, not a computer. I don't like a depersonalized thing, I like to talk with a person and explain the situation, because there are always questions, and the information of the account manager is important.

For the same financial product, customers also use different service interfaces according to the stage of product usage. Information gathering for decision or monitoring purposes may be performed through the Web, even for mortgage loans. However, negotiation and contracting are usually undertaken in the BB, where customers can have person to person interaction, as shown in Table 4-9. A woman aged 54, college graduate and regular user of IB stated:

> For a mortgage loan, or for financial applications, the Internet is used more for information purposes. Because, if we want to make one of these things, we have to talk with someone, preferably someone we know personally, someone who gives advice, so we don't make big mistakes.

Table 4-8. Essential use case for mortgage loan application

Essential use case	Basic functional-requirements Customer Intentions	 Bank responsibilities	Most important experience requirements
Loan application	Request loan		Mutual knowledge between customer an the bank Professional knowledge Individualized attention Responsiveness to customer's questions and requests
		Request formal and informal information about customer	
	Provide information requested		
		Analyze information	
		Approve/reject loan	
		Propose loan conditions (amount, price, term…)	
	Accept/reject/negotiate loan conditions		

Information search has been traditionally seen as an area of service provision where the Internet has great potential. In fact, the results of the study indicate that one of the strongest uses of IB is information search for decision purposes and for account monitoring. However, besides the routine information and transactions, IB is also used for a more detailed analysis of customers' financial relationship with the bank. A man, aged 36, high-school graduate ex-user of IB, and user of a competitor bank, observed:

> People who access their bank at home have more time, more time to make a thorough analysis of accounts and sub-accounts, and all that. (…) Sometimes I am wondering by, seeing things that I even thought I did not have.

Table 4-9. Essential use cases for information gathering and evaluation of alternatives of mortgage loans

Essential use case	Basic functional-requirements: Customer Intentions	Basic functional-requirements: Bank responsibilities	Most important experience requirements
Information search on mortgage loan	Request information on mortgage loan conditions	Provide information on mortgage loan conditions	Deepness of information Clarity of information Autonomy Convenience Ease of use
Evaluation of alternatives of mortgage loan	Request information On loan conditions Analyze information: Comparing alternatives	Provide information on loan conditions Provide opinion on what alternative is most suited	Deepness of information Clarity of information Mutual knowledge between customer an the bank Professional knowledge Individualized attention Responsiveness to customer's questions and requests

4.4.3. Study Implications for service interface design

A large number of bank operations can now be functionally provided through the Internet, such as a simple view of current account balance, or the pre-approval of a complex mortgage loan. However, the study shows that, in spite of the availability of all these functions, customers are reluctant to undertake some operations through self-service technologies.

Each EUC previously described has a specific set of functional requirements, which are well studied, given the long tradition of the banking industry. The development of new technologies has made it possible to satisfy these functional requirements through Web interfaces, and has expanded the potential use of the Internet for service provision. However, more than just making services functionally available in new interaction channels, it is important to understand which CERs are associated with each user profile and EUC, in order to identify which service interfaces are best suited to provide the desired service, as shown in Figure 4-3.

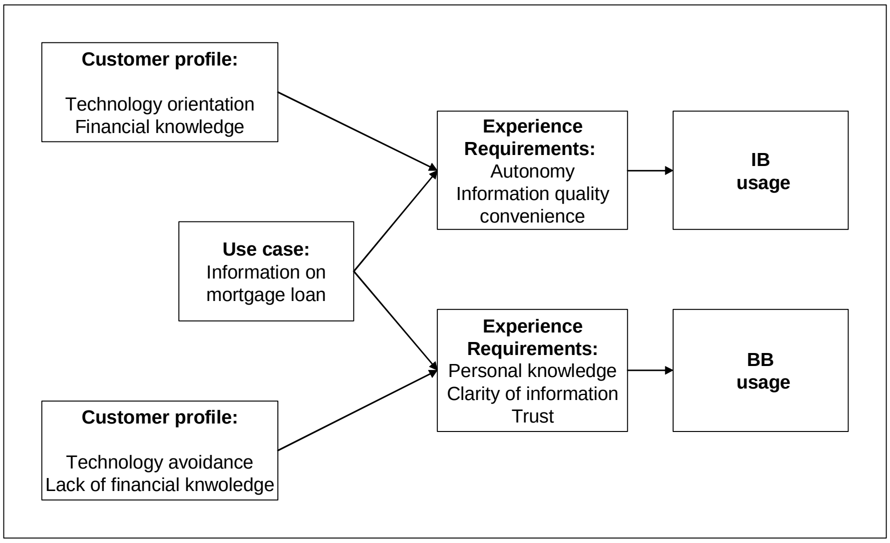

Figure 4-3 Example of the Influence of use cases and customer profiles in channel choice

Internet service provision creates a new interaction context, characterized by an open and uncontrolled environment - the market environment, and a different nature of interaction - service provision. These deep changes require a different approach to interaction design. As functional requirements are already well understood, experiences make the difference, and efforts should be made in improving the methods to address experience requirements in service interface design. In this regard, more attention should be paid to customer evaluations of the different service interfaces, according to customer perceptions and experiences, in order to understand how the different interaction channels can satisfy the requirements associated with different user profiles and use cases.

With the application of EUC, which allows the elicitation of experience requirements in a technology-independent way, each service interface can be designed to best contribute to the overall multi-interface service in an integrated way. With this analysis, service providers are better positioned to make their decisions on what services are best suited to each service interface before technology decisions are made. This approach helps service providers to effectively address customer needs and to make an efficient allocation of resources among service platforms.

4.5. Conclusion of qualitative study

The qualitative study provided a deeper understanding of customer satisfaction and usage of Internet services in a multi-interface context. These results could already be applied to identify which CERs were associated with the different user profiles and essential use cases (EUCs) under study. With this approach, service interface designers can better allocate resources among interaction channels in order to offer a satisfying overall customer experience.

The qualitative results supported the conceptual model already presented in Chapter 3, showing that its building blocks (customer characteristics, service characteristics and service interface performance) were important factors influencing customer satisfaction and usage of the different service interfaces in a multi-platform service environment. Moreover, the qualitative study provided valuable information to fill in the blocks, by identifying service interface experience requirements and performance attributes that could be relevant in a multi-interface service environment.

However, although the qualitative study offered an in-depth view of the phenomena, it did not allow for generalization of the findings. The qualitative sample was theoretically designed to include the different groups and perspectives that could enrich the analysis, but the results obtained could not be generalizable to the overall population of bank customers. Nevertheless, the qualitative results had a critical contribution to the overall study, as they provided a sound basis for the quantitative stage that followed in the research plan. This exploratory study provided a sound basis for establishing a sample of measurement indicators for the domain of the concepts under study, which were further used in the quantitative stage, and reinforced the hypotheses formulated in the conceptual model.

5. Quantitative study

5.1. Conceptual model and research design for quantitative analysis

The literature review offered a diversified view of the factors underlying customer satisfaction and usage of technology enabled service interfaces, providing the framework for the development of the dissertation conceptual model. As no previously developed measures existed to address the concepts under study, the qualitative study offered a deeper understanding of the phenomena and identified a large sample of indicators that could be potentially relevant for measuring the intended constructs. These previous stages provided a sound basis for the quantitative study that followed, as shown in Figure 5-1.

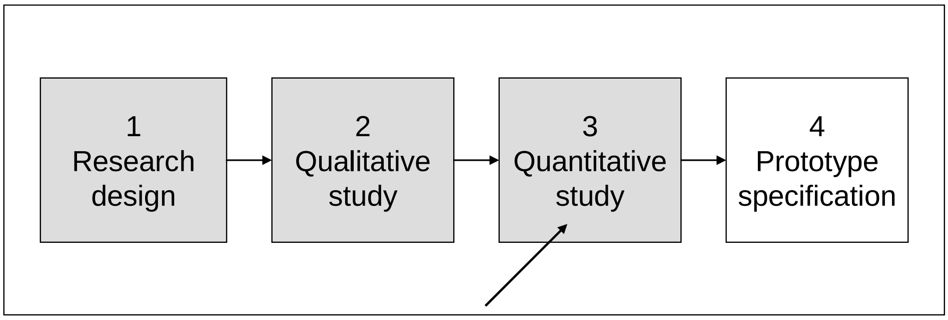

Figure 5-1: The quantitative stage of research

The research focused on understanding Internet services satisfaction and usage, from multi-interface and multidisciplinary perspectives. The conceptual model for the qualitative study previously presented in Figure 3-1 defined the broad dimensions of factors influencing service interface satisfaction and usage: customer characteristics, service characteristics and performance evaluation of each channel. The qualitative study provided a better understanding of this process, as well as the identification of potential attributes relevant for each broad dimension previously defined.

However, this model was too broad to be operationalized into a survey instrument for the quantitative stage. Each of the three broad dimensions would require a specific study to be well understood. Therefore, the boundaries of the quantitative study were narrowed in order to find a balance between the research objectives and the maintenance of a manageable degree of research complexity.

The multi-platform approach and the multidisciplinary perspective were crucial for the study. The initial conceptual model hypothesized, and the results of the qualitative study supported, the idea that customer characteristics and service characteristics influenced customer interaction experience requirements. Satisfaction was influenced by the fit between those requirements and the ability of each service interface to satisfy them. Therefore, it was necessary to measure both customer interaction needs and service interface performance on the same battery of attributes.

The qualitative study also indicated that two types of requirements could be identified:

1. Customer *general interaction experience requirements* were associated with the general relationship established between the customer and the bank throughout a set of interactions. These general experience requirements seemed to influence the mix of service interfaces regularly used by customers and their general satisfaction with each one of them.

2. Customer *specific interaction experience requirements* were related to specific financial activities. For each concrete financial operation, customers had specific requirements that were strongly influenced by the type of financial activity at hand. If customers had a general pattern of service interface usage, for each concrete interaction they chose the one that was best suited to the needs generated by the specific situation at hand.

Having in mind the balance between the research objectives and the need to clearly define the research focus, two conceptual models were developed for the quantitative research, which served as the basis for two surveys. Figure 5-2 presents the model for service interface profile. In this model, it is hypothesized that customer satisfaction of each service interface is influenced by the fit between customer general experience needs and the performance evaluation of interaction channel.

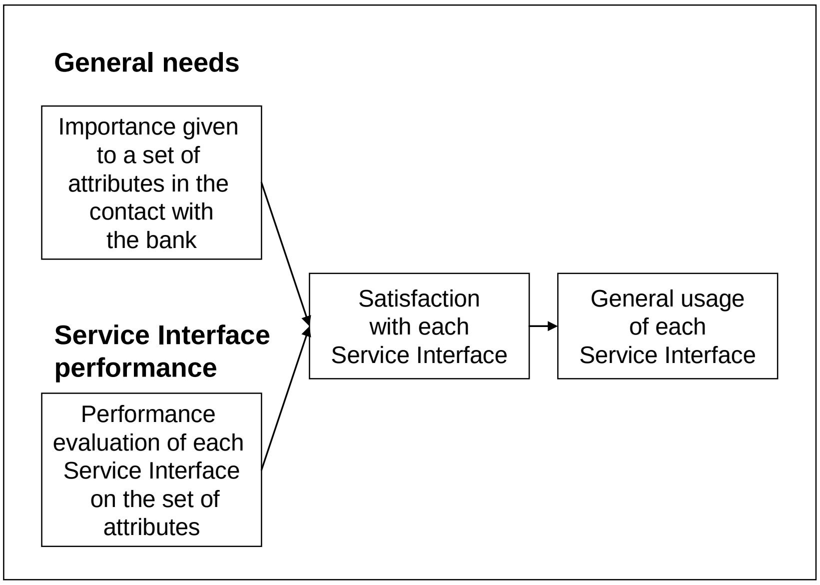

Figure 5-2: Model for telephone survey questionnaire: Service Interface Profile

In order to better understand the usage of the different service interfaces in a multi-interface service, both users and non-users of IB and TB were included in the survey sample. All customers responded to the needs section, where they stated the importance given to a set of attributes in their general interactions with the bank. Each group of service interface users then responded to questions regarding the evaluation of the interaction channels they used. As half of the sample was non-users of Internet banking, the survey was administered by telephone, as it was the most effective medium to interview the different groups.

Figure 5-3 presents the conceptual model for understanding Internet banking satisfaction and usage for specific financial activities. The qualitative results indicated that for the same customer, interaction needs for mortgage loan applications and gathering current account information were quite different. This model hypothesizes that the fit between customer specific interaction needs and service interface performance will influence satisfaction and usage of Internet banking for the financial activity at hand.

In the Web survey, only IB users were included in the sample, as they were the only group that could evaluate the adequacy of IB for the different financial service purposes. In these circumstances, a Web survey was considered adequate, as it enabled the access to the population of interest. However, as questionnaire length is even more important in e-mail surveys than in telephone surveys, the questionnaire focused only on Internet banking performance, although general satisfaction and usage was also measured for the other service interfaces.

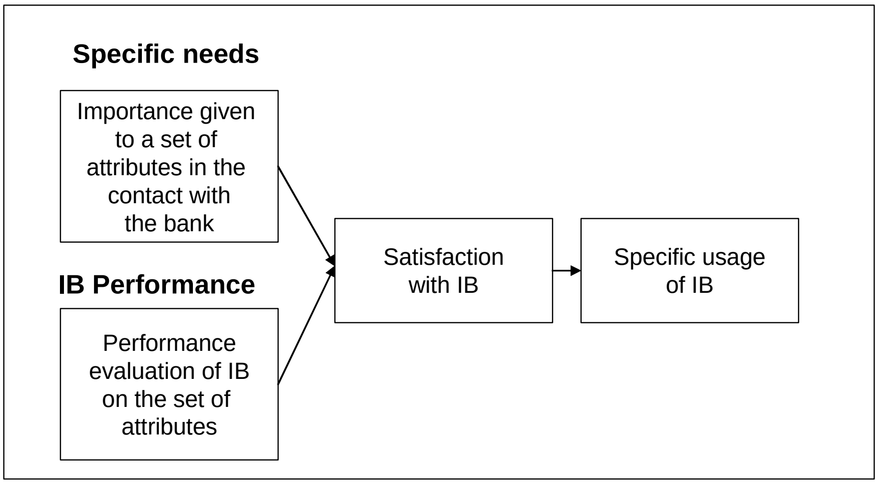

Figure 5-3: Structure of Web survey questionnaire: Internet banking needs vs. performance

Both models gave rise to long survey questionnaires. In the telephone survey, users of both IB and TB would answer to a battery of needs questions and would rate the four service interfaces used (IB, TB, BB and ATM). In order to maintain the multi-interface focus, it was necessary to clearly define the boundaries of the study. A primary research objective was to understand the factors driving SSTs usage, aiming to provide guidance for interaction designers. Thus, the quantitative study focused on the identification of customer requirements and the performance evaluation of the different interaction channels. Both survey instruments included some questions regarding customer characteristics and service characteristics, but the survey questionnaire focused on customer needs and service interface performance.

5.2. Methodology for quantitative study

The extant literature on Internet service quality and satisfaction by the time of survey design was scarce, and multi-channel studies were practically inexistent. Therefore, the constructs addressed in the quantitative study were based both on previous research from related fields, and the results of the qualitative study. The theoretical sample of the qualitative study provided in-depth and rich information about Internet services, but it did not allow generalization of the findings. Nevertheless, these results served as a strong basis for the development of the survey instruments used in the quantitative stage that followed.

The telephone survey aimed at understanding general usage of the different service interfaces, involving a battery of questions regarding customer general interaction needs and performance evaluation of the four interaction channels. The Web survey aimed at understanding Internet banking usage for specific financial operations, including a group of questions regarding customer interaction needs associated with a specific financial activity, and Internet banking performance evaluation. These two surveys provided a complementary view of Internet banking usage for general and specific interaction purposes. As no previously developed and tested measures could be used, the study involved the development of measurement scales for interaction needs and service interface relative performance evaluation, following several steps, as shown in Figure 5-4.

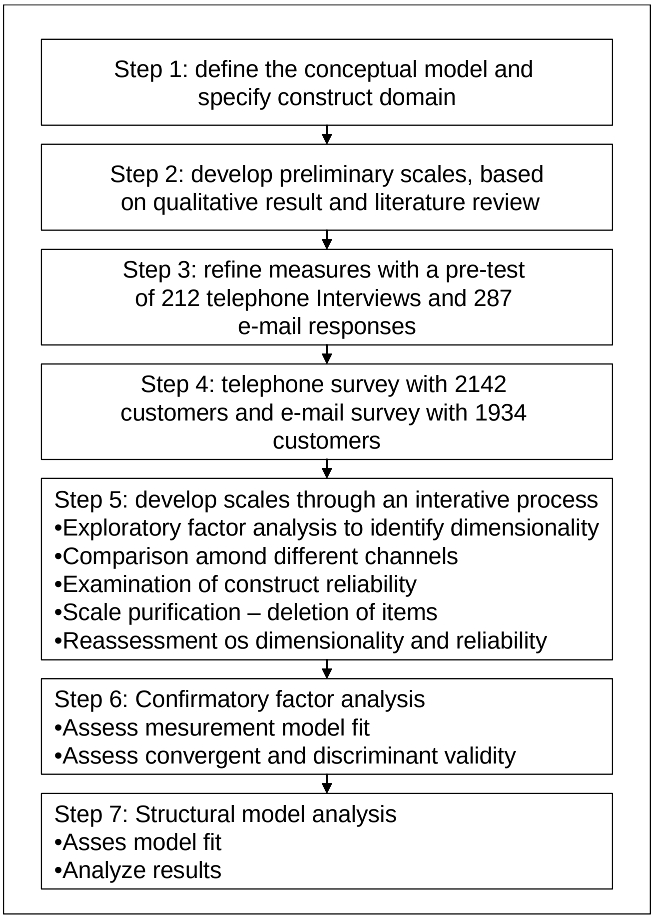

Figure 5-4: Steps of quantitative study

First, the conceptual model and construct domain were defined, as previously explained in the Conceptual Background chapter. Then, based on the literature review and the qualitative study presented in Chapter 4, the preliminary scales were developed. These scales were first refined through a qualitative pre-test and a pilot test, with the re-wording and deletion of some items.

The final telephone and Web surveys allowed further development of the measurement scales through an iterative process, involving exploratory factor analysis (EFA). The overall sample was split into a calibration sample and a holdout sample, and the EFA was undertaken with a calibration sample. Although the qualitative study and the literature review guided the selection of items for the questionnaire, the EFA helped in identifying the underlying dimensions, purifying the scales, and interpreting the factor structure (Churchill 1979). Each of the iterations involved the assessment of scale dimensionality and reliability, with a comparison across service interfaces, to find measures of needs and performance that could be used across the different interaction channels.

When a stable factor solution was found, the process continued through Confirmatory Factor Analysis (CFA) with the holdout sample, to assess the measurement model fit, construct convergent and discriminant validity (Fornell and Larcker 1981; Gerbing and Anderson 1988). The CFA was undertaken using Structural Equation Modeling (SEM) techniques using LISREL 8.7. After identifying the dimensions of service interface performance evaluation and validating the measurement model, the process continued with a structural equation modeling approach, analyzing the relationships between constructs, following the four-step approach (Mulaik and Millsap 2000). Specifically, the study analyzed:

- The relationship between customer interaction needs for specific financial activities, IB performance and IB satisfaction and usage for that specific financial operation (Web survey).

- The relationship between customer general interaction needs, service interface performance, satisfaction and usage (telephone survey);

- The contribution of each service interface to customer satisfaction with the overall service (telephone survey).

In the SEM analysis, after assuring that the structural model had acceptable fit, the results are discussed, and the implications for both services marketing and interaction design are analyzed.

5.3. Sample design

The two surveys required two different samples. In the telephone survey the aim was to develop a service interface profile, understanding customer general satisfaction with the different interaction channels used in the overall service offering. As IB and TB users still represented a small percentage of bank customers, a non-proportional stratified sample was defined, in order to obtain enough respondents from each user group.

No stratification was made in terms of BB and ATM users, because these service interfaces are heavily used in Portugal. In the case of the BB, the great majority of customers use it, at least to open the account, and it's the only interaction channel where some important financial operations are available. In the case of the ATM, the penetration rate in Portugal is above 90%, and the bank automatically allocates an ATM card for every opened account. Therefore, it was assumed that almost all customers used these two service interfaces, and no stratification was needed in this regard. Using the information provided by the bank, the following criteria were used to select the sample:

- Customers were considered IB or TB users if they had used the service interface at least once in the previous 6 months.
- Other restrictions were applied to the sample :
    - Age between 18 and 65 years old.
    - Education level above elementary school.

These restrictions were applied as the survey pretests showed that customers above 65 and below elementary school had more difficulty in responding to the questionnaire. As the study focused on technology enabled service interfaces, it was thought that theses restrictions would not reduce the impact of study results.

The objective was to attain at least 400 responses, to attain a ratio of 10 respondents per variable indicator, as recommended by (Hair et al. 1998). In the telephone survey, from an overall sample of 5931 customers, 2142 usable responses were obtained, which represents a response rate of 36.1%. It is interesting to note, however, that from the customers who were effectively contacted, 83% completed a usable questionnaire. The responses per user group were the following:

- Users of both IB and TB (IBuTBu)– 585
- Users of IB and non-users of TB (IBuTBnu) – 616
- Non-users of IB and users of TB (IBnuTBu) – 549
- Non-users of both IB and TB (IBnuTBnu) – 392

Analyzing the socio-demographics of the telephone survey global sample, and comparing them with the target bank population, no major differences were found in terms of gender distribution, but the sample had a higher level of education, income and intensity of usage of the bank's products. As can be seen in Table 5-1, the sample comprised 59% males, an average age of 36 years old, and 36% were college graduates. However, analyzing the socio-demographics by user group, it can be seen that this difference may be in great part due to the non-proportional stratification in terms of user groups.

Comparing IB users with non-users, IB users had higher income and education levels, used the bank's products more and had a higher percentage of males. It is interesting to note that there were no such differences between TB users and non-users. In fact, customers who used TB and did not use IB were the only group with a higher percentage of women (54%) and were also the oldest group. In terms of income, education and bank products' usage levels, this group was closer to non-users of both IB and TB, than to users of both IB and TB.

For the Web survey, the target population was only IB users, as the aim was to study IB satisfaction and usage for specific financial operations. The Web survey respondents' demographics should be close to IB users and TB non-users group, as the percentage of IB users who also use TB is quite small. However, the difference between these respondents and the global telephone survey sample was higher in terms of income, education, percentage of males and bank usage.

Table 5-1: Sample demographics

	Telephone survey					Web survey
	global	IBuTBu	IBuTBnu	IBnuTBu	IBnuTBnu	
n	2142	585	616	549	392	1934
Gender						
M	59,1%	62,9%	70,0%	46,0%	55,0%	72,8%
F	40,9%	37,1%	30,0%	54,0%	45,0%	27,1%
Age (average)	36,2	35,2	34,7	38,8	36,8	35,3
Education						
elementary school	19,8%	9,2%	10,7%	30,9%	33,6%	5,5%
high-school	44,1%	44,3%	44,7%	42,4%	45,0%	32,1%
college degree	36,2%	46,4%	44,5%	26,7%	21,3%	62,4%
Monthly income (€)						
<= 650	25,3%	16,9%	21,5%	24,9%	44,4%	10,2%
650-1250	40,9%	43,2%	39,1%	45,2%	34,2%	34,0%
1250-2250	22,7%	24,4%	28,2%	22,5%	12,0%	34,7%
2250-4000	6,9%	10,2%	8,5%	4,0%	3,1%	16,3%
>4000	1,1%	2,3%	0,7%	0,8%	0,3%	3,7%
Bank usage						
Low	27,6%	22,9%	25,3%	24,3%	42,7%	12,9%
Medium	42,9%	41,1%	44,7%	45,8%	28,7%	33,0%
High	29,3%	35,8%	29,8%	29,9%	17,9%	54,0%

To understand how interaction needs and IB satisfaction changed across different financial activities, a stratified sample was defined, covering 12 different financial operations. To ensure that customers knew the financial operations they were evaluating, the following segments were defined:

- Segment A: all customers not included in the other segments.
- Segment B: customers owning stock trade investments.
- Segment C: customers owning mutual funds investments.
- Segment D: customers with mortgage loans, having made the application in the previous 3 years.

- Segment E: customers owning at least one credit card that they used at least once in the previous year.
- Segment F: customers with personal loans, having made the application in the previous 3 years.

Each group of customers answered to a questionnaire regarding a specific financial activity, as shown in Table 5-2. In the Web survey sample, as it was known that IB users were younger and higher educated, no further restrictions applied to the sample. In order to be able to compare different financial activities, an objective sample of 100 responses per financial operation was defined. From 14.173 e-mails sent, 1934 usable responses were obtained, evenly distributed by financial operation, with a response rate of 13.7%.

Table 5-2: Distribution of Web survey sample

Segment	Financial activity or Essential Use Case (EUC)	nºcases
A	Current account information gathering	177
A	Money transfer from current account	184
A	Current account problem solving	148
B	Information gathering on stock investments	132
B	Stock trading	130
C	Information gathering for mutual funds investments	156
C	Mutual funds buying	158
C	Mutual fund selling	163
D	Information gathering on mortgage loan	174
D	Mortgage application	192
E	Credit card application	156
F	Personal loan application	164
	Total	1934

The sample stratification according to the financial activities used by each segment assured that respondents knew the financial activities they were talking about and allowed the study of different financial activities. This stratification can also explain the differences between the telephone survey and Web survey samples in terms of socio-demographics. As customers were selected according to their usage of the bank's financial products, such as stock trading, mutual funds and loans, it is reasonable to believe that these customers had a stronger relationship with the bank, higher income and education level.

Although the stratification which was applied to the telephone and Web surveys implied that the sample was different from the overall population of bank customers, it nevertheless allowed a richer comparison in terms of user groups and financial operations. Taking into account the research objectives, it was considered that these benefits outweighed the potential disadvantages.

5.4. Survey development and administration

"Although much progress has been made, designing questionnaires is still an art and not a science" (Churchill and Iacobucci 2002). In this difficult task, the admonitions of experts are crucial for the less experienced researchers. The survey development and administration built upon the existing recommendations for scale development and survey questionnaire design (Churchill and Iacobucci 2002; Converse and Presser 1986), with particular attention to Web survey design (Dillman 2000).

Survey pre-tests

The survey questionnaires covered the main attributes of CERs and satisfaction with service interfaces deemed relevant in the literature review and qualitative results, with the objective of avoiding misspecification error in the model. However, due to the multi-interface approach, it was necessary to find a balance between coverage and questionnaire length. Therefore, the battery of attributes was limited to a manageable number and the questions were formulated in a way that could apply across the four service interfaces, to allow comparisons.

The telephone survey was administered through the Bank's call center, and the Web survey was sent by the Bank. This cooperation allowed access to socio-demographic and service interface usage data that provided better sample stratification. The Bank's survey administration allowed a better access to customers and assured the confidentiality of customer information, as the researcher had only access to a respondent number and the respective socio-demographics. This anonymous access to customer data also avoided to burden customers with questions about information that the bank already had.

Both the telephone and Web questionnaires were developed taking into account conventional design guidelines (Churchill 1979; Churchill and Iacobucci 2002; Dillman 2000). The question wording was kept simple and negative worded items were avoided. The Web questionnaire was carefully designed in order to facilitate customer response.

The survey was subject to several pretests, as recommended by (Dillman 2000). The first versions were tested with a convenience sample, were revised by specialists within the areas of scale development and marketing, and were also reviewed by key elements of the Bank. Then, a first qualitative pre-test was made through telephone to a set of 20 customers. The researcher, to detect unclear questions and misunderstandings, listened to all telephone interviews and several questions were re-worded. Older customers with low education levels had trouble understanding and answering the questionnaire, so some restrictions were applied to the studied population in terms of age and education, as explained in the sample design above.

The second pretest involved a pilot study with both telephone and Web surveys with 212 and 287 customers, respectively. The telephone survey questionnaire ranged from 63 questions for non-users of both IB and TB, to 108 questions for users of both IB and TB. A significant part of the telephone interviews were listened to by the researcher, in order to monitor interviewers' performance and provide feedback, using recommended techniques for monitoring interviews (Cannel and Oskenberg 1988). This process also contributed to identifying further refinements in question wording.

This time, the focus was on analyzing response rates, item variability, and to make a first exploratory factor analysis of the scales. From the analysis of the interviews and the data, it was concluded that the telephone questionnaire was too long. An effort was made to reword the items in order to facilitate understanding and answering. The exploratory factor analysis of the data using SPSS provided insights for scale purification, eliminating items that had high loadings on several dimensions, did not fit into any dimension, or did not contribute to construct reliability.

Telephone survey instrument

In the end, the questionnaire ranged from 61 questions for non-users of both IB and TB to 92 questions for users of both IB and TB. The telephone survey questionnaire for both users and non-users can be seen in Table 5-3. In the telephone survey, perceived performance questions were repeated for each service interface used, except for the ones related to personal contact, which only applied to BB and TB. For all questions, an option "don't know/don't respond" was available.

Table 5-3: Final telephone survey instrument

Customer characteristics
((0) totally disagree, (10) totally agree)
Technology readiness
I like to use the most recent technologies available
New technologies make more efficient in my professional life
New technologies are easy to use
Type of financial services used
I take care of my financial matters frequently
My financial matters are routine
Customer general interaction needs
(When I interact with the bank, it is extremely important for me -
(0) totally disagree, (10) totally agree)
To take care of my financial matters at my own pace
To get complete information for my needs
To get information that I can understand clearly
That all operations I need are available
To take care of my financial matters when it is more convenient for me
To take care of my financial matters without having to go very far
To take care of my financial matters easily
To take care of my financial matters quickly
To verify the result of what I do
That my instructions are done without failure
That my contact with the bank is safe
To talk to someone knowledgeable in financial matters
To talk to someone I can trust
To receive a personalized treatment
To know personally who is on the bank's side
To receive a nice and courteous treatment

Final telephone survey instrument (continued)

Service Interface performance
(In this SDS - (0) totally disagree, (10) totally agree)
I take care of my financial matters at my own pace
I get complete information for my needs
I get information that I can understand clearly
All operations I need are available
I take care of my financial matters when it is more convenient for me
I take care of my financial matters without having to go very far
I take care of my financial matters easily
I take care of my financial matters quickly
I can verify the result of what I do
My instructions are done without failure
My contact with the bank is safe
I talk to someone knowledgeable in financial matters
I talk to someone I can trust
I receive a personalized treatment
I know personally who is on the bank's side
I receive a nice and courteous treatment
Satisfaction with Service Interface
((0) totally dissatisfied, (10) totally satisfied)
How satisfied are you with the service interface?
Service Interface usage
((0) never, (10) several times a day)
How frequently do you use the service interface?
Satisfaction with the Bank overall service
((0) totally dissatisfied, (10) totally satisfied)
How satisfied are you with the Bank's service?
Bank loyalty
((0) 0%, (10) 100%)
What percentage of your financial matters is dealt with this bank?
((0) totally disagree, (10) totally agree)
Would you recommend this bank to a friend?
The next time you need to take care of your financial matters, will this bank be your first choice?

The Web survey was shorter, involving 65 questions, as shown in Table 5-4. Although the Web survey focused on IB performance, overall satisfaction and usage of the different service interfaces for the specific financial activity under evaluation were also included. The questionnaire was carefully designed in order to facilitate customer navigation and response, according to design (Dillman 2000) and usability principles.

The pilot test provided suggestions in terms of questionnaire redesign for the Web survey. The exploratory factor analysis also contributed to scale refinements and item rewording, and the final version of the questionnaire had 57 questions. As the research aimed at comparing IB general and specific usage, the results of the two pilot tests were used in this process of scale refinement, in order to develop comparable measurement scales.

Table 5-4: Web survey instrument

Customer characteristics
((0) totally disagree, (10) totally agree)
I like to use the most recent technologies available
New technologies make more efficient in my professional life
New technologies are easy to use
Type of financial activity
This financial activity ((0) totally disagree, (10) totally agree)
Involves a high financial risk
Is a routine operation for me
Is very important for my personal life
Is a complex operation for me
Is an activity that I undertake frequently
Customer general interaction needs
(When I interact with the bank to undertake this financial activity, it is extremely important for me - (0) totally disagree, (10) totally agree)
To take care of my financial matters at my own pace
To get complete information for my needs
To get information that I can understand clearly
That all operations I need are available
To take care of my financial matters when it is more convenient for me
To take care of my financial matters without having to go very far
To take care of my financial matters easily
To take care of my financial matters quickly
To verify the result of what I do
That my instructions are done without failure
That my contact with the bank is safe
To talk to someone knowledgeable in financial matters
To talk to someone I can trust
To receive a personalized treatment
To know personally who is on the bank's side
To receive a nice and courteous treatment
IB performance
(In the Internet banking service - (0) totally disagree, (10) totally agree)
I take care of my financial matters at my own pace
I get complete information for my needs
I get information that I can understand clearly
All operations I need are available
I take care of my financial matters when it is more convenient for me
I take care of my financial matters without having to go very far
I take care of my financial matters easily
I take care of my financial matters quickly
I can verify the result of what I do
My instructions are done without failure
My contact with the bank is safe
I receive a personalized treatment

Web survey instrument (continued)

Satisfaction with each service interface for the specific financial activity
((0) totally dissatisfied, (10) totally satisfied)
How satisfied are you with the SDS?
Service interface usage for the specific financial activity
((0) never, (10) always)
How frequently do you use the service interface to undertake this financial activity?
Satisfaction with the Bank overall service
((0) totally dissatisfied, (10) totally satisfied)
How satisfied are you with the Bank's service?
Bank loyalty
((0) 0%, (10) 100%)
What percentage of your financial matters is dealt with this bank?
((0) totally disagree, (10) totally agree)
Would you recommend this bank to a friend?
The next time you need to take care of your financial matters, will this bank be your first choice?

Questionnaire sections and scale types

In the end, the two questionnaires included the following sections: customer characteristics, financial activity characteristics, interaction needs or experience requirements, service interface performance, service interface satisfaction and usage, and bank satisfaction and loyalty. As service interface performance evaluation was the focus of the study, this section was the longest one.

Regarding customer characteristics, both the literature review on technology adoption and the qualitative results stressed the importance of customer attitude towards technology. Parasuraman (2000) developed the Technology Readiness Index, which measures consumer readiness to adopt technology, and found that its components (optimism, innovativeness, discomfort and insecurity) were strong predictors of technology adoption behaviors. Therefore, some items of this scale were adapted and used in the questionnaire.

The influence of the type of decision process on consumer buying behavior is well established in the consumer behavior field (Solomon et al. 1999). Both previous research and the qualitative study indicated that SSTs were more suited for simple and routine services, whereas complex and extensive problem solving situations still required the personal contact of the bank branch. Therefore, some questions were included to characterize both customer general relationship with the bank and the specific financial operations in a continuum from routine response behavior to extensive problem solving.

The section of customer interaction needs and channel performance aimed at measuring the performance factors influencing service interface satisfaction in a multi-platform setting. Therefore, these constructs did not aim to measure overall e-service quality, such as eTailQ or E-S-Qual. The domain of these later two measures is the quality of the overall Internet service, from beginning to end, while the dissertation research concentrates on the frontstage and interaction component of service provision.

The domain of this study is different from eTailQ and E-S-Qual as it focuses on those factors that are relevant in evaluating and choosing each service interface in the context of a multi-channel offering. Therefore, in the present study, service recovery provided by other service interfaces is not modeled as being a component of Internet banking performance, but as a component of bank branch or telephone banking performance. Similarly, back-office operations and service fulfillment are not considered in this context, as these components of the service are common to all interaction channels and are therefore less relevant to the relative evaluation of the different service interfaces.

To allow a comparison between different service interfaces, the telephone survey asked customers to rate all the interfaces they used. This meant that users of both IB and TB would respond to five batteries of questions, regarding interaction needs, and performance evaluation of the four service interfaces used. As explained before, it was assumed that all customers would use the other two service interfaces, as ATM and BB usage rates are above 90%.

In order to maintain questionnaire length at an acceptable level, the battery of attributes had to be chosen very carefully. With this multi-interface research design, the full exploratory approach advocated by Churchill (1979) of eliciting a large number of scale items to conduct a first survey in order to purify the measure was not completely viable. Therefore, the questionnaire items were chosen having in mind a balance between questionnaire length and the incorporation of all potential relevant factors previously identified in the literature review and qualitative study.

The majority of survey questions used a Likert scale type, with the anchors: 0 (totally disagree), 5 (neither agree nor disagree) and 10 (totally agree). The 0 – 10 scale was chosen as it is commonly used in Portugal. Due to questionnaire length, it was decided to measure service interface global satisfaction with a single item, in a 0 – 10 scale, ranging from 0 (completely dissatisfied) to 10 (completely satisfied).

Although single-item constructs pose limitations to the research, as attitudes are more rigorously measured with multi-item scales (Nunnally and Bernstein 1994), the use of traditional scales for satisfaction with 5 items, such as Oliver's satisfaction scale, (Oliver 1980) would increase questionnaire length by 25 questions (5 four each of the four service interfaces, plus 5 for satisfaction with the bank). Bank global satisfaction was also measured with a single item scale, similar to service interface satisfaction, and bank loyalty was measured with a three item scale adapted from Zeithaml et al. (1996).

Service interface usage was measured with 0 to 10 point scales. The telephone survey model measured general service interface usage, and as such, customers were asked to rate their usage in a scale ranging from 0 – never, to 10 – several times a day. In the Web survey, service interface usage was measured for specific financial activities, and as such, customers were asked to rate their usage from 0 – never use this service interface for the specific financial activity, to 10 – always use the service interface for the specific financial activity.

Administration of final surveys

The final telephone survey was administered in March 2004, in a one week period. Four attempts were made at different time schedules before the customer was considered a non-response. The Computer Aided Telephone Interviewing (CATI) system helped managing the survey administration process. Although the telephone interviewers were experienced elements of the Bank's call center, they were nevertheless specifically trained for this survey. The first days of the survey were also monitored by the researcher, in order to assure that survey administration was undertaken as desired.

The Web survey was administered in two waves, separated by two weeks. Each customer received an e-mail from the bank, inviting him or her to participate in the study jointly undertaken with the University. The e-mail provided a link to the Web survey, which was locked after the first response from the customer. This process assured that the questionnaire was answered by the intended customers, and no duplicate responses were collected.

In spite of the recommendations to make several attempts to contact customers in order to achieve satisfactory response rates in self-administered surveys (Dillman 2000), this was not deemed possible. The Bank was concerned with overburdening customers with several e-mails, especially because it usually contacts customers through this medium for other purposes. Therefore, only one e-mail was sent to the customers, and the survey was made available for two weeks.

5.5. Preliminary data analysis

First, the data was subject to a preliminary analysis, to identify the nature of the distribution of variables. All variables had a mean on the right hand side of the scale, with a negative skewness and a positive kurtosis. This response pattern has been reported in other satisfaction and service quality studies (Wolfinbarger and Gilly 2003). In the case of non-normality, it is recommended to increase sample size from 10 to 15 respondents per indicator (Hair et al. 1998), which was attained in the study.

Missing Value Analysis (MVA) revealed no significant problems. The only variable with significant missing values (MV) was satisfaction with TB for specific financial operations in the Web survey, which was missing for 23% of respondents. Analyzing the other questions, it could be seen that satisfaction was missing because customers did not use TB for the financial activity in question, and as such they were not able to rate their satisfaction. This also happened with IB and BB, but missing values did not exceed 8%. As the most important comparison was between IB and BB, the questions related to TB specific satisfaction and usage were dropped from the analysis.

After dropping TB satisfaction and usage questions in the Web survey, no major MV problems remained. In the Web survey, besides satisfaction with IB and BB, which had 8% and 7% MV respectively, no other question had more than 1% MV. In the telephone survey, with the exception of two questions regarding

TB performance, which had 5% and 6% MV, no other question had more than 2% MV.

As tests indicated that the process was not Missing Completely at Random (MCAR), the EM estimation method of SPSS 12.0 for missing value replacement was used. This procedure explicitly incorporates missing data into the analysis, and is recommended in non-MCAR situations (Hair et al. 1998). The EM estimation method used by SPSS is an iterative two-stage method, in which the E-stage makes the best possible estimates of the missing data and the M-stage then makes the best possible estimates of the parameters (means, standard deviations, or correlations), assuming that the missing data were replaced. The process continues iteratively until the change in the estimated values is negligible.

The EM model for missing value replacement assumes that the data is continuous. However, there is some debate on how to treat data collected through Likert scales. It is generally accepted that Likert scales only produce ordinal data (Nunnally and Bernstein 1994), as the difference between subsequent levels of agreement or disagreement is not equal. However, scales using numbers (such as the ones used in the survey), with anchors such as 0 – completely disagree to 10 – completely agree, make a better approximation to interval scales. In this case, if it is reasonable to assume that the measure approximates interval level characteristics, it is acceptable to treat it as continuous, and the variables can be effectively analyzed using statistical methods that assume interval level properties (Jaccard and Wan 1996). Therefore, the variables were treated and analyzed as continuous.

CERs importance and service interface relative performance

After this preliminary analysis, the data descriptives provided some interesting information regarding the comparison of the different service interfaces, as can be seen in Figure 5-5. First, security and reliability are considered the most important attributes, with averages of 9.7 and 9.5 in a scale from 0 to 10. This is understandable as security and reliability are considered basic requirements, and some studies have found that they act more as dissatisfiers than satisfiers (Johnston 1997).

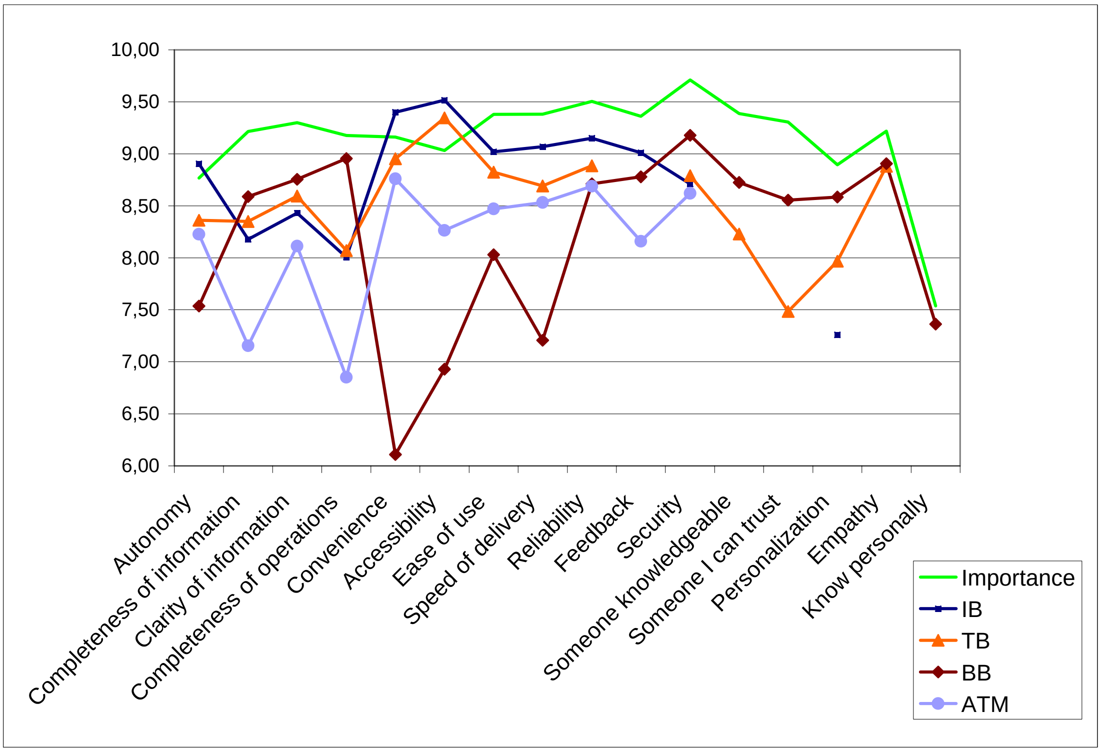

Figure 5-5: Attribute importance and service interface performance evaluation

On the other hand, knowing personally who is on the bank side and personalization are the least important attributes, with averages of 7.5 and 8.9. It is interesting to note, however, that these attributes are also the ones with the highest standard deviations. This indicates that whereas customers are not very different in the way they rate the importance of other interaction needs, more significant differences emerge in their needs for personal contact.

In the qualitative findings, some customers considered knowing personally who is on the bank's side as very important. However, the fact that this item has the lowest importance mean and the highest standard deviation in the battery, indicates that this item may vary in importance for different customer segments. Some customers who value personal contact rate it highly, while other customers who even avoid customer contact consider it unimportant.

The comparative evaluation of the different service interfaces in the battery of performance attributes in Figure 5-5 shows that Internet Banking is the best performer in terms of convenience, accessibility, speed of delivery and ease of use. IB also offers the most reliable service and the best feedback. However, it does not provide personal contact.

On the other hand, BB is the most complete service interface in terms of operations and information available. It is also considered the securest service interface, and provides the most personalized, trustworthy and competent service. However, its performance is relatively poor in terms of convenience, accessibility, ease of use and speed of delivery.

The other two service interfaces fall in between IB and BB. TB provides some personal contact, but the trustworthiness, competence and personalization of the service provided is significantly lower than BB. When compared with IB, TB performs a little better in terms of clarity and completeness of information and operations available, but is considered less convenient, accessible and easy to use than IB. Finally, ATM underperforms IB and TB in all comparable attributes, especially in terms of completeness of information and operations available. However, it is still much better than BB in terms of convenience, accessibility, ease of use and speed of delivery.

Improvement areas for IB

The data descriptives also allowed a more detailed analysis by each service interface. Through the importance-performance grid analysis, it was possible to identify the major improvement areas for each service interface. First, as shown in Figure 5-6, Internet banking performs well in terms of reliability, accessibility, speed of delivery and convenience, but it needs improvements in terms of completeness of operations and information, as well as in terms of clarity of information. These results are in tune with the qualitative study, where customers stated their desire to have more operations available in the Internet banking service.

Internet banking personalization still received poor ratings, although it is rated as a relatively low importance attribute. This indicates that personalization is still an important improvement area, although not all customers will value this attribute in the same way.

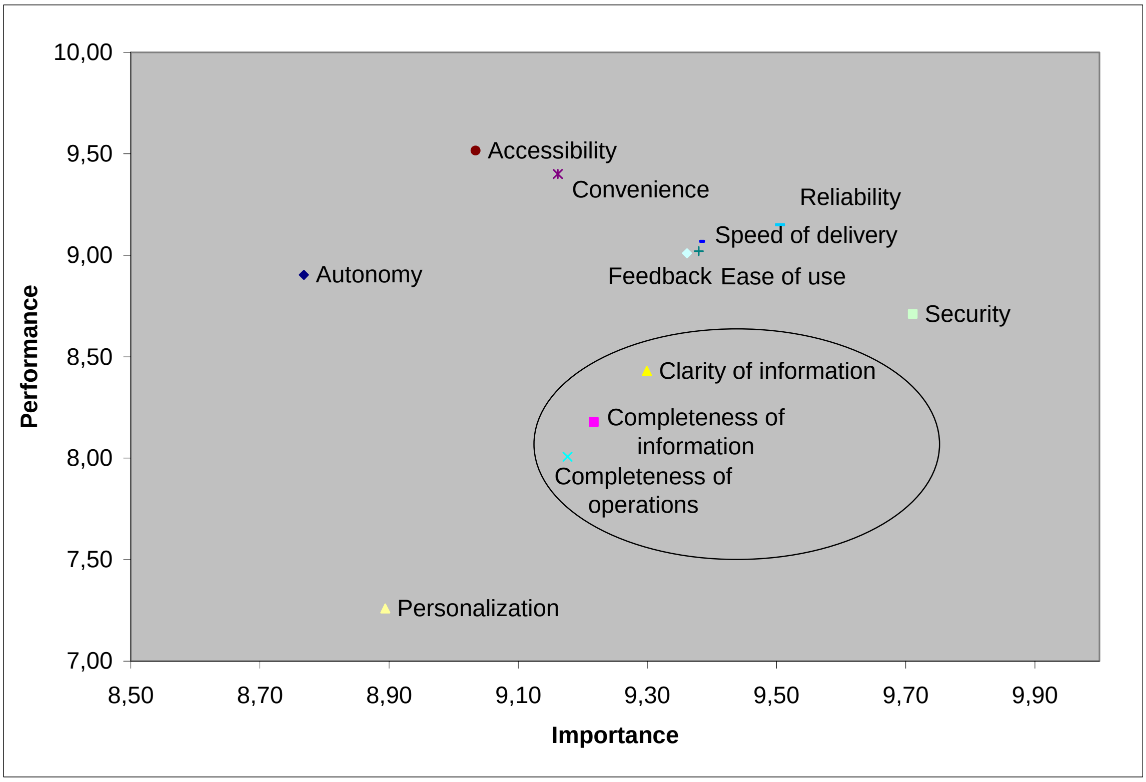

Figure 5-6: Internet Banking Importance-Performance grid

Improvement areas for TB

As shown in Figure 5-7, TB service performs well in terms of accessibility, convenience, ease of use and speed of delivery. The major improvement area for TB service is related to the confidence in the personal contact provided. Although the personnel empathy is well rated, TB performs poorly in terms of perceived knowledge and trustworthiness of employees. This is in tune with the qualitative study, where customers expressed their difficulty in establishing personal trust relationships through the telephone, because they cannot see the person on the other side and there is no continuity in the relationship - the next time they call, the attendant will probably not be the same.

The lack of relationship continuity has to do with the bank's strategy of maximizing call center's efficiency. However, it is important to understand that these efficiency gains have side effects in terms of the relationship established between the bank and its customers through this service interface. If the issue of continuity is related to the bank's strategy, the lack of visual capabilities of the telephone is a technology constraint, as it does not allow the visual contact between the customer and the bank employee. New technology developments may, however, change the capabilities of this service interface.

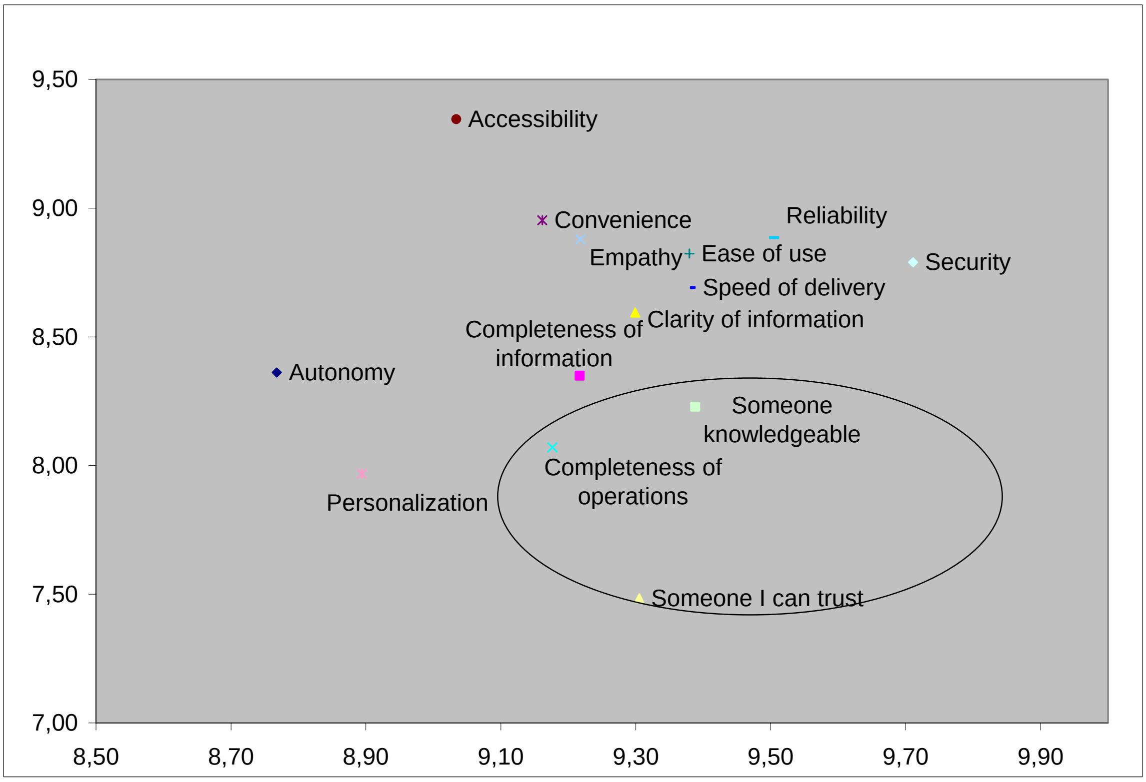

Figure 5-7: Telephone banking Importance-Performance grid

Improvement areas for BB

BB performs well on the majority of attributes, as shown in Figure 5-8. It is well rated in terms of security and reliability, completeness of operations and information. BB employees are considered highly trustworthy and knowledgeable in financial matters, and BB also rates high in terms completeness and clarity of the information provided.

However, BB has a considerable lack of efficiency, in terms of convenience, accessibility and speed of delivery. BB receives especially low ratings in terms of convenience, which is understandable when its schedule is compared with the 24/7 availability of all other banking service interfaces.

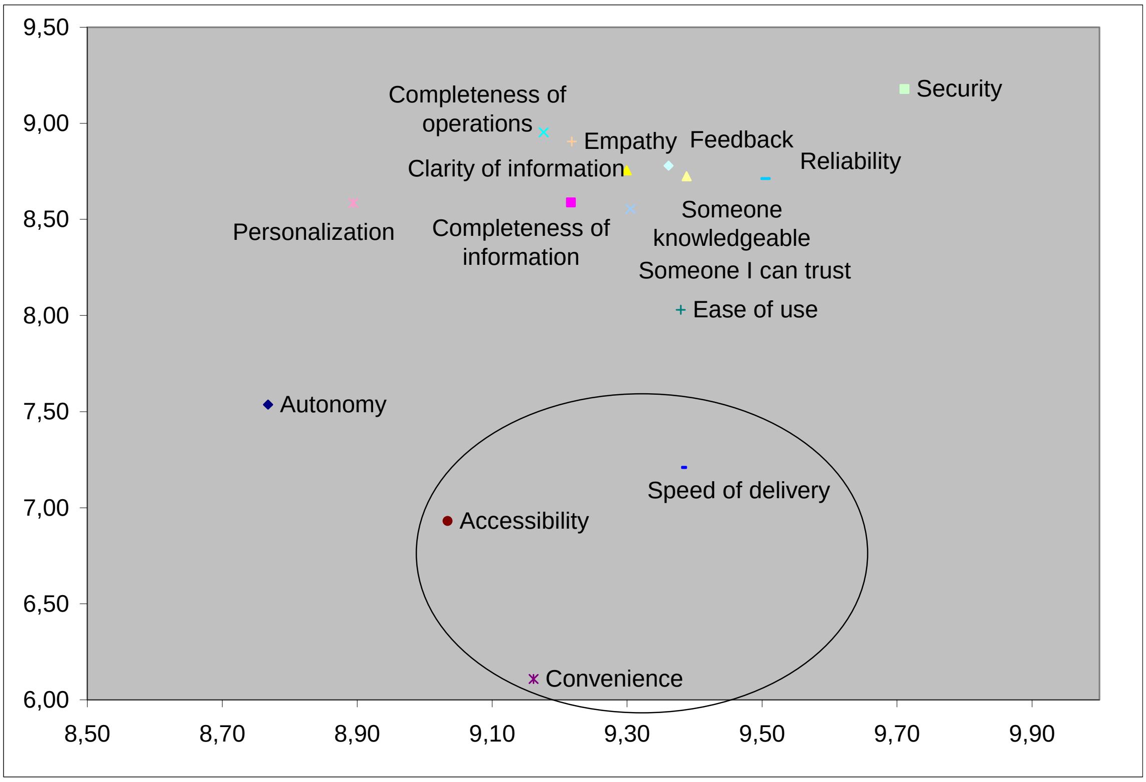

Figure 5-8: Bank branch Importance-Performance grid

Improvement areas for ATMs

As can bee seen in Figure 5-9, ATMs perform well in terms of convenience, speed of delivery and ease of use. The most important improvement areas are the completeness of operations and information, similar to IB and TB. In fact, ATMs provide a limited set of financial operations, being mostly used for cash withdrawals and current account information gathering, but do not offer other financial services such as stock trading or other financial services information.

These results reinforce the qualitative findings, where ATMs were seen as a very efficient service interface when compared with the BB, but with a limited set of financial operations available. In spite of these limitations, ATMs were well valued by customers, especially non-users of IB, as they offer an efficient alternative for some simple financial activities, such as cash withdrawals, that customers would otherwise have to undertake in BB.

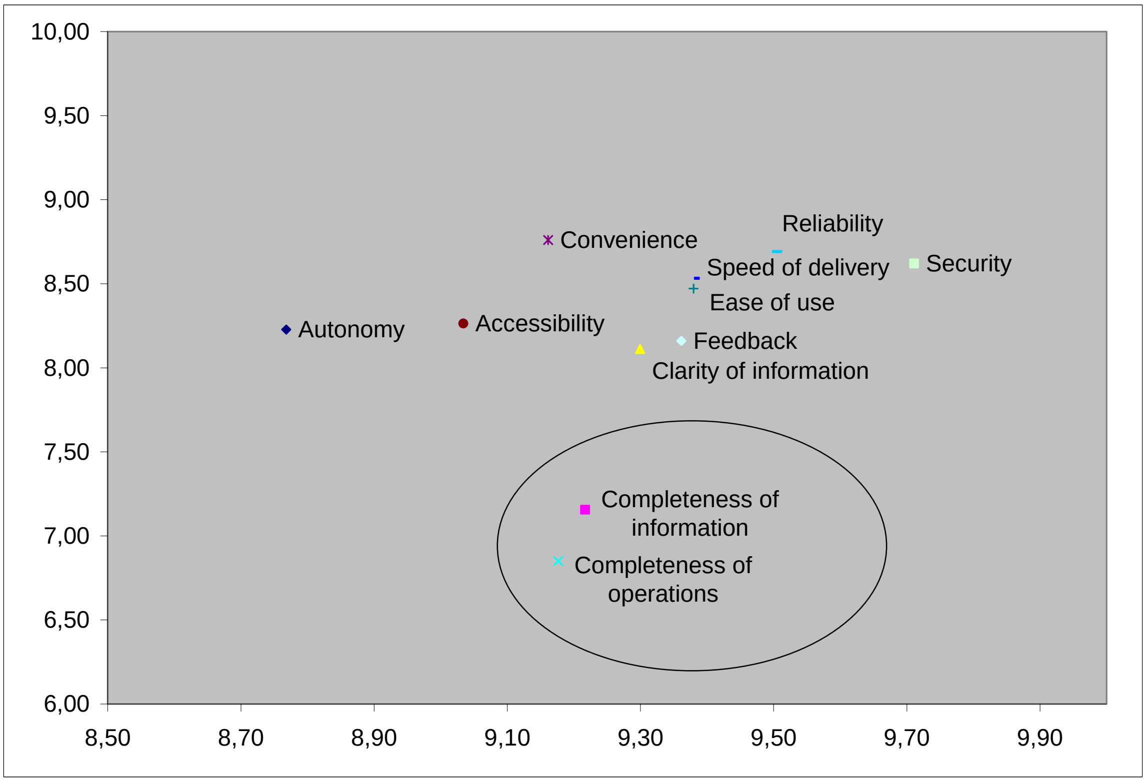

Figure 5-9: ATM Performance-Importance grid

The analysis of data descriptives provided some interesting information on the relative performance of the different service interfaces, as well as major improvement areas for each one. These results indicate that there is no service interface that is the best performer in all attributes, but each one complements and adds value to the overall service. BB provides a more complete service with a high quality personal contact, but is an inefficient mode of interaction. TB provides some personal contact, and is highly accessible. IB and ATMs provide an accessible and convenient service, but still need improvements in terms of financial operations and information available, and do not provide personal contact.

5.6. Scale refinement through Exploratory Factor Analysis (EFA) and reliability assessment

The analysis of data descriptives already provided some information, but the aim of the quantitative study was to identify the constructs underlying the battery of attributes (the measurement model), and to analyze how these constructs influenced service interface satisfaction and usage (structural model). Therefore, the study involved an exploratory factor analysis (EFA) to identify the dimensions of interaction needs and performance evaluation that were relevant for service interface satisfaction, a confirmatory factor analysis (CFA) to assess the adequacy of the measurement model, and a structural model analysis (SEM) to examine the relationships between the measured constructs.

For the EFA and the CFA, a calibration and holdout sample approach was employed, for both the telephone and Web surveys. The overall sample was randomly split into two equally sized samples, with slightly different compositions in terms of user groups in the case of the telephone survey, as shown in Table 5-5. The EFA was performed with the calibration sample, whereas the CFA was performed with the holdout sample.

Table 5-5: Composition of calibration and holdout samples of telephone survey

	Calibration sample	Holdout sample
Users of both IB and TB (IBuTBu)	298	287
Users of IB and non-users of TB (IBuTBnu)	309	307
Non-users of IB and users of TB (IBnuTBu)	280	269
Non-users of both IB and TB (IBnuTBnu)	184	208
Total	1071	1071

The first factor analysis (EFA) was performed with the calibration sample to identify the main dimensions of customer interaction needs and service interface satisfaction, and the reliability of each factor was assessed. In order to improve construct reliability, the scales were then purified through the analysis of factor solutions, construct reliabilities and item-to-total correlations. Items which loaded highly on more than one factor and had low item-to-total correlations were deleted.

When items were deleted, the factor solution and reliabilities were reassessed in an iterative process. This stage involved an additional level of complexity, as the objective was to identify a factor structure that could be applied across the different service interfaces. As the study addressed importance assessment and performance evaluation of four service interfaces in the telephone survey, as well as the importance assessment and Internet banking evaluation in the Web survey, each iteration involved the analysis of seven scales (general interaction requirements and performance evaluation of four service interfaces in the telephone survey; specific interaction requirements and IB satisfaction in the Web survey).

After this process of scale refinement, three dimensions of service interface satisfaction were identified: *usefulness, efficiency and personal contact*.

Usefulness

Usefulness is defined in this study as the degree to which the service interface offers a useful and complete service according to customer needs. This construct involves completeness of operations and information as well as clarity of information. Usefulness, defined as “the degree to which a person believes that using a system will enhance his or her performance” has been identified as the strongest predictor of computer technology acceptance (Davis 1989; Pavlou 2003), and has been successfully applied to technology enabled service contexts (Keen et al. 2002). The qualitative study also indicated that the adequacy of functionalities and information provided by each service interface were important factors influencing satisfaction. Although the usefulness concept was adapted to the multi-interface service context, it was nevertheless considered that this was the label that best represented the global concept and its indicators.

Usefulness can also be related to software engineering functional requirements, as it represents what the system does (performance evaluation), or should do (customer interaction requirements). However, it is important to note that usefulness is measured in this study in terms of customer perceptions or salient beliefs, and not in terms of system objective functions, as it is usually defined in traditional software engineering.

Construct label – usefulness

Construct indicators

- (USE1) I get complete information for my needs
- (USE2) I get information that I can understand clearly
- (USE3) All operations I need are available

Efficiency

Efficiency is defined as the lack of effort needed to get the desired service through the service interface, involving accessibility, ease of use and speed of delivery. Efficiency was also identified as a crucial factor in both literature review (Parasuraman et al. 2005; Zeithaml et al. 2002) and the qualitative study. In fact, efficiency of service provision was pointed out by customers as a major advantage of IB when compared to other bank interfaces. On the other hand, lack of efficiency of bank branches was pointed out as an important factor for BB avoidance.

Efficiency can be related to usability requirements, which have been the focus of Human Computer Interaction. Again, it is important to note that efficiency is measured in terms of customer perceptions, and not with behavioral measures such as time to learn or error rates.

Construct label – efficiency

Construct indicators:

- (EFF1) I take care of my financial matters without having to go very far
- (EFF2) I take care of my financial matters easily
- (EFF3) I take care of my financial matters quickly

Quality of personal contact

Personal contact is defined as the quality of the interaction provided by bank employees through personal contact, involving personalization, professional knowledge and trustworthiness of bank employees.

Construct label – personal contact

Construct indicators:

- (PC1) I talk to someone knowledgeable in financial matters
- (PC2) I talk to someone I can trust

- (PC3) I receive personalized treatment

The quality of personal contact, comprising empathy and awareness of personal needs, is an important dimension of SERVQUAL, and assumes a particular relevance in branch banking (Avikran 1999; Bahia and Nantel 2000; Johnston 1995; Johnston 1997). Although it is not possible to provide personal contact through SSTs, recent studies stress the importance of the existence of personal customer service and service recovery for e-service quality (Parasuraman et al. 2005; Wolfinbarger and Gilly 2003).

As the dissertation research approaches Internet services from a multi-interface perspective, the quality of personal contact was not conceptualized as a component of IB performance evaluation, but rather as a component of TB and BB performance, which is complementary to e-service quality. In fact, the Bank does not have a stand alone call center or BB network created to provide support to the IB service, but uses existing service interfaces such as BB to provide the personal support that customers need while using the IB.

The qualitative study also provided strong support for this idea. If customers used the IB for routine operations and information gathering, they liked to know that they could call the BB or the TB service in case they had a question or a problem they could not solve through the Internet service.

Personal contact has not been treated as an interactive system requirement in the HCI or RE fields. These research areas have approached interface design with a focus on one interaction technology. In a multi-interface service, however, the success of a technology enabled service system depends, not only on the system itself, but on the overall service provided by all other interfaces. As the e-service literature has recently indicated, and the qualitative study showed, the quality of personal contact support is important for the quality of e-services. Therefore, although not being a traditional interaction system requirement, personal contact becomes an important experience requirement for the design of technology enabled systems that are integrated in multi-interface services.

System trust was initially identified in the survey pre-tests as the fourth construct of customer interaction needs and service interface performance evaluation, comprising reliability, security and feedback provided by the service system. Assurance was found to be an important predictor of service quality (Parasuraman et al. 1988), but in the e-service environment, lack of trust has also been found to be a major factor preventing the adoption of e-commerce (Hoffman et al. 1999).

In the recent past, there has been extensive research on e-trust, defined in two broad dimensions. Trust in the service provider is related to the more traditional concept of trust, defined as the “confidence in an exchange partner’s reliability and integrity” (Morgan and Hunt 1994). System trust is defined as “the belief about the reliability and security of the e-commerce system”(Grabner-Krauter and Kaluscha 2003) and encompasses trust in the integrity of the transaction medium (Pavlou 2003).

In a relational, multi-interface service setting such as banking, trust in the service provider is the same for all service interfaces, as they belong to the same firm, but system trust changes from interface to interface. The qualitative study showed that e-service security concerns were a major issue for both users and non-users of IB. Therefore, items related to system trust, comprising security, reliability and feedback control were included in the survey.

However, although trust appeared as a factor in the EFA of the pre-test with 212 telephone interviews and 287 Web responses, it did not emerge in the final survey. The three system trust components did not have a very high loading on one component, but had relatively high and significant loadings on several factors. By decreasing Eigen values below 1, the system trust factor appeared, but the solution was not clear, and some items loaded in different factors across the different service interfaces. Therefore, the system trust items were dropped from the subsequent analysis.

The fact that trust did not show up as a clear and distinct dimension in the analysis does not mean that the factor is not important. In fact, security had the highest ratings in the importance assessment, with almost no variance. However, it may indicate that this is a complex construct, requiring a deeper analysis, with a larger battery of items that can encompass the different customer perceptions of system trust.

Satisfaction and usage of each service interface

Extensive research has stressed the importance of satisfaction as a critical factor influencing customer usage of technology enabled service interfaces. The importance of satisfaction has been analyzed in marketing (Dabholkar 1996; Fournier and Mick 1999; Szymanski and Hise 2000), financial services (Moutinho and Smith 2000) and information systems (Kekre et al. 1995). Therefore, satisfaction was chosen as the construct used to measure customer global evaluations of each service interface and the overall multi-interface service. As explained in the previous section, satisfaction was measured with a single indicator, and therefore it was not included in the EFA.

Results of Web survey exploratory factor analysis (EFA)

The results of the EFA, with factor solutions and scale reliabilities are presented in the tables that follow. This EFA was performed with the calibration sample. After the initial factor solution was computed, two rotations were made to better interpret the factors: the oblique rotation (Oblimin) is shown in Table 5-6 for the Web survey and Table 5-8 for the telephone survey; the orthogonal rotation (Varimax) is shown in Table 5-7 for the Web survey and Table 5-9 for the telephone survey.

As can be seen in the tables below, three factors emerge from the EFA: *usefulness, efficiency and personal contact*. These three factors emerge in the customer needs section. IB performance scale comprised only two factors, as this service interface does not provide personal contact, but the usefulness and efficiency dimensions found are consistent with the requirements scale.

In the oblique rotation, the factors were allowed to correlate, while in the orthogonal rotation the initial factor solution was rotated maintaining factor independency. As the factor analysis was made for each section (needs and each service interface performance), it was expected that the factors inside each scale would correlate significantly. Therefore, the oblique rotation, which allows factors to correlate, provides a clearer factor structure. Nevertheless, both solutions provide the same results, grouping the same indicators into the same factors.

Table 5-6: Exploratory factor analysis (EFA) loadings after Oblimin rotation – Web survey

	Factors		
Needs importance (Variance explained – 81.4%)	Efficiency	P. Contact	Usefulness
To take care of my financial matters without having to go very far	0.92		
To take care of my financial matters quickly	0.87		
To take care of my financial matters easily	0.83		
To talk to someone I can trust		0.92	
To receive a personalized treatment		0.92	
To talk to someone knowledgeable in financial matters		0.83	
To get information that I can understand clearly			-0.96
To get complete information for my needs			-0.93
That all operations I need are available			-0.72
Reliability (Cronbach's alpha)	0.88	0.88	0.89

Internet Banking performance (Variance explained – 80.0%)	Efficiency	Usefulness
I take care of my financial matters without having to go very far	0.95	
I take care of my financial matters quickly	0.91	
I take care of my financial matters easily	0.88	
I get complete information for my needs		0.92
I get information that I can understand clearly		0.85
All operations I need are available		0.81
Reliability (Cronbach's alpha)	0.91	0.83

Table 5-7: Exploratory factor analysis (EFA) loadings after Varimax rotation – Web survey

	Factors		
Needs importance (Variance explained – 81.4%)	Efficiency	P. Contact	Usefulness
To take care of my financial matters quickly	0.85		
To take care of my financial matters without having to go very far	0.85		
To take care of my financial matters easily	0.83		0.36
To talk to someone I can trust		0.90	
To receive a personalized treatment		0.88	
To talk to someone knowledgeable in financial matters		0.83	
To get information that I can understand clearly			0.89
To get complete information for my needs			0.87
That all operations I need are available	0.42		0.73
Reliability (Cronbach's alpha)	0.88	0.88	0.89

Note: loadings <0.3 are not shown

Exploratory factor analysis (EFA) loadings after Varimax rotation – Web survey (cont.)

	Factors	
Internet Banking performance (Variance explained – 80.0%)	Efficiency	Usefulness
I take care of my financial matters without having to go very far	0.89	
I take care of my financial matters quickly	0.88	
I take care of my financial matters easily	0.87	0.34
I get complete information for my needs		0.87
I get information that I can understand clearly		0.84
All operations I need are available		0.78
Reliability (cronbach's alpha)	0.91	0.83

Note: loadings <0.3 are not shown

Results of telephone survey exploratory factor analysis (EFA)

The results of the EFA of telephone survey data consistently identified the three factors already presented, as shown in Tables 5-8 and 5-9 presented below. Although with some differences in factor loadings, the factor structure remained stable across the different service interfaces, with the same dimensions, measured by the same indicators. The needs importance scales and the BB and TB scales entailed three dimensions: usefulness, efficiency and personal contact. IB and ATM performance comprised only two dimensions – usefulness and efficiency – as these service interfaces do not provide personal contact interaction.

Table 5-8: Exploratory factor analysis (EFA) loadings after Oblimin rotation – telephone survey

	Factors		
Needs importance (Variance explained – 70.2%)	Usefulness	P. Contact	Efficiency
To get information that I can understand clearly	0.89		
To get complete information for my needs	0.82		
That all operations I need are available	0.74		
To talk to someone I can trust		0.83	
To received a personalized treatment		0.82	
To talk to someone knowledgeable in financial matters		0.71	
To take care of financial matters without having to go very far			-0.87
To take care of my financial matters quickly			-0.80
To take care of my financial matters easily			-0.75
Reliability (Cronbach's alpha)	0.81	0.72	0.80

Note: loadings <0.3 are not shown

Exploratory factor analysis (EFA) loadings after Oblimin rotation– Telephone survey (cont.)

Factors

Internet banking (Variance explained – 71.9%)	Usefulness	Efficiency
I get complete information for my needs	0.87	
I get information that I can understand clearly	0.82	
All operations I need are available	0.79	
I take care of my financial matters without having to go very far		0.93
I take care of my financial matters quickly	0.33	0.67
I take care of my financial matters easily	0.46	0.57
Reliability (Cronbach's alpha)	0.79	0.78

Telephone banking (Variance explained – 75.5%)	Efficiency	P. Contact	Usefulness
I take care of my financial matters without having to go very far	0.94		
I take care of my financial matters quickly	0.71		
I take care of my financial matters easily	0.70		
I talk to someone I can trust		0.93	
I receive a personalized treatment		0.84	
I talk to someone knowledgeable in financial matters		0.83	
I get complete information for my needs			-0.89
I get information that I can understand clearly			-0.86
All operations I need are available	0.30		-0.57
Reliability (Cronbach's alpha)	0.84	0.84	0.81

Branch banking (Variance explained – 78.6%)	Efficiency	P. Contact	Usefulness
All operations I need are available	0.85		
I get complete information for my needs	0.84		
I get information that I can understand clearly	0.82		
I take care of my financial matters without having to go very far		0.96	
I take care of my financial matters quickly		0.84	
I take care of my financial matters easily		0.76	
I talk to someone I can trust			0.91
I receive a personalized treatment			0.91
I talk to someone knowledgeable in financial matters			0.74
Reliability (Cronbach's alpha)	0.88	0.85	0.84

ATM (Variance explained – 76.5%)	Usefulness	Efficiency
I get complete information for my needs	0.93	
All operations I need are available	0.84	
I get information that I can understand clearly	0.78	
I take care of my financial matters without having to go very far		-0,91
I take care of my financial matters quickly		-0,85
I take care of my financial matters easily		-0,79
Reliability (Cronbach's alpha)	0.83	0.86

Table 5-9: Exploratory factor analysis (EFA) loadings after Varimax rotation – Telephone survey

	Factors		
Needs importance (Variance explained – 70.2%)	Usefulness	Efficiency	P. Contact
To get information that I understand clearly	0.85		
To have complete information for my needs	0.80		
That all operations I need are available	0.75		
To take care of financial matters without having to go very far		0.81	
To take care of financial matters quickly	0.31	0.79	
To take care of my financial matters easily	0.37	0.76	
To talk to someone I can trust			0.81
To receive a personalized treatment			0.80
To talk to someone knowledgeable in financial matters	0.33		0.71
Reliability (Cronbach's alpha)	0.81	0.80	0.72

Internet banking (Variance explained – 71.9%)	Usefulness	Efficiency
I get complete information for my needs	0.85	
I get information that I can understand clearly	0.81	
All operations I need are available	0.76	
I take care of my financial matters without having to go very far		0.87
I take care of my financial matters quickly	0.44	0.73
I take care of my financial matters easily	0.56	0.67
Reliability (Cronbach's alpha)	0.79	0.78

Telephone banking (Variance explained – 75.5%)	P. Contact	Efficiency	Usefulness
I talk to someone I can trust	0.86		
I talk to someone knowledgeable in financial matters	0.81		
I receive a personalized treatment	0.80		
I take care of my financial matters without having to go very far		0.86	
I take care of my financial matters easily		0.76	0.43
I take care of my financial matters quickly		0.75	0.38
I get information that I can understand clearly			0.82
I get complete information for my needs	0.33		0.81
All operations I need are available		0.45	0.60
Reliability (Cronbach's alpha)	0.84	0.84	0.81

Note: loadings <0.3 are not shown

Exploratory factor analysis (EFA) loadings after Varimax rotation – Telephone survey (cont.)

Branch banking (Variance explained – 78.6%)	Usefulness	Efficiency	P. Contact
I get complete information for my needs	0.81		
I get information that I can understand clearly	0.80		0.32
All operations I need are available	0.77		
I take care of my financial matters without having to go very far		0.89	
I take care of my financial matters quickly		0.83	
I take care of my financial matters easily	0.39	0.78	
I talk to someone I can trust			0.84
I received a personalized treatment			0.82
I talk to someone knowledgeable in financial matters	0.39		0.74
Reliability (Cronbach's alpha)	0.84	0.88	0.85

ATM (Variance explained – 76.5%)	Usefulness	Efficiency
I get complete information for my needs	0.87	
All operations I need are available	0.80	
I get information that I can understand clearly	0.76	0.33
I take care of my financial matter quickly	0.35	0.83
I take care of my financial matters without having to go very far		0.83
I take care of my financial matters easily	0.43	0.80
Reliability (Cronbach's alpha)	0.83	0.86

Note: loadings <0.3 are not shown

In both surveys, customers were asked to rate their needs when interacting with the bank without referring to a specific service interface. Therefore, the telephone survey and the Web survey models allow the analysis of customer general interaction needs and financial activity specific needs, independently of the service interface used. In the case of the telephone survey, the performance evaluation of the different service interfaces also allows the analysis of how each one of them satisfies customer general interaction needs.

It is interesting to note that the factor solution for the Web survey is clearer than the one for the telephone survey. This may be due to the fact that in the telephone survey customers were asked to rate their general interaction needs, and to evaluate each service interface performance. In the Web survey, customers stated their needs for a specific financial operation, ranging from information about current account to a mortgage loan application.

As the Web survey sample was stratified across 12 different financial activities, the increased variance generated by the different activities may have allowed the emergence of a clearer factor solution. Nevertheless, the joint analysis of both surveys provides a better understanding of how general and specific interaction needs are satisfied through the different service interfaces.

5.7. Measurement model evaluation - Confirmatory Factor analysis (CFA)

With the EFA performed with a calibration sample, CERs and service interface performance dimensions were identified, and the measurement scales were purified through an iterative process, based on the analysis of the factor solution across service interfaces and the assessment of scale internal consistency. At this stage, although theory and the qualitative study guided questionnaire design and data analysis, the factor structure was not pre-determined. EFA is concerned with exploring patterns of relationships among variables, providing the basis for identifying and interpreting the factors (Hair et al. 1998).

In the Confirmatory Factor Analysis (CFA) performed with the holdout sample, the researcher tests a previously specified model using Structural Equation Modeling (SEM) techniques. Based on the EFA previously undertaken, the researcher tests a fully specified model where the relationships between variables and factors are pre-defined, assessing model goodness-of-fit (GOF).

Scale development methods follow these steps: the EFA is first undertaken to identify the factors or latent constructs through an iterative process. The CFA tests the EFA solution to assess model fit, convergent and discriminant validity. After testing the scales, if the measurement model has acceptable model fit, the process continues with the analysis of structural relationships among measured constructs, following a four step approach (Mulaik and Millsap 2000).

According to this method, the final EFA solution was tested through CFA, with the three dimensions – *usefulness*, *efficiency* and *personal contact*. The CFA was undertaken with LISREL 8.7, treating the variables as continuous and using Maximum Likelihood (ML) estimation. Once again, although there is some debate on whether to treat Likert scales as continuous or ordinal, it was assumed that, as the underlying distribution was continuous, the variable could be treated as continuous (Jaccard and Wan 1996). As the sample had more than 15 variables per indicator, as advised by (Hair et al. 1998) for cases of non-normality with ML estimation, this method was chosen. This estimation procedure also has the advantage of being the most used method, and Goodness of Fit Indices (GOF) are more easily compared and evaluated.

For ordinal, non-normal data, other methods, such as Weighted Least Squares, using the asymptotic covariance matrix, can be used (Hair et al. 1998; Joreskog and Sorbom 1996), but these methods require very large sample sizes. Although the telephone and the Web surveys had 2142 and 1934 respondents, respectively, the sample was significantly shortened with the calibration and holdout sample approach, as well as with the analysis by user group. As the Diagonal Weighted Least Squares (DWLS) also accommodates non-normal data, and is less demanding in terms of sample size, the service interface satisfaction and usage models were also estimated with the DWLS method. This method provided similar results, but with stronger relationships between variables.

As there were two data collection methods, and as the telephone survey was stratified by user group, the CFA was performed both by service interface and by user group. Model fit was assessed according to recommended cutoff values for fit measures (Hair et al. 1998; Hu and Bentler 1999; Marsh et al. 1996). As there is no fit index that can provide the best evaluation of the overall model, the analysis of model fit considered different fit indices, which provide different perspective of model adjustment.

- Exact fit, which measures the difference between the sample data and estimated covariance matrix:
    - $\chi 2$: should be non-significant, but as it increases with sample size, it is usually significant for large samples.
    - GFI (Goodness of Fit Index) > 0,9 (Hair et al. 1998)
    - SRMR (Standardized Root Mean Square Residual) < 0,06 (Hu and Bentler 1999), or < 0,05 (Marsh et al. 1996)

    - RMSEA (Root Mean Square Error of Approximation) < 0,06 (Hu and Bentler 1999) or < 0,08 (Marsh et al. 1996) with upper CI not exceeding 0,1.

- Incremental fit measures, which measure the model improvement, compared with the null model:

    - NFI (Normed Fit Index) > 0,95 (Hu and Bentler 1999; Marsh et al. 1996)

    - NNFI (Non-Normed Fit Index or Tucker-Lewis Index – TLI) > 0,95 (Hu and Bentler 1999; Marsh et al. 1996)

- Parsimonious fit measures:

    - CFI (Comparative Fit Index) > 0,95 (Hu and Bentler 1999; Marsh et al. 1996)

5.7.1. Service interface satisfaction and usage

The research model hypothesized that service interface satisfaction and usage were influenced by both customer interaction experience needs and service interface performance on satisfying those needs. The telephone survey model measured customer general interaction needs, independently from the interaction channel used, with an essential use case approach. The survey instrument also measured how each service interface (IB, TB, BB and ATM) satisfied those interaction needs, as well as service interface general satisfaction.

The Web survey measured customer specific interaction experience needs for different financial activities, also in a service interface independent way. However, the Web questionnaire only addressed IB performance in satisfying those specific needs, as well as satisfaction with IB for that specific financial activity. Based on the EFA, the model was specified as shown in Figure 5-10. Using the telephone survey holdout sample, this model was applied to each service interface (IB, TB, BB and ATM), to analyze general satisfaction with each one. Using the Web survey holdout sample, the model was also applied to IB specific satisfaction and usage for specific financial activities.

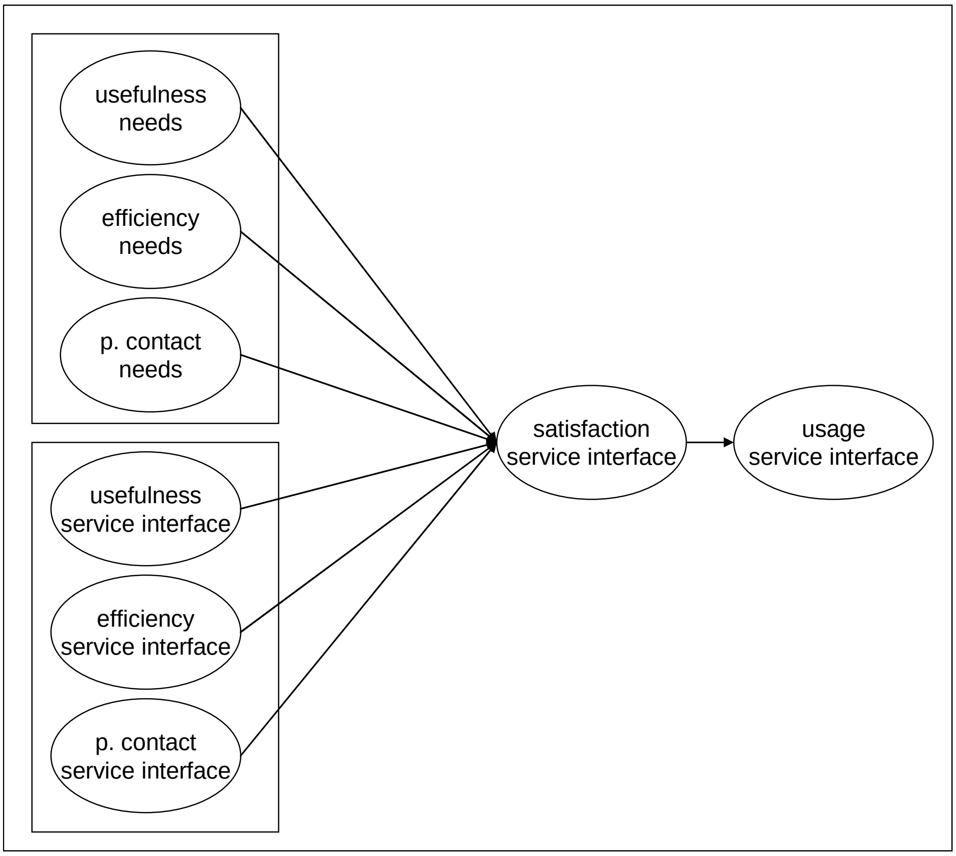

Figure 5-10: Service interface satisfaction and usage

In analyzing the measurement models for service interface general satisfaction and usage, the needs data were reused for the different service interfaces (each customer responded to one needs section and one performance section for each interface used). However, the performance evaluation data changed according to the service interface being analyzed.

The results of the CFA are shown in Table 5-10. Constructs and indicators are labeled as previously presented in the constructs definition. As service interface satisfaction and usage were measured with single indicators, the loadings were fixed to 1.0, and the measurement error was fixed to 0.0 in the LISREL model. All measurement models were tested with and without the single indicator constructs, but no major differences emerged in both indicator loadings and model fit.

Table 5-10: CFA results for service interface satisfaction and usage (holdout sample)

		Web survey	Telephone survey			
		IB	IB	TB	BB	ATM
		Load	load	load	Load	Load
Needs importance						
usefulness	USEN1	0.89	0.76	0.79	0.78	0.79
	USEN2	0.89	0.82	0.80	0.82	0.82
	USEN3	0.71	0.78	0.78	0.69	0.72
efficiency	EFFN1	0.74	0.63	0.61	0.58	0.60
	EFFN2	0.90	0.82	0.87	0.88	0.86
	EFFN3	0.85	0.89	0.87	0.81	0.84
p contact	PCN1	0.83	0.57	0.59	0.65	0.63
	PCN2	0.90	0.71	0.75	0.71	0.72
	PCN3	0.79	0.69	0.65	0.66	0.67
Channel performance						
usefulness	USE1	0.89	0.78	0.88	0.89	0.84
	USE2	0.86	0.79	0.87	0.90	0.73
	USE3	0.67	0.69	0.76	0.66	0.74
efficiency	EFF1	0.76	0.58	0.62	0.71	0.70
	EFF2	0.91	0.82	0.91	0.89	0.90
	EFF3	0.85	0.84	0.91	0.85	0.88
p contact	PC1			0.83	0.82	
	PC2			0.80	0.78	
	PC3			0.73	0.76	
satisfaction	SAT	1	1	1	1	1
usage	FREQ	1	1	1	1	1
GOF						
n		967	592	515	1001	1024
χ2		520	293	426	523	404
DF		100	100	144	144	100
GFI		0.94	0.95	0.93	0.96	0.96
NFI		0.96	0.96	0.97	0.98	0.97
NNFI		0.96	0.96	0.97	0.98	0.97
CFI		0.97	0.97	0.98	0.98	0.98
RMSEA		0.07	0.06	0.06	0.05	0,06
SRMR		0.05	0.04	0.04	0.04	0,03

Notes: GOF – Goodness of Fit; DF – degrees of freedom; GFI – Goodness of Fit Index; NFI – Normed Fit Index; NNFI – Non-Normed Fit Index or Tucker – Lewis Index; CFI – Comparative Fit Index; RMSEA – Root Mean Square Error of Approximation; SRMR – Standardized Root Mean Square Residual.

As can be seen in the Table above, all models present a good model fit, according to recommended cutoff values (Hair et al. 1998; Hu and Bentler 1999;

Marsh et al. 1996). Chi-Square ($\chi 2$) is significant, but this can be justified by the large sample size used. The models also have good exact fit, with Goodness of Fit Index (GFI) above 0.90, RMSEA below 0.06, and RMSR well below the 0.08 recommended levels. The models also have good incremental fit indexes, with Normed Fit Index (NFI) and Non-Normed Fit Index (NNFI). Finally, parsimonious fit is also above recommended levels of 0.95, measured by the Comparative Fix Index (CFI).

All indicators have significant and high loadings (>0.5) on the correspondent factor, which provides evidence of construct convergent validity. In the final solution, constructs composite reliability exceed or are very near to 0.7, and the variance extracted are above or near the 0.5 value (Hair et al. 1998).

The correlations between constructs were also analyzed, as shown in Tables 5-11 to 5-15. The correlations between constructs are significant, but lower than one, which would mean that they would not have discriminant validity. Two tests were made to assess discriminant validity. First, in all cases, the confidence interval for each pairwise correlation estimate between constructs (± 2 standard errors) did not include the value of one (Gerbing and Anderson 1988). Second, for every pair of factors, the measurement model was run constraining the constructs pairwise correlation to one. In every case, this constraint significantly deteriorated model fit, measured by the significance of the Chi-Square difference with one degree of freedom (Kaplan 2000).

Table 5-11: Construct correlations and composite reliabilities – IB specific satisfaction and usage

Web survey	Needs			IB performance		IB satisfaction	
	use	eff	pc	use	eff	usage	Sat
Needs							
usefulness	***0.87***						
efficiency	0.63	***0.87***					
p contact	0.37	0.34	***0.88***				
IB performance							
usefulness	0.26	0.21	0.19	***0.85***			
efficiency	0.35	0.37	0.16	0.64	***0.88***		
IB satisfaction							
usage	0.10	0.21	-0.08	0.16	0.14	*NA*	
satisfaction	0.13	0.25	-0.03	0.25	0.20	0.75	*NA*

Construct composite reliabilities are shown in diagonal. Construct correlations are shown below the diagonal.

Table 5-12: Construct correlations and composite reliabilities – IB general satisfaction and usage

Telephone survey	Needs			IB performance		IB satisfaction	
	use	eff	pc	use	eff	usage	Sat
Needs							
Usefulness	***0.83***						
Efficiency	0.74	***0.82***					
p contact	0.41	0.46	***0.70***				
IB performance							
Usefulness	0.32	0.34	0.29	***0.79***			
Efficiency	0.39	0.46	0.31	0.70	***0,80***		
IB satisfaction							
Usage	-0.08	-0.05	-0.13	0,06	0.08	*NA*	
Satisfaction	0.22	0.23	0.25	0.60	0.55	0.10	*NA*

Table 5-13: Construct correlations and composite reliabilities – TB general satisfaction and usage

Telephone survey	Needs			TB performance			TB satisfaction	
	use	eff	pc	use	eff	Pc	Usage	sat
Needs								
Usefulness	***0.83***							
Efficiency	0.78	***0.83***						
p contact	0.56	0.52	***0.70***					
TB performance								
Usefulness	0.30	0.28	0.29	***0.88***				
Efficiency	0.30	0.28	0.34	0.84	***0.86***			
p contact	0.15	0.22	0.37	0.70	0.66	***0.83***		
TB satisfaction								
Usage	0.01	0.03	0.09	0.25	0.28	0.16	*NA*	
Satisfaction	0.29	0.25	0.35	0.78	0.76	0.67	0.24	*NA*

Table 5-14: Construct correlations and composite reliabilities – BB general satisfaction and usage

Telephone survey	Needs			BB performance			BB satisfaction	
	use	eff	pc	use	eff	pc	Usage	sat
Needs								
Usefulness	***0.81***							
Efficiency	0.74	***0.81***						
p contact	0.44	0.49	***0.71***					
BB performance								
Usefulness	0.39	0.34	0.23	***0.86***				
Efficiency	0.23	0.24	0.33	0.65	***0.86***			
p contact	0.36	0.28	0.47	0.75	0.66	***0.83***		
BB satisfaction								
Usage	-0.03	0.04	0.14	0.05	0.18	0.14	*NA*	
Satisfaction	0.19	0.16	0.27	0.64	0.70	0.68	0.12	*NA*

Construct composite reliabilities are shown in diagonal. Construct correlations are shown below the diagonal.

Table 5-15: Construct correlations and composite reliabilities – ATM general satisfaction and usage

Telephone survey	Needs			ATM performance		ATM satisfaction	
	use	eff	pc	use	eff	usage	sat
Needs							
usefulness	***0.82***						
efficiency	0.78	***0.81***					
p contact	0.47	0.49	***0.71***				
ATMperformance							
usefulness	0.15	0.18	0.28	***0.81***			
efficiency	0.28	0.30	0.32	0.78	***0.87***		
ATM satisfaction							
usage	0.02	0.04	-0.03	0.06	0.14	*NA*	
satisfaction	0.20	0.20	0.24	0.63	0.66	0.09	*NA*

Construct composite reliabilities are shown in diagonal. Construct correlations are shown below the diagonal.

These results show that the measurement models fit reasonably well across the different service interface and apply to both specific and general satisfaction. The fact that the EFA (performed with the calibration sample) produced the same results as the CFA (performed with the holdout sample) increased the robustness of results. Therefore, in the subsequent structural equation modeling analysis the overall sample was used.

It is interesting to note that construct reliability and variance extracted are better for the Web survey, especially for the needs constructs. Again, this can be related to the fact that Web respondents were asked to rate their interaction experience needs for a specific financial activity, ranging from current account information to mortgage loan application. The Web survey therefore provided more variability that allowed the emergence of a clearer measurement model. The measurement of both specific and general needs allowed this comparison.

5.7.2. Contribution of each service interface to overall satisfaction with the service provider

The previous CFA analyzed the applicability of the measurement model across the different service interfaces, but it was also important to assess if the measurement model for service interface performance also worked across the different user groups. Moreover, one of the key research questions was to understand how each service interface contributed to overall satisfaction with the service provider. Therefore, a second model was tested for each user group, analyzing how the performance evaluation of the different service interfaces contributed to overall satisfaction with the bank, as shown in Figure 5-11.

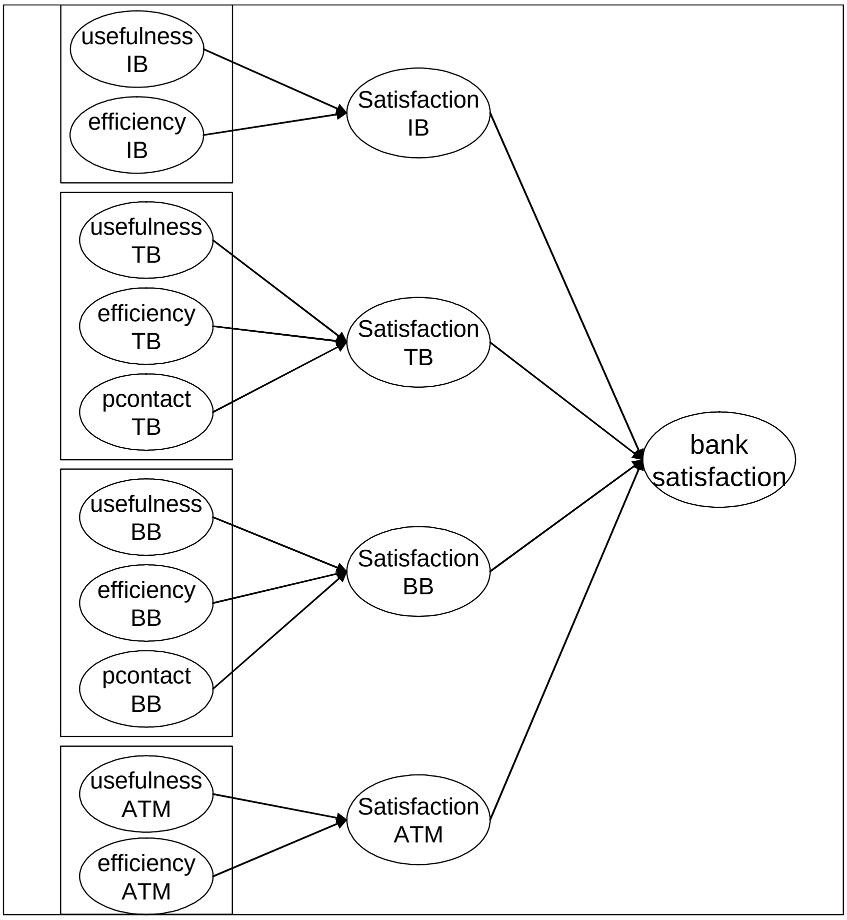

Figure 5-11: Contribution of each SDS for overall satisfaction with service provider

As each user group evaluated only the service interfaces used, Figure 5-11 represents the model for users of both IB and TB. As the information provided by the bank indicated that BB and ATM were used by more than 90% of the population under study, and less than 5% of respondents declared themselves as non-users of BB or ATM, those respondents were excluded from this analysis. Therefore, all user groups evaluated BB and ATM, and IB and/or TB according to the Bank's usage information, confirmed by the customer in the survey.

As the sample was stratified into four user groups, sample size for each one was significantly reduced, when compared with sample size for the model of service interfaces satisfaction and usage. Moreover, the calibration and holdout sample approach applied to the EFA and CFA presented above showed that the measurement models worked well across the different service interfaces.

Therefore, to attain a comfortable sample size to model service interface contribution to the overall service, in this case the overall sample was used at both the CFA and SEM stages. The results of the CFA are shown in Table 5-16.

Table 5-16: CFA results for service interface performance evaluation by user group

		IBuTBu load	IBuTBnu load	IBnuTBu load	IBnuTBnu load
Internet Banking					
usefulness	USE1	0.80	0.76		
	USE2	0.79	0.81		
	USE3	0.68	0.68		
efficiency	EFF1	0.56	0.53		
	EFF2	0.88	0.83		
	EFF3	0.85	0.81		
Telephone Banking					
usefulness	USE1	0.88		0.81	
	USE2	0.87		0.78	
	USE3	0.78		0.69	
efficiency	EFF1	0.66		0.56	
	EFF2	0.93		0.87	
	EFF3	0.85		0.91	
p contact	PC1	0.85		0.77	
	PC2	0.82		0.77	
	PC3	0.78		0.69	
Bank branch					
usefulness	USE1	0.90	0.92	0.89	0.79
	USE2	0.93	0.89	0.87	0.86
	USE3	0.70	0.60	0.64	0.74
efficiency	EFF1	0.73	0.68	0.67	0.72
	EFF2	0.89	0.90	0.90	0.90
	EFF3	0.87	0.86	0.84	0.79
p contact	PC1	0.86	0.83	0.88	0.79
	PC2	0.80	0.87	0.86	0.74
	PC3	0.74	0.77	0.72	0.76
ATM					
usefulness	USE1	0.83	0.84	0.83	0.78
	USE2	0.72	0.73	0.76	0.87
	USE3	0.78	0.69	0.75	0.62
efficiency	EFF1	0.70	0.57	0.67	0.73
	EFF2	0.91	0.84	0.91	0.93
	EFF3	0.86	0.87	0.90	0.89

CFA results for service interface performance evaluation by user group (continued)

		IBuTBu load	IBuTBnu load	IBnuTBu load	IBnuTBnu load
Service interface satisfaction					
IB	IBSAT	1	1		
TB	TBSAT	1		1	
BB	BBSAT	1	1	1	1
ATM	ATMSAT	1	1	1	1
overall satisfaction					
satbank	BSAT	1	1	1	1
GOF					
n		528	550	498	351
$\chi 2$		1300	761	774	289
DF		460	224	288	110
GFI		0.88	0.90	0.90	0.92
NFI		0.97	0.96	0.97	0.97
NNFI		0.97	0.96	0.97	0.97
CFI		0.98	0.98	0.98	0.98
RMSEA		0.06	0.07	0.06	0.07
SRMR		0.04	0.05	0.04	0.05

Notes: GOF – Goodness of Fit; DF – degrees of freedom; GFI – Goodness of Fit Index; NFI – Normed Fit Index; NNFI – Non-Normed Fit Index or Tucker – Lewis Index; CFI – Comparative Fit Index; RMSEA – Root Mean Square Error of Approximation; SRMR – Standardized Root Mean Square Residual.

As shown in the Table above, all loadings are significant and above 0.5, which indicates good convergent validity. All constructs have acceptable reliability, reflected in composite reliabilities above 0.7 and variance extracted above 0.5. All measurement models have acceptable fit, with GFI above or very close to 0.90, RMSEA below 0.08 and SRMR below 0.08, and NFI, NNFI and CFI all above the 0.95 recommended level.

Finally, discriminant validity was again assessed through the two tests already described above. Based on the analysis of correlations shown in Tables 5-17 to 5-20, the confidence interval for all pairwise correlations between constructs ($\pm$ 2 standard errors) were computed and did not include the value of one, and constraining correlations between each pair of constructs to one significantly increased the Chi-Square statistic, indicating a significant decrease in model fit.

Table 5-17: Construct correlations and composite reliabilities – IB and TB users

	IB			TB				BB				ATM			Bank
	use	eff	sat	use	eff	pc	sat	use	eff	pc	sat	use	eff	sat	sat
IB															
use	***0.80***														
effic	0.80	***0.82***													
sat	0.64	0.59	*NA*												
TB															
use	0.51	0.41	0.33	**0.88**											
effic	0.42	0.42	0.25	0.83	***0.86***										
p cont	0.49	0.43	0.34	0.74	0.68	***0.86***									
sat	0.40	0.26	0.30	0.79	0.73	0.68	*NA*								
BB															
use	0.48	0.48	0.36	0.45	0.37	0.42	0.35	***0.88***							
effic	0.43	0.30	0.37	0.42	0.35	0.38	0.35	0.65	***0.87***						
p cont	0.47	0.45	0.29	0.39	0.30	0.47	0.31	0.81	0.62	***0.87***					
sat	0.37	0.29	0.36	0.29	0.20	0.32	0.26	0.65	0.74	0.69	*NA*				
ATM															
use	0.48	0.29	0.34	0.39	0.33	0.40	0.25	0.32	0.53	0.36	0.35	***0.82***			
effic	0.34	0.34	0.31	0.37	0.40	0.31	0.26	0.42	0.51	0.37	0.38	0.70	***0.87***		
sat	0.26	0.21	0.26	0.27	0.24	0.27	0.23	0.27	0.30	0.24	0.25	0.63	0.61	*NA*	
Bank															
sat	0.41	0.41	0.45	0.40	0.35	0.40	0.36	0.54	0.50	0.54	0.56	0.37	0.34	0.22	*NA*

Table 5-18: Construct correlations and composite reliabilities – IB users and TB non-users

	IB			BB				ATM			Bank
	use	eff	sat	use	eff	pc	sat	use	eff	sat	sat
IB											
usefulness	***0.79***										
efficiency	0.69	***0.77***									
satisfaction	0.57	0.52	*NA*								
BB											
usefulness	0.39	0.38	0.31	***0.85***							
efficiency	0.39	0.29	0.31	0.64	***0.86***						
p contact	0.40	0.37	0.35	0.72	0.66	***0.86***					
satisfaction	0.30	0.28	0.29	0.66	0.67	0.71	*NA*				
ATM											
usefulness	0.43	0.29	0.34	0.31	0.51	0.37	0.33	***0.80***			
efficiency	0.45	0.48	0.35	0.43	0.52	0.43	0.41	0.75	***0.81***		
satisfaction	0.35	0.30	0.34	0.24	0.29	0.28	0.25	0.58	0.68	*NA*	
Bank											
satisfaction	0.42	0.41	0.39	0.48	0.42	0.47	0.50	0.27	0.31	0.27	*NA*

Construct composite reliabilities are shown in diagonal. Construct correlations are shown below the diagonal.

Table 5-19: Construct correlations and composite reliabilities – IB non-users and TB users

	TB				BB				ATM			Bank
	use	eff	pc	sat	use	eff	pc	sat	use	eff	sat	sat
TB												
usefulness	***0.80***											
efficiency	0.80	***0.83***										
p contact	0.60	0.50	***0.79***									
satisfaction	0.72	0.65	0.60	*NA*								
BB												
usefulness	0.40	0.34	0.40	0.32	***0.85***							
efficiency	0.40	0.32	0.47	0.32	0.69	***0.85***						
p contact	0.37	0.36	0.56	0.36	0.77	0.67	***0.86***					
satisfaction	0.30	0.24	0.39	0.31	0.61	0.70	0.68	*NA*				
ATM												
usefulness	0.48	0.38	0.48	0.33	0.34	0.46	0.41	0.30	***0.82***			
efficiency	0.41	0.40	0.31	0.30	0.32	0.33	0.33	0.22	0.76	***0.87***		
satisfaction	0.34	0.26	0.33	0.31	0.24	0.28	0.28	0.25	0.65	0.66	*NA*	
Bank												
satisfaction	0.39	0.28	0.39	0.33	0.49	0.50	0.61	0.53	0.28	0.23	0.33	*NA*

Table 5-20: Construct correlations and composite reliabilities – IB and TB non-users

	BB				ATM			Bank
	use	eff	pc	sat	use	eff	sat	sat
BB								
usefulness	***0.84***							
efficiency	0.83	***0.84***						
p contact	0.68	0.69	***0.81***					
satisfaction	0.65	0.68	0.64	*NA*				
ATM								
usefulness	0.44	0.41	0.33	0.29	***0.80***			
efficiency	0.33	0.33	0.36	0.23	0.82	***0.89***		
satisfaction	0.29	0.28	0.29	0.28	0.64	0.65	*NA*	
Bank								
satisfaction	0.39	0.41	0.31	0.44	0.44	0.29	0.16	*NA*

Construct composite reliabilities are shown in diagonal. Construct correlations are shown below the diagonal.

The CFA results indicate that the measurement model has acceptable fit across the different user groups, although the factor loadings may differ. To analyze the invariance of factor loadings across groups, a multi-group approach can be used, where parameter estimates are first derived for each group separately but the measures of fit are calculated for the overall model for both groups (Jaccard and Wan 1996). Then, the fit of the multi-group model is calculated again, imposing the equality constraint of the parameters across groups. The significance of the Chi-Square difference provides the test for the equality of parameters across groups.

This approach was not followed in this research, as the different groups did not have the same model (constructs and indicators differed), and therefore could not be directly compared. At this stage, the main objective was to evaluate the appropriateness of the measurement model across groups, which the model assessment supports.

5.8. Constructs means comparison

The CFA analysis showed that the measurement model had acceptable fit for specific as well as for general service interface satisfaction. It also showed that the measurement model worked reasonably well for the four interaction channels under study, and for the different user groups. Convergent and discriminant validity were also assessed for the measurement scales of the different constructs, providing acceptable results.

After this stage, the constructs summated scales were computed and used to compare means. Although construct mean comparison was not part of the modeling strategy, it was nevertheless considered that it could bring interesting insights into the analysis of the overall multi-interface service and the relative position of each service interface. These insights could contribute to a better analysis of the structural model results, and to a better design of the multi-interface service.

In this analysis, first, the performance evaluation of the different service interfaces was compared, to analyze the relative performance of each interaction channel. Second, the means of interaction needs, BB and ATM performance were also compared across user groups through t-tests. Third, the interaction needs were compared between the two extreme types of financial activities: current account information and mortgage loan application.

5.8.1. Relative service interface performance

The mean computation of the summated scales for each construct provided an interesting view of the relative position of each service interface in the overall service, as shown in Figure 5-12.

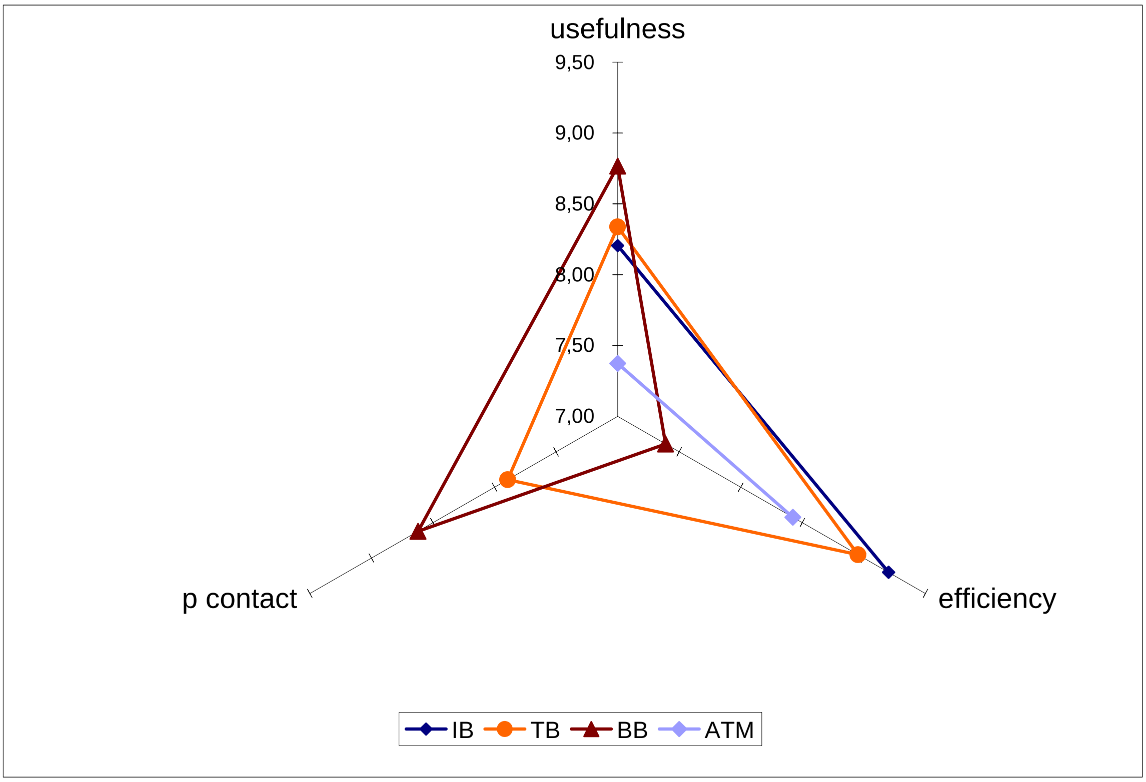

Figure 5-12: Service interface relative performance in the three dimensions analyzed

Corroborating the results of the qualitative study, BB is seen as the most useful service interface, in terms of completeness of information and financial operations available. It is also the best performer in terms of personal contact, providing a more trustworthy, competent and personalized service. However, this service interface clearly underperforms all others in terms of efficiency.

On the other hand, IB is the most efficient service interface, but is less complete in terms of operations and information available, similar to TB. This is in tune with the importance-performance analysis, which showed that usefulness attributes were the ones deserving further improvement efforts in the automatic interfaces, whereas efficiency was the highest priority improvement in the BB.

ATM underperforms both IB and TB, but is clearly better than the BB in terms of efficiency, which makes it the SST used by the less technology-oriented customers. Although with a limited range of financial activities, ATMs cash withdrawal and efficient information gathering adds an important value to the service provided by the BB.

Finally, TB falls in between BB and IB. It underperforms BB in terms of personal contact and usefulness, but it nevertheless provides some degree of personal contact when compared with the pure SSTs, such as IB and ATM. On the other hand, it underperforms IB in terms of efficiency.

If customers tended to choose only one service interface, TB could be seen as the best of both worlds, balancing some degree of personal interaction with the efficiency of telephone contact. However, seen in an integrated multi-interface service, where the customer can use each service interface according to the specific needs inherent to each situation, TB falls behind the others interaction channels. It underperforms BB in terms of personal contact and usefulness, it underperforms IB in terms of efficiency, and therefore adds little value to the overall service.

No service interface performs best in every attribute, but BB is the best performer in usefulness and personal contact, IB is the most efficient, and ATM is still the most efficient in some financial activities that can only be undertaken in this service interface or in the inefficient BB. Therefore, each one of these service interfaces adds value to the overall service. However, the value added by TB seems to be in question, as it is not the best one in any attribute.

TB lack of contribution to the overall service can explain the trend in TB usage in the recent years. As banks started offering IB service, customers gradually abandoned the TB service, and now prefer to use IB. Many call center operations have shrunk or even disappeared. When customers need personal attention, they prefer to go to the bank branch, which provides them a full personal contact service. When customers need efficiency, they prefer to use the most efficient service interface - IB. The qualitative results showed that TB usage is frequently relegated for some situations, in which the other service interfaces are not available.

5.8.2. Comparison between user groups

These results are further supported by the mean comparisons between user groups. As can be seen in Table 5-21, IB users are more demanding customers in terms of usefulness and efficiency requirements, but consider personal contact as less important. These customers are also more rigorous in their evaluations of the other service interfaces. When compared with non-users, IB users underrate all other service interfaces, especially TB.

Table 5-21: Mean comparisons for construct summated scales by user groups (telephone survey)

	IB users	IB non-users	Mean Difference		TB users	TB non-users	Mean Difference
Needs							
usefulness	9.33	9.10	0.23**		9.25	9.21	0.04
efficiency	9.37	9.13	0.24**		9.29	9.24	0.05
p. contact	9.12	9.30	-0.18**		9.27	9.12	0.15**
IB							
usefulness					8.18	8.23	-0.05
efficiency					9.19	9.21	-0.02
satisfaction					8.55	8.60	-0.05
usage					7.30	7.31	-0.01
TB							
usefulness	8.04	8.65	-0.61**				
efficiency	8.71	9.21	-0.50**				
p. contact	7.59	8.22	-0.63**				
satisfaction	8.14	8.91	-0.77**				
usage	4.83	5.69	-0.86**				
BB							
usefulness	8.72	8.83	-0.11*		8.86	8.67	0.19**
Efficiency	6.79	8.12	-1.33**		7.30	7.49	-0.19**
p. contact	8.54	8.73	-0.19**		8.75	8.48	0.27**
satisfaction	8.08	8.67	-0.59**		8.36	8.33	0.03
Usage	5.51	5.59	-0.08		5.62	5.46	0.16**
ATM							
usefulness	6.89	8.01	-1.12**		7.31	7.45	-0.14*
efficiency	8.13	8.81	-0.68**		8.38	8.48	-0.10
satisfaction	8.17	8.67	-0.50**		8.34	8.44	-0.10**
usage	7.99	7.87	0.12*		7.97	7.91	0.06

* significant at p<0.05; ** significant at p<0.01

It is interesting to note that, although IB users are less satisfied, they nevertheless use ATM more and do not use BB significantly less. The only service interface that they use significantly less is again the TB. These results indicate that IB complements, rather than substituting the existing service interfaces, except for TB.

In fact, IB users underrate TB in all evaluative dimensions, use this service interface less, and have less overall satisfaction. This supports the idea that the adoption of IB complements the service provided by BB and ATMs. However, it changes TB relative position in the overall service, as this service interface becomes a non-adding value service.

The difference between IB users and non-users in terms of BB perceived usefulness and personal contact is not so high, but is especially significant in terms of efficiency. It seems that customers who adopt the most efficient service interface become more aware of BB inefficiencies. The same happens with the ATM, where its lack of efficiency and especially usefulness become more pronounced for IB users.

When comparing TB users with non-users, most differences are non-significant. TB users seem to be more personal contact oriented, as they give more importance to this type of requirement, and they rate the personal contact provided by BB higher. However, although these differences are statistically significant, their practical significance is tenuous, as they range from 0.15 to 0.27 in a 0-10 point scale.

The different results in the comparison between IB and TB users and non-users show there are significant differences between IB users and non-users. IB users are willing to exchange personal contact for efficiency, and are globally more demanding. It seems that customers who use IB are more aware of the value added or lost for using other service interfaces, and have a more selective and critical assessment of their performance. Specifically, they underrate TB and are more critical in their evaluations of the efficiency of BB and the usefulness of ATMs. Although this is not a longitudinal study, where the evolution of customer requirements and performance evaluation could be analyzed, these results indicate that using or not using IB changes customer assessment of the performance of other service interfaces as well as the performance of the overall service.

5.8.3. Comparison between financial activities or Essential Use Cases (EUCs)

The complementarity of the different service interfaces is also supported by the comparison of CERs for different financial activities as well as service interface satisfaction and usage. From the 12 financial activities, the two extremes were compared: mortgage loan application, which is considered a risky and complex financial activity, versus current account information gathering, which is considered a routine financial operation. The results presented in Table 5-22 show that, when comparing the two financial activities, customers give more importance to efficiency and less importance to personal contact when dealing with simple and routine financial activities, such as current account information, as opposed to a complex mortgage loan application, for which they are willing to tradeoff efficiency for personal contact.

Table 5-22: Mean comparisons for construct summated scales – mortgage loan application vs. current account information gathering (Web survey)

	Current account	Mortgage loan	Mean difference
Needs			
usefulness	8.94	9.04	-0.10
efficiency	9.37	8.76	0.61**
p. contact	8.07	9.10	-1.02**
IB			
satisfaction	8.90	4.27	4.64**
Usage	8.85	3.27	5.59**
BB			
satisfaction	6.11	7.92	-1.81**
Usage	2.51	8.19	-5.68**

* significant at p<0.05; ** significant at p<0.01

These tradeoffs are well reflected in customer satisfaction and usage of IB versus BB. For current account information gathering, customers are much more satisfied and willing to use IB than BB, as opposed to mortgage loan applications, for which they prefer BB. Comparing these results with the differences between IB users and non-users, it can be seen that adopting the IB service may not decrease significantly BB usage in general, supporting the idea of service interface complementarity. But for specific financial activities, there is a clear tradeoff between efficiency and personal contact, and a substitution between IB and BB occurs.

5.9. *Analysis of the relationships between constructs - structural model*

After validating the measurement scales for each of the models analyzed, which involved assessing constructs' reliability, convergent and discriminant validity, the relationships between constructs can be analyzed, with a structural equation modeling (SEM) approach (Mulaik and Millsap 2000). Analyses of the measurement model assured that the scales used have acceptable reliability and convergent validity, i.e., are consistent measures of the unobservable concepts that the researcher intends to measure. The second step of structural modeling further validates the measurement scales, as the identification of significant relationships between the measurement scales and other constructs of interest, such as satisfaction and usage, indicates that they have nomological validity.

In the structural model analysis presented in this section, two models were analyzed, similarly to the CFA approach. In the service interface profile model, customer interaction experience needs and service interface performance were hypothesized to influence service interface satisfaction and usage. In the second model, the contribution of the different service interfaces to global satisfaction with the service provider was analyzed by user group.

In this structural equation modeling analysis, before interpreting the results, the model fit was assessed, according to the different fit measures and recommended cutoff values presented previously. The r^2 was also analyzed to understand the model explanatory power. Moreover, the analysis of modification indices provided some insights into model re-specifications that could be accepted if theoretically justified. After this process, as the models had acceptable fit, the results were then interpreted. The Structural Equation Modeling (SEM) stage was undertaken with LISREL 8.7, similarly to the CFA.

5.9.1. Service interface satisfaction and usage

The results of the SEM analysis for service interface satisfaction and use are presented in Table 5-23. The model of IB satisfaction and usage for specific financial activities was performed with the Web survey data, and the model for each service interface general satisfaction and usage was performed with the telephone survey data. As the measurement model had already been tested and validated through the EFA and CFA, using a calibration and holdout sample approach, at the SEM stage, both samples were joined and the overall telephone survey and Web survey samples were used.

Except for the $\chi 2$, which is sensitive to sample size, all fit indices are within an acceptable range, indicating good model fit. As the results may be influenced by excess multicollinearity between independent variables, the variance inflation factor (VIF) was analyzed for the regressions of customer needs and service interface performance scales on service interface satisfaction. The maximum average VIF found was 2.05, which is well below the 10 value limit above which multicollinearity is considered a severe problem (Hair et al. 1998).

Table 5-23: Standardized coefficients, t-values and fit indices for service interface satisfaction and usage model

	Web survey		Telephone survey							
	IB		IB		TB		BB		ATM	
	coeff.	*t-value*	coeff.	*t-value*	coeff.	*t-value*	coeff.	*t-value*	coeff.	*t-value*
Impact on service interface satisfaction										
Needs importance										
usefulness	0.01	*0.37*	-0.02	*-0.41*	0.02	*0.42*	0.01	*0.23*	0.00	*0.06*
efficiency	0.25**	*7.40*	-0.03	*-0.62*	-0.06	*-1.56*	-0.09**	*-2.93*	0.02	*0.46*
p contact	-0.16**	*-6.29*	0.08*	*2.28*	-0.00	*-0.10*	-0.01	*-0.34*	0.02	*0.60*
Service interface performance										
usefulness	0.22**	*6.82*	0.44**	*9.81*	0.45**	*7.92*	0.15**	*4.39*	0.31**	*9.12*
efficiency	0.02	*0.48*	0.23**	*5.17*	0.26**	*5.59*	0.44**	*17.22*	0.42**	*12.59*
p contact	na	*na*	na	*na*	0.18**	*4.72*	0.31**	*9.03*	na	*na*
Impact on service interface usage										
Service interface satisfaction	0.74**	*48.9*	0.10**	*3.29*	0.25**	*8.50*	0.14**	*6.32*	0.07**	*3.03*
r^2										
Service interface satisfaction	0.13		0.40		0.63		0.60		0.49	
Service interface usage	0.55		0.01		0.06		0.02		0.01	
GOF										
N	1934		1198		1134		2012		2050	
$\chi 2$	806		413		576		920		618	
DF	105		105		150		150		105	
GFI	0.95		0.96		0.95		0.96		0.97	
NFI	0.97		0.97		0.98		0.98		0.98	
NNFI	0.97		0.97		0.98		0.98		0.98	
CFI	0.98		0.98		0.98		0.98		0.98	
RMSEA	0.06		0.05		0.05		0.05		0.05	
SRMR	0.04		0.04		0.04		0.04		0.03	

* significant at p<0.05; ** significant at p<0.01

The results reveal that the constructs used for evaluating service interface performance (*usefulness*, *efficiency* and *personal contact*) have nomological validity, as they are significantly related to other variables of interest, such as service interface satisfaction. While service interface general satisfaction had a good r^2 (meaning that the model explained a high percentage of variance for this dependent variable), the r^2 for general service interface usage was low. Although significant, the impact of service interface satisfaction on service interface usage was low, and much lower than in the model for IB usage for specific financial operations.

Several reasons can justify a weaker relationship than what would be expected. First, consumer behavior theory has proven that the path between attitudes and behavior is influenced and mediated by other variables, such as behavioral intentions, subjective norms (Fishbein and Ajzen 1975), and other variables that may prevent customers from behaving according to their attitudes. As the model estimates a direct path between attitudes and usage, the lack of mediating variables may mask the indirect relationship between attitudes and actual behavior.

Second, although these relationships are beyond the scope of the present study, the bank context can bring several insights into the variables that may weaken the relationship between general service interface satisfaction and general service interface usage. Customer service interface usage is limited to the financial activities available. Although customers would like to make cash withdrawals through IB, at home, this is one of the most frequent financial activities that cannot be performed on the Web. Therefore, even if customers are completely satisfied with the IB service for the available operations, the impact of satisfaction on service interface usage is limited by the range of financial operations made available by the Bank. Finally, interaction channel usage is also influenced by the intensity of customer relationship with the bank, as well as the type of financial products portfolio.

These conclusions are reinforced by the results of the Web survey, where the r^2 for IB specific usage is much higher than the r^2 for general IB usage in the telephone survey. In this case, as each customer rated IB usage for a specific financial operation, in a set of 12 financial operations, which were all available in the IB service, the availability constraint was not present. Therefore, for a specific financial operation, service interface choice and usage depended more on customer willingness to use it and not so much on limitations imposed by channel availability or type of general usage of financial services.

To facilitate the interpretation of results, the modeling results are also shown graphically. As can be seen in Figure 5-13, IB satisfaction for specific financial operations is positively influenced by efficiency needs, and negatively influenced by personal contact needs, specifically related to the financial activity at hand. These results show that customers perceive they have to make a choice between efficiency of IB and personal contact of BB. When they need more efficiency for a specific financial activity, they become more satisfied with the most efficient service interface; when they need personal contact, they become less satisfied with IB, which does not provide this kind of service experience.

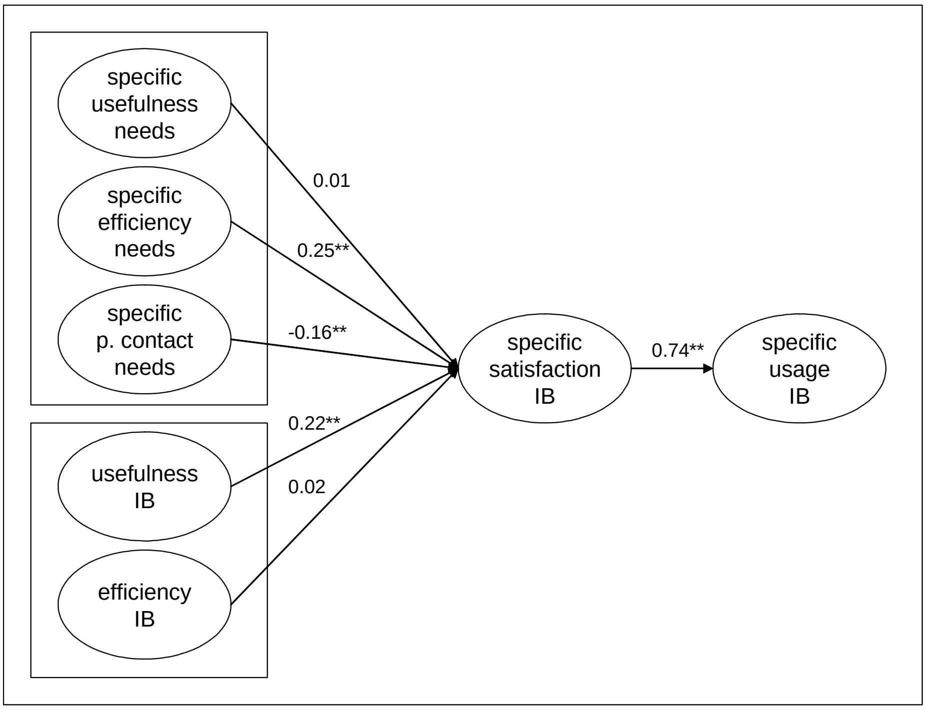

Figure 5-13: IB satisfaction and usage for specific financial operations (Web survey)

IB usefulness performance has a significant positive impact of IB satisfaction for specific financial activities, but performance in terms of efficiency is somehow eclipsed by the effect of efficiency needs. Finally, there is a strong linkage between specific IB satisfaction and specific IB usage.

When analyzing IB general satisfaction and usage, the results are significantly different, as shown in Figure 5-14. For general satisfaction with IB, the most influential factors are related to IB performance. Usefulness is the most important factor, followed by efficiency. The impact of general customer needs on satisfaction with IB is much less significant. In fact, the only significant need is personal contact, which interestingly has a positive impact on general satisfaction with IB. Moreover, the simple correlation between personal contact needs and IB satisfaction is positive, which means that this positive relationship is not the result of excess multicollinearity.

This result was not expected, and is different from the one obtained for specific IB satisfaction, where personal contact needs had a significant negative impact on IB satisfaction and usage. However, these apparently contradictory results may yet have a different interpretation. It seems that although customers are willing to trade-off efficiency for personal for specific financial activities, they do not perceive that trade-off in their general interaction with the bank.

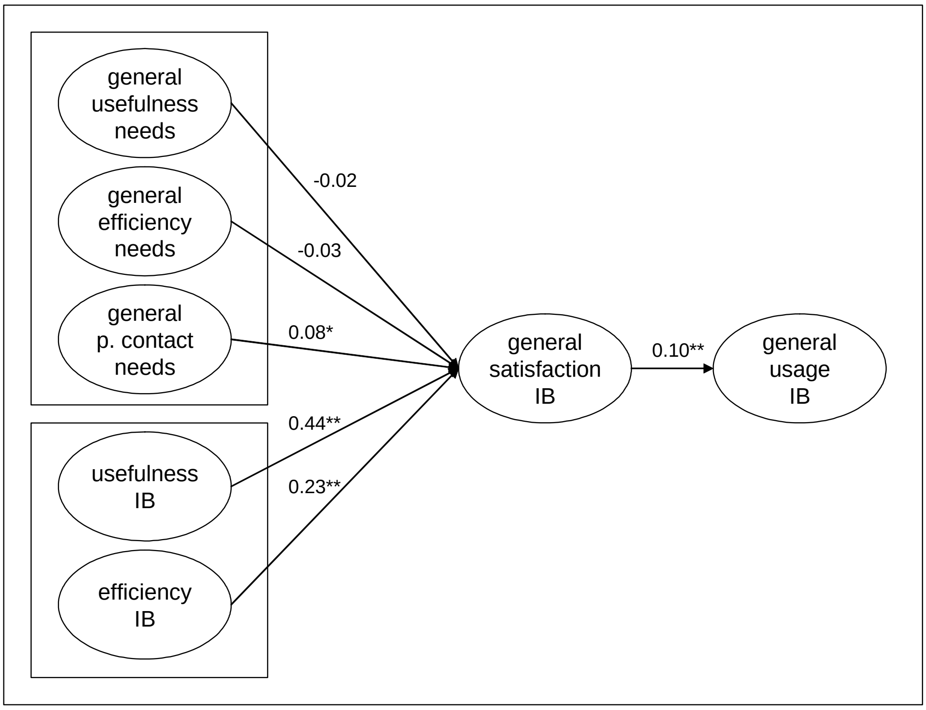

Figure 5-14: IB general satisfaction and usage (telephone survey)

In a specific situation where customers need to gather current account information, they perceive that they have to choose between service interfaces: they can use the inefficient personal contact of BB or they can choose the efficient

IB self-service. For a specific financial activity, customers use each service interface, one at a time, and tradeoff efficiency for personal contact with IB and BB. However, in their general interaction with the bank, customers can use a mix of service interfaces, from which they can then pick the one that is best suited to each particular situation. In the general relationship established with the multi-interface service provider, customers do not feel the need to make such trade-offs, as they can use the different service interfaces from the overall multi-interface offering. Instead, in this context, service interface satisfaction is mostly influenced by customer perceptions of service interface performance and the tradeoff is not so pronounced.

The pattern observed for the IB general satisfaction model was maintained for the other service interfaces. The model for TB general satisfaction and usage shows that TB satisfaction is mostly influenced by TB performance, as can be seen in Figure 5-15. Usefulness is the most important factor, followed by efficiency and personal contact. None of the needs constructs have a significant impact on TB satisfaction.

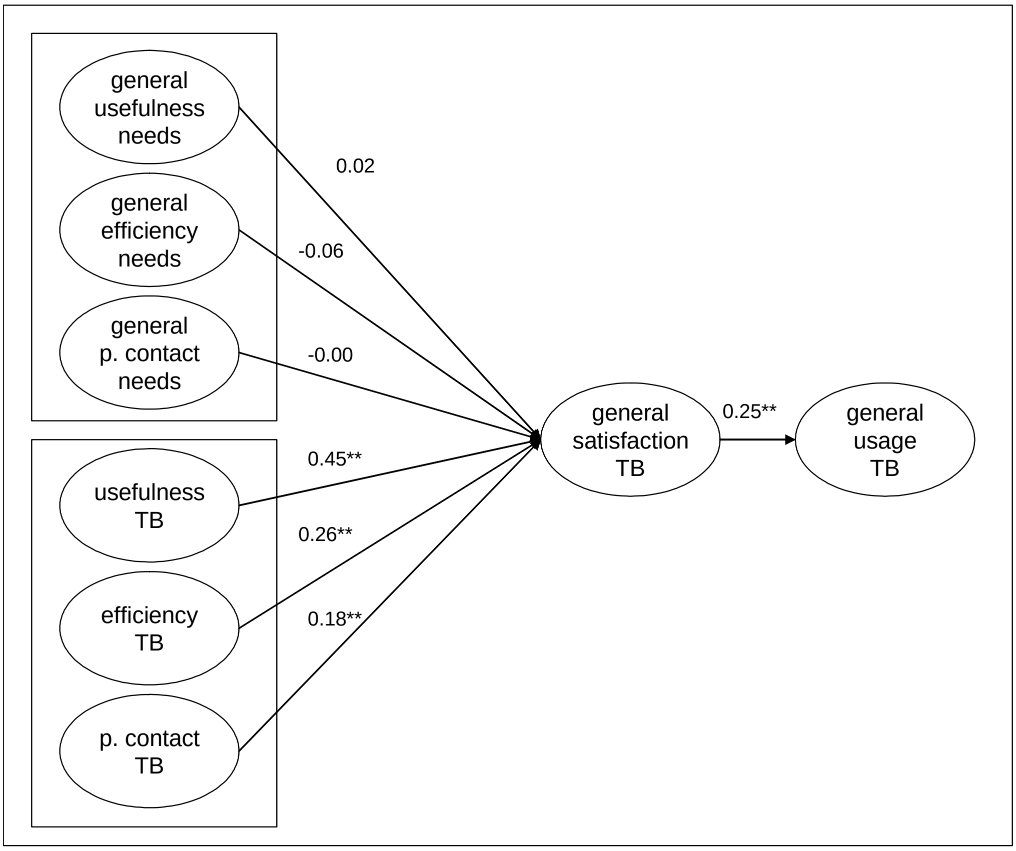

Figure 5-15: TB general satisfaction and usage (telephone survey)

As shown in Figure 5-16, the main dimensions influencing BB satisfaction and usage are also related to BB performance. In this case, the most important factor is efficiency, followed by personal contact and usefulness. Again, general customer needs don't have a significant impact on BB satisfaction, with the exception of efficiency needs. These results can be related to the notoriously poor performance of BB when compared to alternative service interfaces.

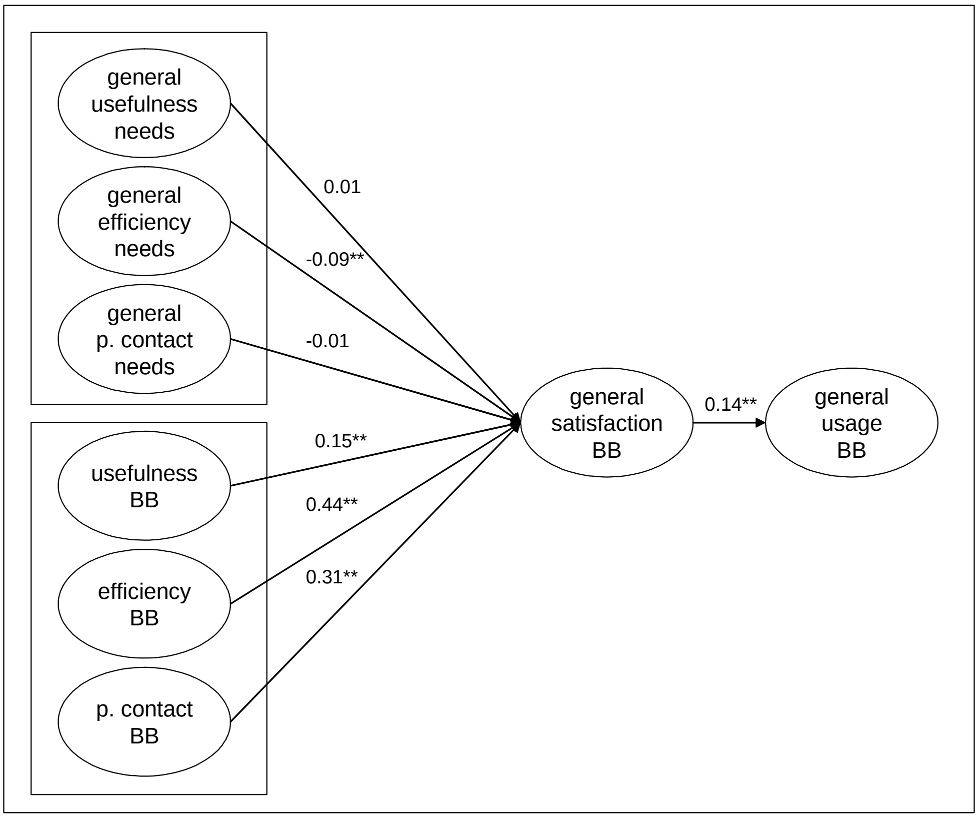

Figure 5-16: BB general satisfaction and usage (telephone survey)

Finally, the model for ATM general satisfaction and usage also shows the same pattern, as can be seen in Figure 5-17. Performance factors have a significant and strong influence on ATM general satisfaction. Efficiency is the most important, closely followed by usefulness. General customer interaction needs again do not have a significant impact on ATM general satisfaction and usage.

The analysis of structural models across the different service interfaces shows other results. First, when analyzing service interface general satisfaction and usage (telephone survey), all service interface performance constructs have a significant impact on satisfaction with the corresponding channel, which indicates that the scales have nomological validity. For IB and TB, usefulness is the most important factor, while for BB, efficiency is the most important factor, followed by personal contact. In light of service interface relative performance, these results indicate that customers are more sensitive to factors where the service interface performs relatively poorly when compared with alternatives.

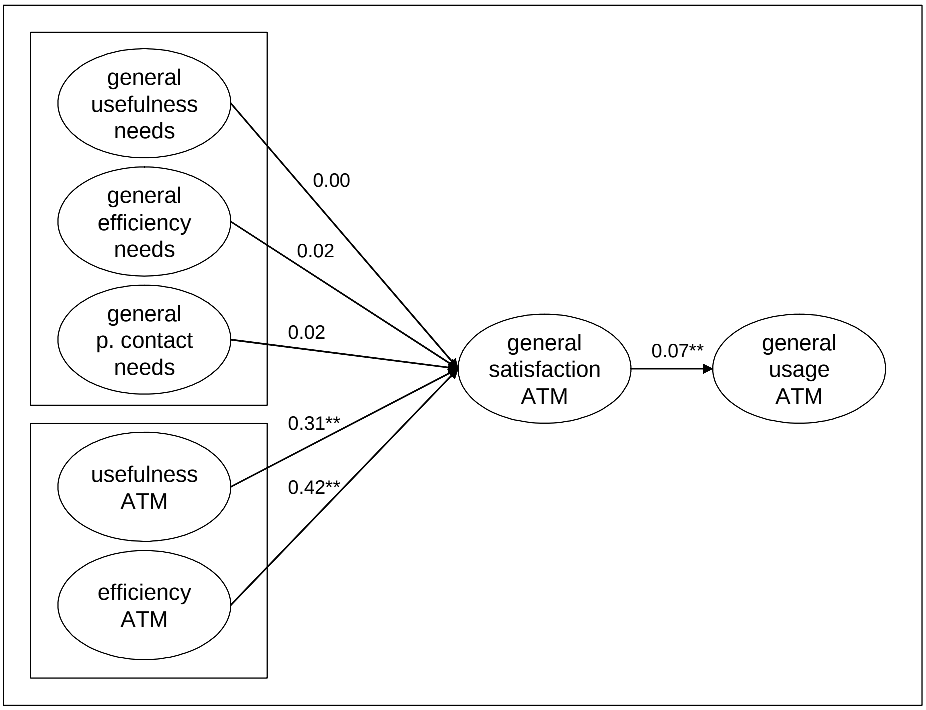

Figure 5-17: ATM general satisfaction and usage (telephone survey)

General customer interaction requirements do not have a significant impact on service interface general satisfaction, with two exceptions. First, general efficiency needs have a negative impact on BB satisfaction, which was expected, as this is seen as the least efficient service interface. Second, general personal contact needs have a positive impact on IB satisfaction, which was not expected.

Comparing IB general satisfaction and usage (telephone survey) with IB satisfaction and usage for specific financial activities (Web survey), several differences arise. Whereas IB performance factors are the most influential on IB general satisfaction, customer interaction needs are more important when customers are choosing a service interface for specific financial activities. More specifically, IB satisfaction and usage for specific financial activities increases with the need for efficiency and decreases with the need for personal contact.

These results can be better understood in light of IB relative performance, being the most efficient service interface, but not offering personal contact. These results are also corroborated by the mean comparison between current account activities (low personal contact needs, high efficiency needs, and high satisfaction and usage of IB) and mortgage applications (high personal contact needs, low efficiency needs, and high satisfaction and usage of BB). Customer IB general satisfaction depends more on IB performance in terms of usefulness and efficiency, but when dealing with a specific financial operation, what counts most is how the service interface satisfies the specific needs at hand, especially the tradeoff between efficiency and personal contact.

These results indicate that the tradeoff between efficiency and personal contact is tenuous in general customer relationship with the bank. As the qualitative study showed, customers like to have all service interfaces available, and in fact, the vast majority of customers use at least two service interfaces – BB and ATM. From the set of service interfaces used in general, customers then choose, each time they need to interact with the bank, the one that best matches their specific needs. Therefore, the different service interfaces act as substitutes for each specific interaction between customer and service provider for a specific financial operation. However, the different service interfaces complement each other in providing a satisfying overall service experience.

5.9.2. Service interface contribution to overall satisfaction

As the quantitative study involved a stratified sample of users and non-users of IB and TB, the contribution of each service interface for overall service satisfaction was analyzed, by user group. As each user group evaluated only the service interfaces used, the models were different for each one of them. Users of both IB and TB rated four service interfaces, whereas non-users of both IB and TB rated only two.

As before, the models were run with LISREL 8.7. Service interface performance in each of the two or three dimensions (usefulness, efficiency and personal contact) was hypothesized to influence service interface satisfaction, which in turn influenced overall service satisfaction. The standardized coefficients and corresponding t-values, the r2 and model fit indices are presented in Table 5-24.

Table 5-24: Standardized coefficients, t-values and fit indices for service interface contribution for overall satisfaction

	Telephone survey							
	IBuTBu		IBuTBnu		IBnuTBu		IBnuTBnu	
	coeff.	*t-value*	coeff.	*t-value*	coeff.	*t-value*	coeff.	*t-value*
IB performance on IB satisfaction								
usefulness	0.55**	*7.00*	0.42**	*6.57*				
efficiency	0.14*	*1.81*	0.24**	*3.77*				
TB performance on TB satisfaction								
usefulness	0.52**	*7.20*			0.40**	*5.08*		
efficiency	0.19**	*3.05*			0.23**	*3.30*		
p contact	0.17**	*3.36*			0.21**	*4.45*		
BB performance on BB satisfaction								
usefulness	0.04	*0.67*	0.21**	*4.08*	0.05	*0.83*	0.19*	*1.96*
efficiency	0.49**	*10.92*	0.31**	*6.60*	0.43**	*8.03*	0.33**	*3.29*
p contact	0.36**	*5.56*	0.35**	*6.56*	0.34**	*5.44*	0.28**	*3.96*
ATM performance on ATM satisfaction								
usefulness	0.38**	*6.59*	0.17**	*2.61*	0.39**	*5.92*	0.32**	*3.42*
efficiency	0.34**	*6.07*	0.54**	*8.44*	0.36**	*6.63*	0.38**	*4.12*
SDS performance on Bank satisfaction								
IB	0.24**	*6.73*	0.25**	*6.79*				
TB	0.18**	*4.84*			0.15**	*3.82*		
BB	0.43**	*11.76*	0.41**	*11.00*	0.42**	*10.62*	0.41**	*8.44*
ATM	0.01	*0.36*	0.08*	*2.18*	0.17**	*4.32*	0.08*	*1.66*
R2								
IB satisfaction	0.45		0.37					
TB satisfaction	0.66				0.56			
BB satisfaction	0.63		0.59		0.56		0.52	
ATM satisfaction	0.44		0.46		0.49		0.45	
Bank satisfaction	0.41		0.31		0.31		0.19	
GOF								
n	528		550		498		351	
χ2	1484		839		867		324	
DF	506		248		315		121	
GFI	0.86		0.89		0.89		0.91	
NFI	0.96		0.96		0.96		0.96	
NNFI	0.97		0.96		0.97		0.97	
CFI	0.98		0.97		0.98		0.98	
RMSEA	0.06		0.07		0.06		0.07	
SRMR	0.04		0.05		0.05		0.05	

significant at $p<0.05$; ** significant at $p<0.01$

All fit indices are within acceptable ranges, with GFI above or near the cutoff value of 0.9, RMSEA below 0.08, SRMR below 0.08, and CFI, NFI, NNFI above 0,95. The r2 are all high, both for service interface satisfaction and overall service satisfaction.

As shown in Table 5-24, the model works well across the different user groups, with acceptable model fit measures for every group. Service interface performance dimensions of usefulness, efficiency and personal contact all have a significant impact on service interface satisfaction (except for BB usefulness for IBuTBu and IBnuTBU groups). These results reinforce the nomological validity of the construct's measurement scales.

Analyzing the results across the different user groups, it can be seen that usefulness is the most important dimension for IB and TB satisfaction, while efficiency is the most important BB performance factor, closely followed by personal contact. Again, the impact of each performance factor on service interface satisfaction can be associated with the relative position of each interface in the overall service. Customers seem to be more sensitive to performance variations in factors where the service interface has a relatively poor performance (usefulness for IB and efficiency for BB).

Finally, the different service interfaces all have a positive impact on overall service satisfaction. BB is still the most important one, followed by IB and TB. ATM is the interaction channel which makes the least contribution to overall service satisfaction, which can be explained by the fact that ATMs are part of a network that does not belong to a specific bank. Therefore, ATMs are seen as not being fully part of the service provided by the bank, and therefore contribute less to overall service satisfaction.

Comparing the different user groups, it is interesting to note that BB still has the strongest impact on overall service satisfaction for all user groups, and its strength does not decrease for users of SSTs. This corroborates the qualitative findings, where customers stated that, although they liked the efficiency of IB and ATM for routine operations, BB service continued to be crucial for the development of the relationship between the customer and the bank. Therefore, offering good IB service does not decrease the importance of providing a good service through BB. Again, service interfaces seem to complement, rather than substitute for each other, in providing a satisfying overall service experience.

5.10. Conclusion and implications of quantitative study

The quantitative results corroborated the findings of the qualitative study, which provided an in-depth understanding of service interface satisfaction and usage in a multi-interface service setting. The quantitative study also brought new insights into the dimensions of customer interaction needs and service interface performance that were most influential in this process (usefulness, efficiency and personal contact). The analysis of the structural models allowed the comparison between general and specific IB satisfaction and usage, the analysis of satisfaction and usage of the different service interfaces, and the contribution of the different service interfaces for overall service satisfaction across different user groups.

The quantitative results show that general customer satisfaction with IB depends more on IB performance in terms of usefulness and efficiency. But when dealing with a specific financial operation, what counts most is how the service interface satisfies the specific needs at hand, especially the tradeoff between efficiency and personal contact. This tradeoff is important for service interface satisfaction and usage for each specific financial activity, but has a tenuous influence on service interface general satisfaction.

Both qualitative and quantitative results show that customers tend to choose a service interface mix in their general interactions with the service provider. Then, from the set of service interfaces generally used, each time they need to interact with the bank, customers choose the one that best matches their specific needs. Therefore, the different service interfaces act as substitutes in each specific interaction, but complement each other in providing a satisfying overall multi-interface service experience.

In this context, it is important that each service interface is able to add value to the overall service. The quantitative results show that no service interface performs best in every attribute, but BB is the best performer in usefulness and personal contact, IB is the most efficient, and ATMs are still the most efficient for some financial activities that can only be undertaken with this service interface or in the inefficient BB. Therefore, each one of these service interfaces adds value to the overall service. However, the value added by the TB seems to be in question, as it is not the best one for any attribute.

The study results also have implications in terms of service interface design, especially in terms of the operations made available in each interaction channel. The development of new technologies has made it possible to offer new functionalities through Web interfaces, and has expanded the potential use of the Internet for service provision. However, more than just making services functionally available in new service interfaces, it is important to understand what CERs are associated with each financial activity, in order to identify the interfaces that are best suited to provide the desired service. Therefore, customer interaction experience requirements should be carefully elicited and incorporated from the early stages of service interface design.

If customers consider personal contact of uppermost importance when applying for a mortgage loan, they prefer the efficient IB when gathering information about their current account. Banks have made mortgage loan applications available on the Internet, but customer usage has been poor. However, for routine financial operations, such as current account information gathering, SSTs have become the preferred interaction mode. Therefore, it may not be the best strategy to invest in developing the overall mortgage loan application service in IB, if customers still prefer the full personal contact of the bank branch. On the other hand, it may not be worthwhile to invest in making BB more efficient in providing current account information, if SSTs can easily overcome BB in providing a satisfying service. An integrated management of the multi-interface service can therefore allow for a better allocation of resources among service interfaces, and a better design of the overall service experience.

Technology and service issues are increasingly intertwined. Interface designers can no longer concentrate on technology issues and cannot focus only on a specific interaction platform. In the Internet service environment, each interface design increasingly depends on service issues and on the overall multi-interface service design. On the other hand, service managers have to take technology into account for service design, whether it is person-to-person interaction or SSTs. Service design is increasingly influenced by technology, with all its potentialities and constraints. In this context, it seems that further efforts are worthwhile in bringing the contributions of interaction designers and service managers to new service design. As technology and service issues become more intertwined, it is important to join both perspectives from the very beginning of multi-interface service design. Joining technology and service perspectives can help service providers to better understand customer needs and provide a better overall service experience.

The qualitative and quantitative stages provided a thorough understanding of customer interaction experience requirements in a multi-interface service setting and how each service interface performed in satisfying those requirements. These studies provided the basis for understanding the improvements needed in designing multi-interface service experiences, which led to the subsequent research stage.

6. Designing the multi-interface service experience

The qualitative and quantitative stages of the dissertation research provided a better understanding of customer satisfaction and usage of Internet services in a multi-interface context, as shown in the previous sections. Based on in-depth and focus group interviews with 36 customers and 13 bank employees, and two surveys with 4076 bank customers, the most relevant experience requirements for multi-interface service were identified: *usefulness efficiency* and *personal contact.*

The dissertation research plan also allowed for the development and validation of measurement scales for these experience requirements, as well as a better understanding of their influence on customer satisfaction with the different service interfaces. These studies provided a deep and rigorous elicitation of CERs, and a better understanding of the importance of those requirements by user group and by essential use case or financial activity. The evaluation of the relative performance of service interfaces also offered a view of how each one satisfied customer interaction experience requirements.

The qualitative and quantitative findings therefore served as the basis for Internet service design within the multi-interface bank service. In fact, the identification of user needs and system requirements is considered the first step in the iterative process of interaction design, as shown in Figure 6-1. In this process, requirements gathering provides the basis for interaction system's design and prototype development, the prototypes are evaluated and tested, and the requirements process receives new feedback, until the process reaches an acceptable end result (Preece et al. 2002).

Following this process, the last stage of research presented in this chapter applied the qualitative and quantitative findings to the requirements analysis and design of integrated multi-interface service experiences, as shown in Figure 6-2. Although the focus was still on requirements analysis, this stage also worked on the link between requirements elicitation and prototype specification, where customer needs are translated into interface design. Focusing on the dissertation research vectors, the prototype specification stage approached service interface design integrated within the multi-interface service, focused on CERs, and adopted a multidisciplinary approach, addressing both service and technology issues.

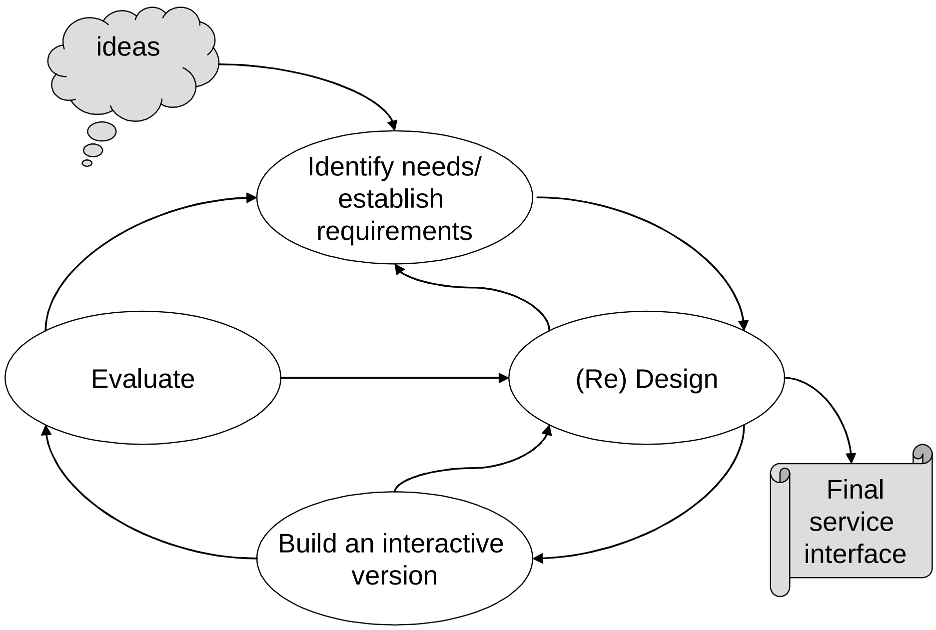

Figure 6-1 A simple Interaction Design Model
(adapted from Preece et al 2002) (Patrício et al. 2003a)

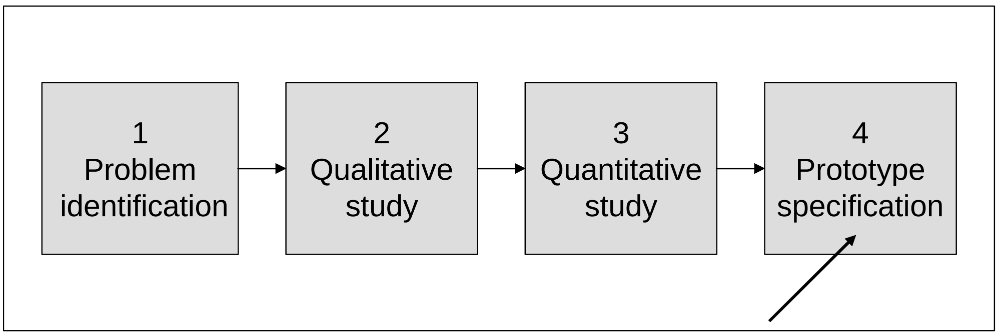

Figure 6-2: The Prototype specification stage of research

Customer experience requirements (CERs) and service interface design

Specifying requirements is considered as one of the most difficult, yet important components of software development (Lauesen 2002). If this task is already considered difficult for traditional software development projects, it becomes more complex for Internet service interfaces. Internet services blend technology and services, and are provided to a wide set of heterogeneous customers, in a non-controlled environment. In multi-interface services, experience requirements become increasingly important as customers have more power to choose between service interfaces and service providers. Service providers and interface designers can try to persuade customers, but cannot force them to use an interactive system.

In the Internet service environment, traditional requirements elicitation methods may not suffice. An important objective of the dissertation research was to contribute to a better elicitation and analysis of requirements in this new context. The methods used throughout the qualitative and quantitative studies contributed to a deep and rigorous understanding of CERs in a multi-interface service. This approach can also be replicated in other multi-interface service contexts, whenever the number of users and the complexity of the service interface context call for rigorous methods for requirements elicitation that can complement traditional ones.

New technologies have enabled the upsurge of multi-interface services, and customers now use the different service interfaces in a complementary way. The qualitative and quantitative studies both brought important insights into the understanding of customer satisfaction and usage of Internet services in the multi-interface context. The study results showed that customers use a mix of interaction channels in their general relationship with the Bank. But for each financial activity they pick the one that best satisfies the specific needs generated by the situation at hand.

In the multi-interface service context, where the same service functionality is provided through different service platforms, CERs determine interactive system's design. For a customer who can make a financial transaction through several different service interfaces, interface choice will depend, not on the system main functionality, but on the experience provided by each service platform.

As previously presented in Chapter 1, Customer Experience Requirements(CERs) are defined as customer perceived attributes of the interaction with the service provider that contribute to satisfaction and usage of the service (Patrício et al. 2004). Using the requirements engineering framework, CERs can be viewed as a more customer centric, interaction focused, and service oriented type of non-functional requirements. CERs focus on the experience nature of the interaction between customer and service provider, comprising both outcome (what) and process (how) attributes.

Again, the study results allowed the identification of the most relevant experience requirements in the multi-interface context, and brought new insights into how they influence customer satisfaction and usage of the different service interfaces. The quantitative results showed that, in their general relationships with the bank, all experience requirements are very important, although some differences emerge between users and non-users of Internet banking. However, when dealing with specific financial activities, larger differences are found. For routine operations such as current account information, customers value more efficiency requirements, and as such prefer to use IB over BB. On the other hand, for more complex financial activities, such as mortgage loan applications, personal contact becomes of utmost importance, and customers prefer to use BB.

Integrated multi-interface service design

Each service interface has its advantages and disadvantages, adding value to the overall service. The analysis of the comparative performance of each service interface in the quantitative study showed that BB is the best performer in terms of personal contact and usefulness, IB is the most efficient service interface, and the ATM is a relatively efficient interface for non-technology users, when compared with BB. Those interaction channels that don’t make a contribution to the overall service, such as TB, tend to be gradually left for some particular customer segments or be relegated for infrequent occasions.

These results stress the importance of an integrated approach to the design of multi-interface service delivery systems that addresses CERs from the earlier development stages. As customers can seamlessly move from interface to interface according to their needs and preferences, it’s important to design each one, not to optimize the interaction experience between customer and that service interface from beginning to end, but to optimize its contribution to the overall service experience, which may involve the interaction with several service interfaces.

Multidisciplinary approach to service interface design

Moreover, as technology enabled services blend services and technology, it is necessary to bring both marketers and interaction designers to the service design process from the very beginning, as service and technology design decisions become increasingly intertwined. The dissertation research has adopted a multidisciplinary perspective in the study of customer satisfaction and usage of Internet services in a relational multi-channel service environment. This multidisciplinary perspective was reflected in the contribution of services marketing, information systems, interaction design and requirements engineering in the research design and conceptual model. However, this multidisciplinary perspective should also go beyond the analysis of customer satisfaction and requirements elicitation stage to the requirements analysis and service design stages.

Although services marketing has addressed the service design process through methods such as the Service Blueprint, this technique was developed for person-to-person service provision and does not explicitly address experience requirements. On the other hand, software engineering has traditionally focused on functional requirements, which are well addressed through standard techniques, such as use case and activity diagrams (Booch et al. 1999). Other proposals have also addressed non-functional requirements (Mylopoulos et al. 1992a), but none of these methods addresses experience requirements for system interfaces within a multi-interface service context, where service and technology issues are interrelated.

The Essential Use Case (EUC) – Service Experience Blueprint (SEB) approach

Having these challenges in mind, throughout the dissertation research, a new approach to multi-interface service design was developed, to design each service interface to make the best contribution to the overall service experience. This approach was applied to the case of the multi-interface Bank under study, comprising the following steps:

1. First, customer interaction experience requirements are elicited with an essential use case (EUC) approach, in a channel independent way. Simultaneously, the relative performance of each service interface in satisfying those CERs is also assessed. This first step corresponds to the qualitative and quantitative stages of research, which provided a rigorous elicitation of CERs and an understanding of their influence on service interface satisfaction and usage.

2. Based on this previous work, experience requirements are analyzed for each EUC and the performance of each service interface in satisfying those needs is assessed. This stage identifies which service interfaces are best suited to satisfy customer experience needs, based on a goal-oriented analysis. With this EUC, multi-interface approach, service providers can better allocate design efforts across the different service interfaces, to take advantage of each interface capabilities, and design a satisfying overall integrated service experience.

3. Finally, after understanding which experience requirements are most important for each essential use case and identifying which service interfaces are best suited to satisfy those needs, design can then drill down to the concrete use case level where the interaction experience is designed for specific service interfaces. To better address CERs, and to take into account the multiple interface nature of the service experience, a new diagrammatic representation for service interaction process is proposed: the *Service Experience Blueprint SEB.* The SEB is a visual representation of the service interaction process at the concrete service interface level, with a special focus on the customer interaction experience. As it joins the contributions of both the service blueprint and activity diagrams, it can be easily understood and used by marketers and interaction designers to better address service interface design. Following the multi-interface service approach, the SEB allows

for a special emphasis in the design of linkages between different service interfaces, aiming at improving the overall service experience.

This approach joins the techniques used in services marketing and requirements engineering, adapting them to the design of technology enabled multi-interface services, where technology and service design issues are deeply interrelated.

- The EUC, goal-oriented analysis and SEB diagrammatic representations of the proposed approach can be easily understood and used by both marketers and engineers. Therefore, it can be used to address service interface design decisions for which technology and service issues are interrelated.
- The approach incorporates experience requirements from the high-level of essential use case/overall service design to the lower level of concrete use case/specific service interface design, contributing to a better incorporation of CERs in the service interface design process.
- The approach adopts an integrated multi-interface design. This integrated perspective is used at the EUC level, as the analysis of experience requirements helps in allocating design efforts to the different service interfaces. The multi-interface perspective is also applied at the CUC level, as the SEB for each service interface explicitly addresses the links between different service interfaces. With this approach, each service interface can be designed, not in isolation, but to best contribute to an overall satisfying multi-interface service experience.

This chapter on designing the multi-interface service experiences starts with a literature review on existing software engineering and marketing design methods, divided in two groups. Section 6.1 presents the group of methods focusing on the design of service delivery process or interaction process. This group comprises the Service Blueprint from marketing, and Use Case and Activity Diagrams from software engineering. Section 6.2 presents the group of methods focusing on translating customer requirements into overall attributes of service or interface design. This group includes the Quality Function Deployment approach, borrowed by marketing from quality management, and the Goal-Oriented Analysis from the requirements engineering field.

Each one of these methods focuses on some particular aspects that are relevant for technology enabled service design. However, they do not address multi-interface service design with an integrated approach, do not address adequately CERs, and do not apply a multidisciplinary perspective. The remaining sections of this chapter explain in further detail the proposal for better designing the multi-interface service experience.

6.1. Technology enabled service process design

In both marketing and information systems there are methods and tools focusing on the analysis and design of the service and interaction process. In services marketing, Service Blueprinting is a technique for designing the process of service delivery (Shostack 1984). In software engineering, use case and activity diagrams are important Unified Modeling Language (UML) components for modeling the intended behaviors of the system and the activities performed by each actor (Booch et al. 1999). These complementary approaches will be reviewed and applied to the case of the multi-interface Bank under study.

6.1.1. The Service Blueprint

Designing Internet service experiences requires the integration of different perspectives in a customer centric way. Whether it is provided through person-to-person or human-computer interaction, a service is fundamentally a process and not an object (Shostack 1987). When compared with product design, service design is more challenging, as the service experience is more difficult to visualize and control (Lovelock 2001).

This intangible nature of services may be one of the reasons for the meager research on service design, as compared to product design. In fact, although service design is considered a crucial factor for service quality, it has been among the least studied and understood topics in services marketing (Brown et al. 1994; Tax and Stuart 1997). Service Blueprinting is one of the few techniques developed in the marketing field which focuses on the design of the service delivery process. As a process design technique, it shares some basic concepts and methods with other process-oriented disciplines, such as operations management or requirements engineering (Shostack 1984).

Service Blueprint for gathering current account information through BB

The Service Blueprint (SB) technique decomposes the service delivery process down into logical steps and sequences to facilitate and guide service design. Developing a service blueprint requires mapping all the key activities involved in service delivery and production and specifying the linkages between these activities (Shostack 1984). Figure 6-3 shows an example of SB for gathering current account information through BB.

As can be seen in this example, the SB divides the activities undertaken by the different actors to provide the service – current account information gathering. Being a marketing based method, it concentrates on the customer and the interaction between customer and service provider. As such, the upper level of the SB shows the sequence of customer activities and how they relate to the bank employee activities. In this case, the customer enters the bank branch to request information about his/her current account. The bank employee requests the necessary information about customer ID and account number, and then uses the technology enabled system to retrieve the information and print it for the customer. The backend information system, although not visible in the eyes of the customer, provides a crucial support for a satisfying customer interaction experience.

The analysis of the responsibilities of each participant is an important step in the process of service design, which should be viewed, not as a given, but as a service design issue. In the current example, three participants are involved in the service provision: the customer, the bank employee, and the technology enabled system that supports the bank employee in the interaction with the customer. This separation of activities is further clarified in the SB by three lines.

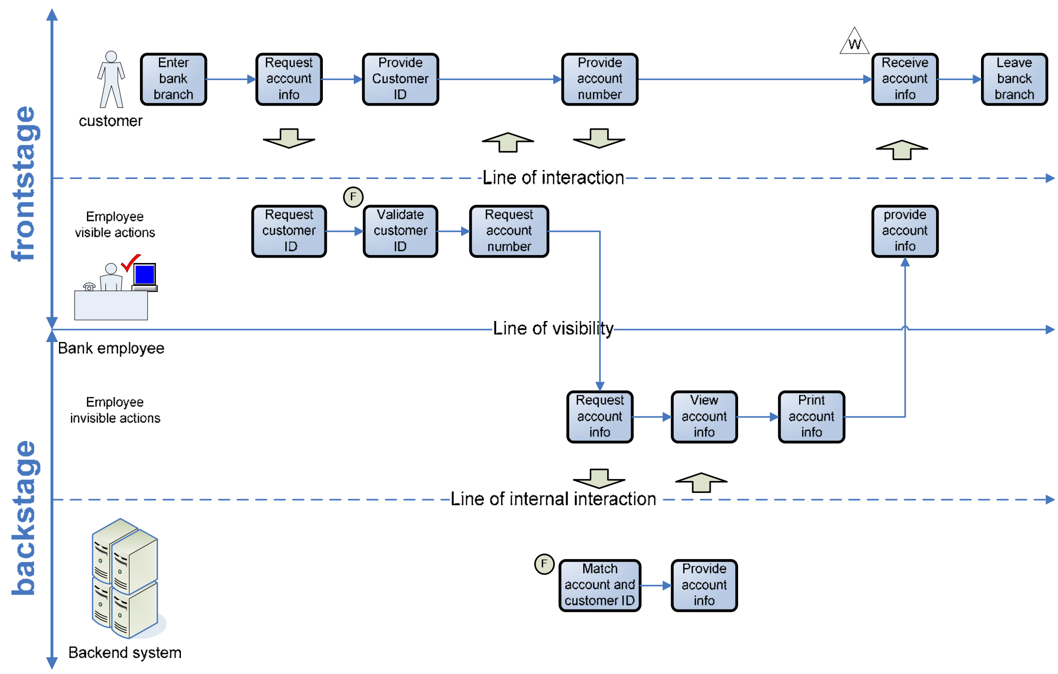

Figure 6-3: Service Blueprint for gathering current account information through the bank branch

Line of interaction

The line of interaction distinguishes the actions of the customer from the actions of the service provider, whether those actions are undertaken by an employee or a by a technology enabled interactive system such as the Internet. In the above example, as the service is provided through person-to-person interaction, the line of interaction separates the actions of the customer from the actions of the employee. All that the customer has to do is to request the information, provide the ID and account number, and wait for the employee to provide the information desired.

The line of internal interaction distinguishes the actions undertaken by the employee in the backstage from the responses of the information system and other back-office operations that provide the necessary support for service provision.

Line of visibility

The line of visibility distinguishes what the customer experiences and visualizes frontstage, from the activities of employees and support systems backstage, where the customer cannot see them (Lovelock 2001). In this case, the bank employee requests the customer ID and account number frontstage, then retrieves the information backstage, and returns to the frontstage to provide the requested information to the customer.

The Service Blueprint also provides a way to represent potential *fail points* and *waiting time points* that are crucial for service quality.

Fail points F

Fail points represent points in the service delivery process where a failure can occur, having a special negative impact on customer experience. These fail points are represented by circles with an F inside. In the above example, wrongly validating or invalidating customer identification would have a strong negative impact on customer service experience. Similarly, if the backend system does not make the match between the customer and the account, and provides information on the wrong account, customer satisfaction will also drop significantly. These fail points determine the points in the service delivery process where there is a risk of something going wrong, helping to better design the service in order to overcome them.

Waiting points W

Waiting points represent points in the service delivery process where a delay can occur, annoying customers and decreasing customer satisfaction. Waiting points are represented with a triangle with a W inside. In the example of gathering current account information through the bank branch, customers wait from the moment they provide the necessary information to the bank employee (ID and account number) until they receive the requested information. This analysis helps in establishing time frames for each of the service sub-process, as well as tolerance levels for deviations from standard execution time (Shostack 1984).

Fail points and waiting points force service designers to think ahead of the things that may go wrong or delayed in the service process, and design it to overcome these potential problems. On the other hand, the line of interaction and the line of visibility, more than being something that has to be taken into account in service design, represent important structural design options that have a strong impact on customer service experience. Different positions of the line of interaction imply different service delivery options that may radically change customer participation in the co-production of the service. The emergence of SSTs had a strong impact on the service line of interaction, as the intervention of the service employee disappeared, while the level of customer co-production of the service increased significantly.

Service Blueprint for gathering current account information through IB

The example of a Service Blueprint for current account information gathering through the Internet banking service can be seen in Figure 6-4. To get current account information through Internet banking, customers interact directly with the bank's technology enabled system. In this service interface, customers make their own validation through the login process, choose the desired financial activity from the available options, and analyze the information on their own. If necessary, customers print the information retrieved and are responsible for closing the login session.

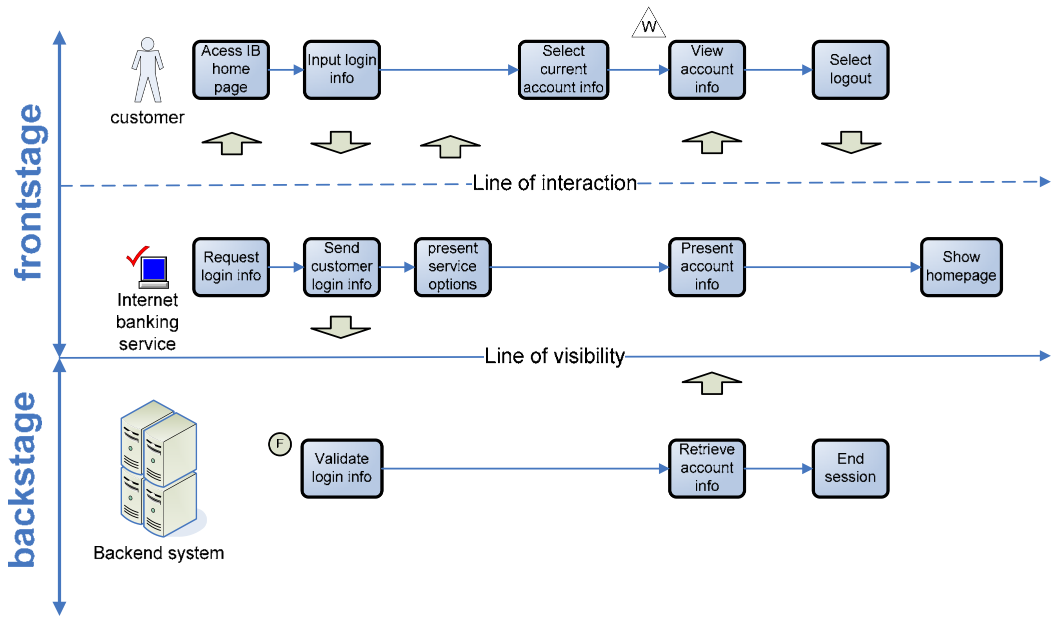

Figure 6-4: Service Blueprint for gathering current account information through the Internet banking service

Internet banking service provision represents a radical change in the line of interaction, with a strong impact on customer interaction experience. In Internet banking, the customer is much more responsible for the co-production of the service, gets a more efficient and autonomous service, but loses the personal contact provided by the bank branch employee.

The position of the line of visibility also changes. In the bank branch, the customer waits for the information while the bank employee interacts with the bank's system behind the computer. The process of ID validation and information retrieval is not visible to the customer. The customer only sees the printed information provided by the bank employee at the end of the interaction. In Internet banking, however, the line of visibility also moves up, and the customer is able to visually follow the process of ID validation and information retrieval, as the sequential computer screens provide feedback of the process states.

These two lines provide an important help for requirements analysis and service design. The line of interaction helps designers decide which activities shall be undertaken by the customer and which activities shall be performed by frontstage employees or interactive systems. These design decisions have a strong impact on multi-interface service design, as personal interaction and self-service interaction require a very different customer participation in service provision.

The line of visibility helps service and interaction designers to explicitly decide which activities shall be visible to the customer, and which activities shall be hidden backstage. The decision to hide back-office operations in many bank branches, to reduce the burden of customers noticing the administrative work needed to manage a bank branch, is an example of a redesign of the line of visibility to improve customer interaction experience. On the other hand, in interaction design, making what is happening backstage more visible can improve the interaction experience. One example is the visible feedback provided when backend systems are working to retrieve information; another example is the order tracking option provided by several systems, where customers can view where their order is in the backstage operations process.

The SB is a useful tool for service design. It helps clarify the service concept, which is still frequently defined subjectively, and to systematize the process of service design, which is frequently undertaken through trial and error process, leading to often to poor results (Shostack 1984). The separation of the activities of each participant in the service provision helps designers to define explicitly which activities will be performed by each one, and which activities will be visible and invisible to the customer. These design decisions have a crucial impact on the customer experience, and should not be taken as fixed characteristics of the service process, especially as new technologies widen the range of service design possibilities.

However, the SB was developed for person-to-person service delivery, and as such is more focused on customer and employee activities, although support processes are also addressed. The design of technology enabled service provision may require some adaptations, to better address the specificities of interface and software systems design. The incorporation of requirements engineering tools and techniques, such as use case and activity diagrams, could help in improving the adaptability of SB to the technology enabled service environment. Moreover, this technique does not address explicitly how CERs, such as usefulness, efficiency and personal contact, are translated into service design. In this regard, other techniques could also complement the process design of the SB with a requirements analysis. These complementary techniques will be presented in the following sections.

6.1.2. Use case diagrams and Activity diagrams in UML

Although focused on the customer and service side of design, the SB, as a technique used for mapping processes, can be related to other interaction design techniques used in software engineering and HCI. In software engineering, the Rational Unified Process (RUP) has become a standard for software development, capturing some of the best practices in this field (Kruchten et al. 2001).

In RUP, many of the activities focus on the development of models, which are described using the Unified Modeling Language (UML). The UML is “a graphical language for visualizing, specifying, constructing and documenting artifacts of a software intensive system” (Booch et al. 1999). The UML provides a standard way to write a system’s blueprint, covering conceptual things, such as business processes and system functions, as well as concrete things, such as classes written in a specific programming language or database schemas.

The existence of a standard language for software modeling such as UML is very important for software development. First, similarly to the Service Blueprint, it provides a way to systematize the process of software development, which can otherwise be chaotic. Modeling is a crucial component of software development, as it allows better design of the system's architecture, better understanding of the system being built, and better communication of the desired structure and the intended system behavior to other stakeholders.

The UML language comprises an extensive set of models, adopting an object-oriented approach, meaning that the software system is structured in terms of objects or classes (Booch et al. 1999). Every object has identity (it can be named and distinguished from other objects), state (with some state associated with it), and behavior (the object can somehow interact with other objects). The UML is use case driven, meaning that use cases are a starting point for defining the desired behavior of the system, for testing the system's architecture, and to communicate with other stakeholders. The main input for user interface design activities in the RUP is the use case model (Kruchten et al. 2001).

Essential use cases (EUCs) and concrete use cases (CUCs)

Use cases capture the intended behavior of the system being developed, without having to specify how that behavior is implemented (Booch et al. 1999). Therefore, use cases provide a way for developers to communicate with end users and domain experts, and are especially used at the requirements stage of the software development process. As previously explained, it is important to distinguish Concrete Use Cases (CUCs), where a specific interaction technology is already assumed, from Essential Use Cases (EUCs), which are technology independent, focusing on user's intentions and system's responsibilities.

The UML language adopts a concrete view of use cases, defined as the description of a set of sequence of actions that a system performs to produce a useful result for an actor (Booch et al. 1999). Concrete use cases (CUC) assume that a specific interaction system or technology is previously defined. Gathering current account information through the Internet banking service can be viewed as a CUC of the IB system. In this CUC, it is already assumed that the customer will use the Internet technology to access the bank.

Essential use cases (EUC) are defined as "a single, discrete, complete, meaningful, and well-defined task of interest to an external user, comprising user intentions and system responsibilities in the course of accomplishing the task, described in abstract and technology-free terms, using the language of external users” (Constantine and Lockwood 2001). From this perspective, the use case of gathering current account information can be defined at an EUC level, if customer intentions and bank’s responsibilities are described in a technology independent way.

In User Centered Design (UCD), it is advocated that design must start at an abstraction level that allows designers to make the essential connection between the user’s goals and the specific ways of meeting those goals, which may involve finding the best device or program to help users achieve their goals (Hackos and Redish 1998). As EUCs are technology independent and are focused on user roles and intentions before any choice of a specific interaction platform is made, they are very useful in eliciting experience requirements, especially when the same service is provided through different interface technologies (Patrício et al. 2003b).

With EUCs, interface designers can identify customer requirements and make design options in a stage when they have a more open set of design options, which may include the choice of platforms that will offer the desired use case. As shown in Figure 6-5, interface designers should therefore first analyze each use case at the essential, multi-interface level, to decide which service platforms will provide the service activity. After this process, interface designers are then better prepared to analyze each use case at the concrete level, designing each interface in a way that best contributes to the overall multi-interface offering.

In the use case analysis at the concrete level, software developers usually first describe the flow of events for a use case in text in written text. As the understanding of the system's requirements is refined, activity diagrams can be used to specify these flows graphically. Typically, software developers use one sequence diagram, such as activity diagrams, to specify a use case's main flow, and variations of that diagram to specify a use case's exceptional flows (Booch et al. 1999).

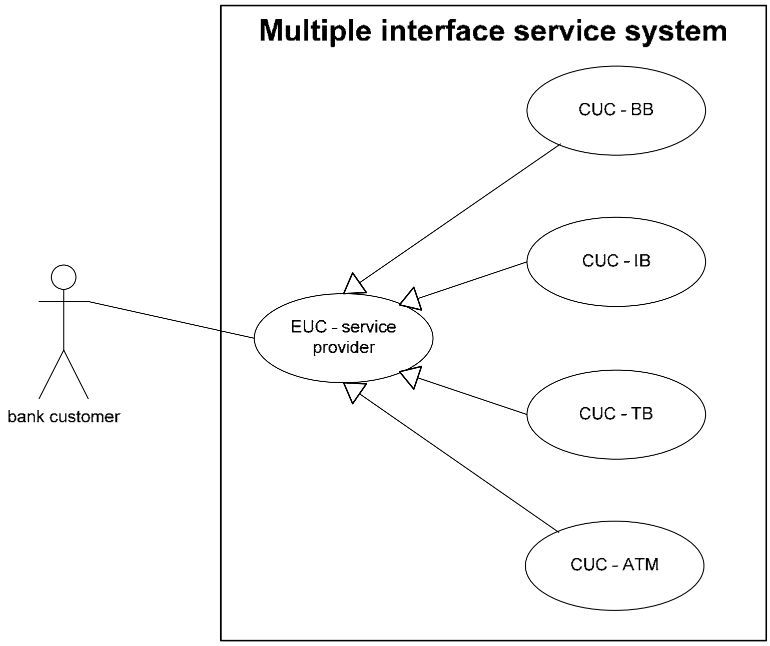

Figure 6-5: The application of Essential Use Cases (EUC) and Concrete Use Cases (CUC) in multi-interface service design

Activity diagrams

Activity diagrams are one of the diagrams used in UML for modeling the dynamic aspects of a system. An activity diagram is essentially a flowchart that emphasizes the activities that take place over time by the different actors (Booch et al. 1999). In this regard, activity diagrams are similar to the SB, in that both techniques can model the interaction process between the customer and the service provider through a specific service interface, showing the sequence of activities of the different actors over time. However, UML activity diagrams use a more standardized language, which helps different software developers in understanding and reusing these diagrams.

Figure 6-6 shows a simplified version of an activity diagram for the concrete use case of gathering current account information through BB. In activity diagrams, activities are represented by lozenge shapes, such as request information, or provide information. The transitions from activities to activities in the workflow are represented by lines with arrows. The flow of activities performed by each actor is grouped into swimlanes, represented by columns. The use of swimlanes helps in clarifying and visualizing the responsibilities of each actor in the use case.

Figure 6-6: Activity diagram for the use case – gathering account information in the bank branch

The activity diagram for gathering current account information in BB is also illustrated in Figure 6-7. In this example, the bank employee swimlane disappears, as this interface provides self-service. The customer therefore interacts directly with the technology enabled system, being responsible for a larger share of the service co-production.

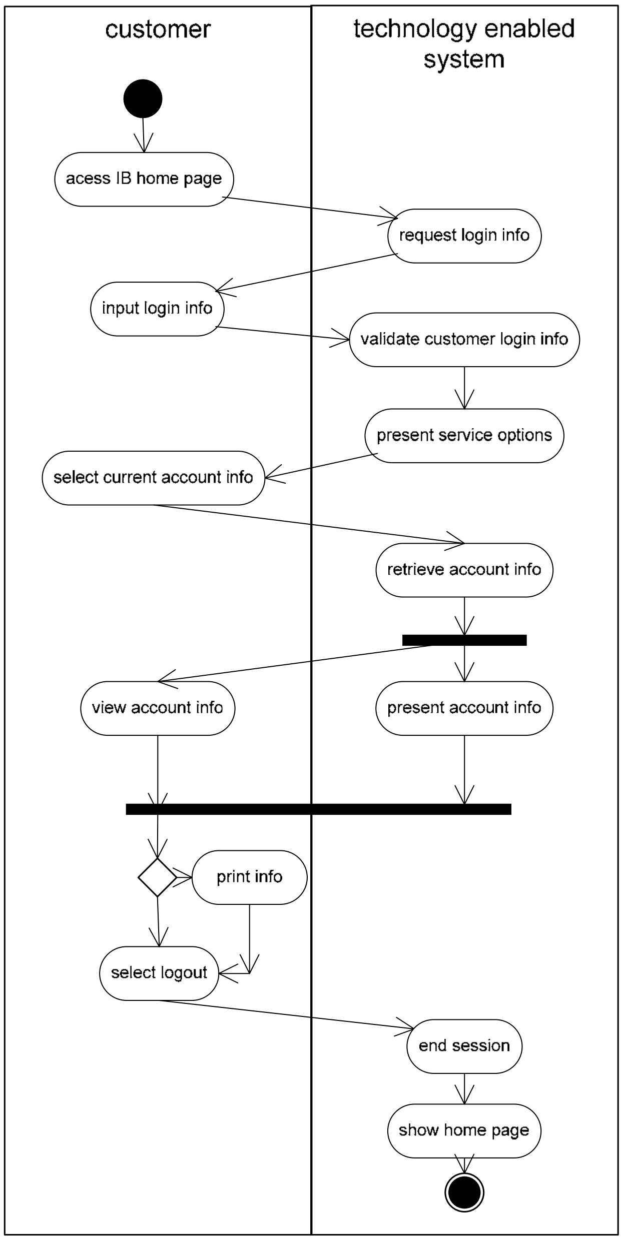

Figure 6-7: Activity diagram for the use case – gathering account information in the Internet Banking

In these two examples, as swimlanes define the boundaries of each actor's actions, the separation of swimlanes can be viewed as corresponding to the lines of interaction in the SB. In the case of BB, the separation of customer and bank employee actions somehow corresponds to the line of interaction in the SB, and the separation of the employee and technology enabled system swimlanes also corresponds to the line of internal interaction. Similarly, the separation between customer and technology enabled swimlanes in the IB activity diagram also corresponds to the line of interaction in the SB.

However, in activity diagrams there is no correspondence to the line of visibility of the SB. Although activity diagrams help in defining the activities performed by each actor and the degree of customer participation in the service co-production, it does not address the decisions regarding which system's activities are going to be visible or invisible. It may be argued that activity diagrams aim at supporting the requirements stage in software development, representing what the system should do without defining how it should do it. However, although the line of visibility may be viewed as an interaction design decision, it could bring a valuable contribution to the analysis of the activity diagram at this stage, as it has a strong impact on customer interaction experience.

If the SB provides a broader perspective of the service provision, activity diagrams have the advantage of being a well accepted standard language that can be easily understood by requirement engineers and be further used in the subsequent stages of the software development process. However, similar to the SB, activity diagrams focus on the process of service provision, and especially activity diagrams, are focused on functional requirements, representing what the system and the actors have to do. Therefore, these techniques should be complemented with other methods that focus on the translation of CERs into attributes of service interface design. These methods are covered in the next section.

6.2. Translating Customer Experience Requirements (CERs) into service interface design

In the requirements field, most efforts still focus on functional requirements, which are well addressed by Object Oriented Analysis (OOA) techniques (Mylopoulos et al. 1999), such as use case and activity diagrams presented before. However, while at the early stages of computer technology, software developers' major concern was to make the best of the technology available to perform new functionalities, the evolution of computer usage has radically changed this context. When computers moved from the segment of specialist users to the office work and service environments, non-functional requirements, such as usability, became crucial for the success of software systems. As already explained, while functional requirements describe what the system should do, non-functional requirements describe not what the software will do, but how the software will do it, such as usability, performance, and other software quality attributes (Tayer and Dorfman 1990).

Non-functional requirements play a crucial role in software systems, serving as selection criteria for choosing among design alternatives. Errors and omissions in addressing non-functional requirements are considered to be the most expensive and difficult to correct, but surprisingly, they have received little attention in the software engineering literature (Mylopoulos et al. 1992b). This may be due to non-functional requirements complex nature that makes them more difficult to evaluate and test. As stated by Chung et al. (2000), non-functional requirements are subjective, as they can be viewed differently by different people; they are relative, since they often may be only partially satisfied; and they are interacting, as satisfying one type of requirement may hurt or help the achievement of other requirements.

The widespread usage of Internet for service provision has radically changed the environment of interaction design. Interface systems are now designed for a wide and heterogeneous set of potential customers, in a non-controlled environment. In this multi-interface service environment, CERs become increasingly important for the success of interaction systems. As gathering current account information can be functionally obtained by both IB and BB, customer choice between the two service interfaces depends mostly on the interaction experience provided by each interface.

The Service Blueprint, use case diagrams and activity diagrams presented previously focus on functional requirements of the service interface, i.e., what the service delivery system must do to provide the service. The methods presented in this section – Quality Function Deployment (QFD) and the Goal-Oriented

Analysis (GOA) – focus on the translation of non-functional or quality requirements into service interface characteristics. These experience requirements or quality attributes often crosscut the different activities in the service delivery process, and its analysis complements the analysis process design.

6.2.1. Quality Functional Deployment

Quality function deployment (QFD) was developed in 1972 in the automotive industry, and has been applied since then to numerous other contexts of product design. QFD comprises a set of planning and communication routines, aiming at coordinating the work of marketing people, design engineers and manufacturing staff in order to better reflect customers' desires and tastes in product design (Hauser and Clausing 1988). One crucial component of QFD is the house of quality, which provides a visual planning matrix linking customer requirements, design requirements, target values and competitive performance in a user friendly chart.

QFD has been widely applied in manufacturing. It is used as a means of integrating marketing and engineering personnel in all phases of the development process. As a product and manufacturing focused method, it concentrates on the product's attributes. In fact, the QFD process involves the development of a sequence of houses of quality, whereby customer attributes (the voice of customer) are translated into product characteristics along the different stages of the product development process. In the product design stage, customer attributes are translated into engineering characteristics; in the parts deployment stage, engineering characteristics are translated into parts characteristics; in the process planning stage, parts characteristics are translated into key process operations; and in the production planning stage, key process operations are related to production requirements (Hauser and Clausing 1988).

However, QFD ideas are also applicable to services (Zeithaml and Bitner 2000), and the house of quality can be a useful approach to the translation of customer requirements into design attributes of the service interface. In fact, there are several case studies on the use of QFD for service design, such as Stuart and Tax (1996).

In the multi-channel bank's case, QFD can be used to evaluate the different design options for the multi-interface service. As shown in Figure 6-8, general customer interaction requirements can be linked to characteristics of the different service interfaces offered, in order to evaluate design alternatives. In this example, the left side of the house of quality shows general customer interaction requirements in rows, as identified in the study (usefulness, efficiency and personal contact) as well as their components. The importance levels shown in the house's chimney represent the importance given by customers to each attribute of general interaction with the Bank, as measured in the quantitative study.

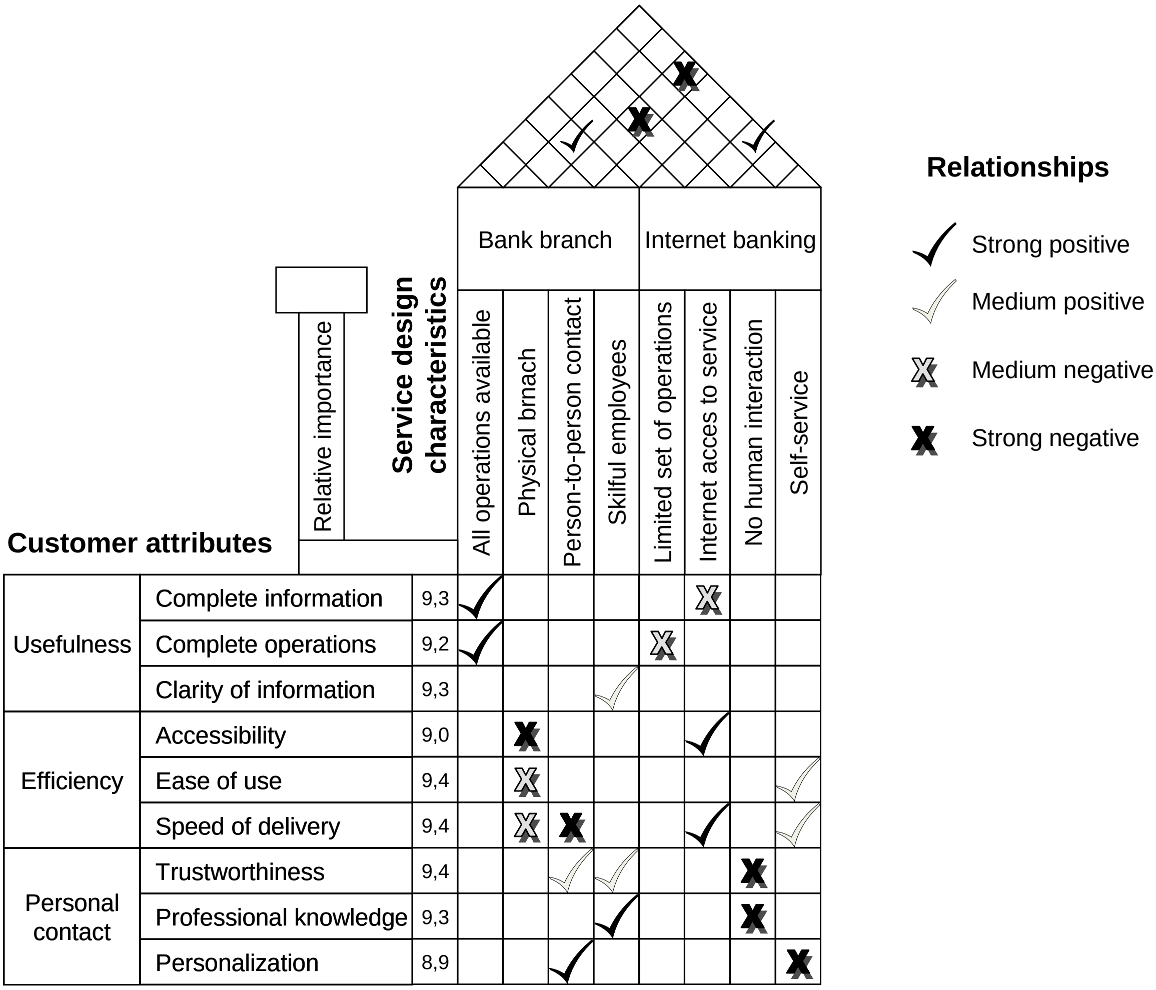

Figure 6-8: The house of quality for the bank service delivery

To respond to customer requirements, the overall service offers different interfaces alternatives, as shown in the columns of the matrix (BB or IB). Each one of these service interfaces has specific design characteristics (presented in columns) that contribute positively or negatively to satisfaction of CERs (presented in rows). The body of the matrix is then filled with the contribution of each service design characteristic to the satisfaction of customer requirements.

In this example, the design characteristics of bank branches, such as the physical branches, skillful and highly trained employees, have strong positive contributions to satisfying customer personal contact needs. However, personal contact provided by BB has a negative side in terms of efficiency, as customers have to go to a physical location and sometimes wait to talk with an employee. On the other hand, the IB service, due to its ubiquity and convenience, provides efficient interaction to customers, but does not provide personal contact, at least in the way the service is designed with the technology available.

In the design of each service interface, the relationships among design characteristics are depicted in the roof of the house of quality. In the Bank's example, to offer personalized, competent and specialized interaction, banks have to arrange physical locations to which bank employees are allocated, so that they can develop a continued relationship with their customers. Therefore, personal contact and physical branches are positively related design characteristics. However, personal contact is incompatible with self-service provision trough the Internet. Therefore, personal contact is negatively related with self-service and Internet service provision, representing a trade-off in terms of design decisions.

The house of quality provides a clear diagrammatic view of the relationships between customer requirements and service design characteristics. Through the analysis of the body of the matrix, marketers, designers and engineers can discuss and analyze the different design alternatives and how they contribute to satisfy customer requirements. Moreover, the roof of the matrix forces designers to explicitly address the trade-offs between their different design options.

The house of quality can also be extended to include the assessment of the company's product performance relative to its competitors, in terms of both customer perceptions and objective design characteristics. Moreover, the improvement in each design characteristic can also be evaluated in terms of technical difficulty and cost, in order to assess the viability of the improvement efforts. These extensions were not developed for the bank's example, as they were not the focus of the dissertation study.

The QFD process and the house of quality can go beyond the service concept level, which was presented in this example. The bank study indicates that, although the importance given to the different experience requirements is not very different when customers are asked to talk about their general interaction with the bank, the priorities change significantly when dealing with specific financial activities. As the study results show, customer requirements are quite different when comparing a mortgage loan application with current account information gathering. Therefore, the analysis of the overall service can continue with an analysis by financial activity or EUC, so marketers and designers can understand how customer requirements for each financial activity could be satisfied by the different service delivery options available.

QFD is a multidisciplinary approach, joining marketing and engineering perspectives to translate customer requirements into product design concrete characteristics. Market research is used to provide the inputs for the identification of customer requirements, the weights of each customer attribute, and the relative performance of the company's products compared to its competitors. On the other hand, engineers contribute by providing design alternatives to satisfy customer requirements, according to technical possibilities and constraints. This joint work allows for better management of the tradeoffs between design characteristics, as well as better design of a product that globally satisfies customer requirements.

QFD has been widely applied and tested in manufacturing contexts, taking the voice of the customer along all stages in the product development process. Although its application in the service context has not been so intensive, its multidisciplinary perspective is very useful for technology enabled service design. However, the house of quality does not allow for a flexible way to represent visually the different design options at different levels of aggregation.

In the bank's example, design trade-offs may be viewed at different levels: at the service interface level (IB versus BB), at the dimension level (usefulness, efficiency and personal contact), and at the attribute level (accessibility, speed, and ease of use). These different levels of aggregation are more difficult to represent in the upper level of the house of quality, because the house of quality only represents the tradeoffs at the attribute level. As the design of technology enabled services involves an important technology component, other requirements engineering proposals for the translation of CERs into design characteristics are covered in the next section.

6.2.2. Non-functional requirements within the goal-oriented requirements analysis

Traditionally, requirements analysis focused on functional requirements, consisting of identifying relevant data and functions that a software system would support (Mylopoulos et al. 2001). The data to be handled by the system might be described in terms of entity-relationship diagrams, while the functions might be described in terms of data flows. In the late 1990's Object-Oriented Analysis (OOA) techniques developed use case, sequence, and other diagrammatic notations for modeling requirements.

More recently, the increased attention paid to business goals in software engineering led to the emergence of a goal-oriented approach to requirements analysis, which complements and enriches the OOA (Mylopoulos et al. 1999). While OOA techniques and functional requirements analysis provide the foundation for understanding what the system should do, goal oriented analysis complements and strengthens these traditional analysis techniques by offering a means for capturing and evaluating alternative ways of meeting business goals.

Goals and functional requirements

Goal-oriented approaches support a rich analysis of requirements, with goal decompositions that help reasoning about design alternatives, as well as tracing low level details back to high-level concerns. From a goal-oriented perspective, requirements engineering is concerned with the elicitation of high-level goals to be achieved by the envisioned system, the refinement of such goals and their operationalization, and the assignment of responsibilities for the resulting requirements to agents such as humans, devices and software (Lamsweerde and Letier 2000).

Goals are objectives that the system under consideration (software to be and its environment) must achieve (Letier and Lamsweerde 2002). A goal is satisfied absolutely when its subgoals are satisfied (Mylopoulos et al. 1999). Functional goals, usually simply called goals, can be completely satisfied, and are related to functional requirements.

An example of a goal is getting current account information, which can include information about the last five transactions AND the account balance. On the other hand, it can be gathered through the BB OR the IB interface. Therefore, an AND decomposition means that both subgoals must be met in order to satisfy the upper level goal; an OR decomposition means that meeting any one of the subgoals is enough to satisfy the upper level goal. Figure 6-9 illustrates an AND/OR decomposition of the goal *gathering current account information*, where goals are represented by ellipses, according to the goal-oriented approach.

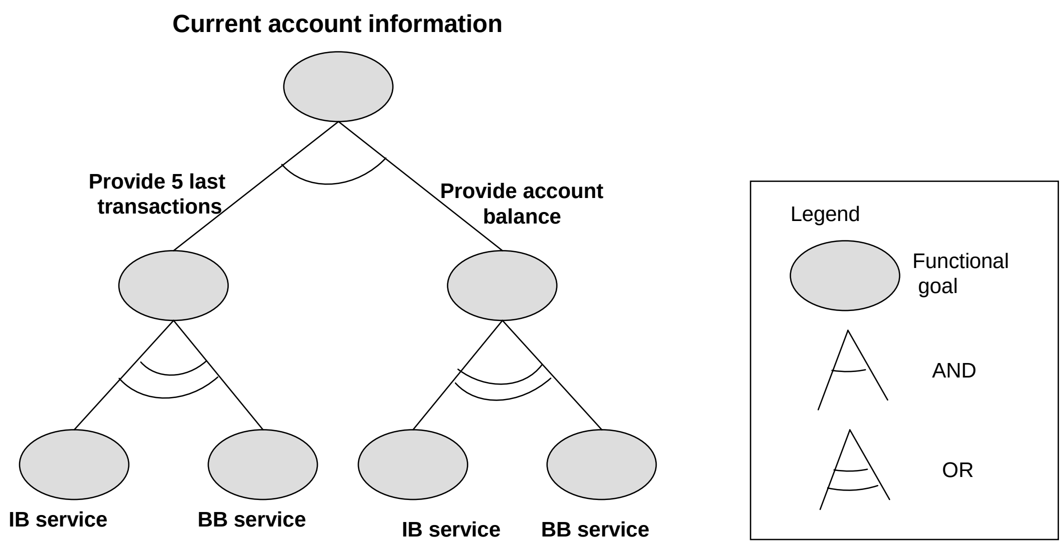

Figure 6-9: Functional goal analysis for current account information gathering

Through AND/OR decomposition, goal-oriented analysis helps in identifying alternative means to accomplishing business goals. As shown in this example, current account information must include information regarding the five last transactions and account balance. The arc linking the two subgoals represents an AND relationship, meaning that both subgoals must be satisfied in order to satisfy the higher-level goal. On the other hand, the account balance information can be undertaken through the IB OR the BB service. The OR relationship is represented by a double arc, meaning that IB and BB are alternative ways to satisfy the higher-level goal.

Softgoals and Customer Experience Requirements (CERs)

The functional goal analysis presented in the above example can only apply to those goals that can be defined crisply, such as providing or not providing current account information. To address non-functional requirements such as usability and efficiency, (Mylopoulos et al. 1999) developed the notion of softgoals, which are goals that do not have a clear-cut criterion for their satisfaction, and cannot be directly observed and measured by the software engineer. Customer experience requirements (CERs) are considered more customer oriented and interaction focused non-functional requirements, and can be defined as customer softgoals. Whereas goals are satisfied or not, softgoals can only be satisficed (when there is sufficient positive and little negative evidence for this claim) or unsatisficeable (when there is sufficient negative evidence and little positive support for their satisficeability). In the goal-oriented analysis, softgoals are represented by clouds, to distinguish them from the functional goals represented by ellipses.

As goals are clear-cut defined, they can be completely satisfied by satisfying all (AND) or some (OR) subgoals, as shown in the previous example. However, in softgoal analysis, subgoals may not be able to satisfy completely high-level softgoals, as they can only be satisficed. Therefore, besides AND/OR decompositions, softgoals can also be decomposed through positive or negative contributions, represented by plus and minus signs. Plus and minus relationships apply when the subgoals contribute positively or negatively to the higher-level softgoal, but may not be sufficient to satisfice it.

Figure 6-10 shows an example of a softgoal hierarchy for satisfaction with bank branches (BB), built upon the results of the study. The quantitative research presented in chapter 5 allowed for the identification of higher-level softgoals, as well as their decomposition. The study results showed that, from the customer perspective, the different non-functional attributes of interaction could be grouped into three high-level softgoals: usefulness, efficiency and personal contact. The Structural Equation Modeling (SEM) approach also allowed the analysis of the strength of the contributions of each high-level softgoal to satisfaction with each service interface. As shown in Figure 6-10, the dimension with the highest impact on BB satisfaction is efficiency, followed by personal contact, but all three dimensions under study have a significant contribution to BB satisfaction.

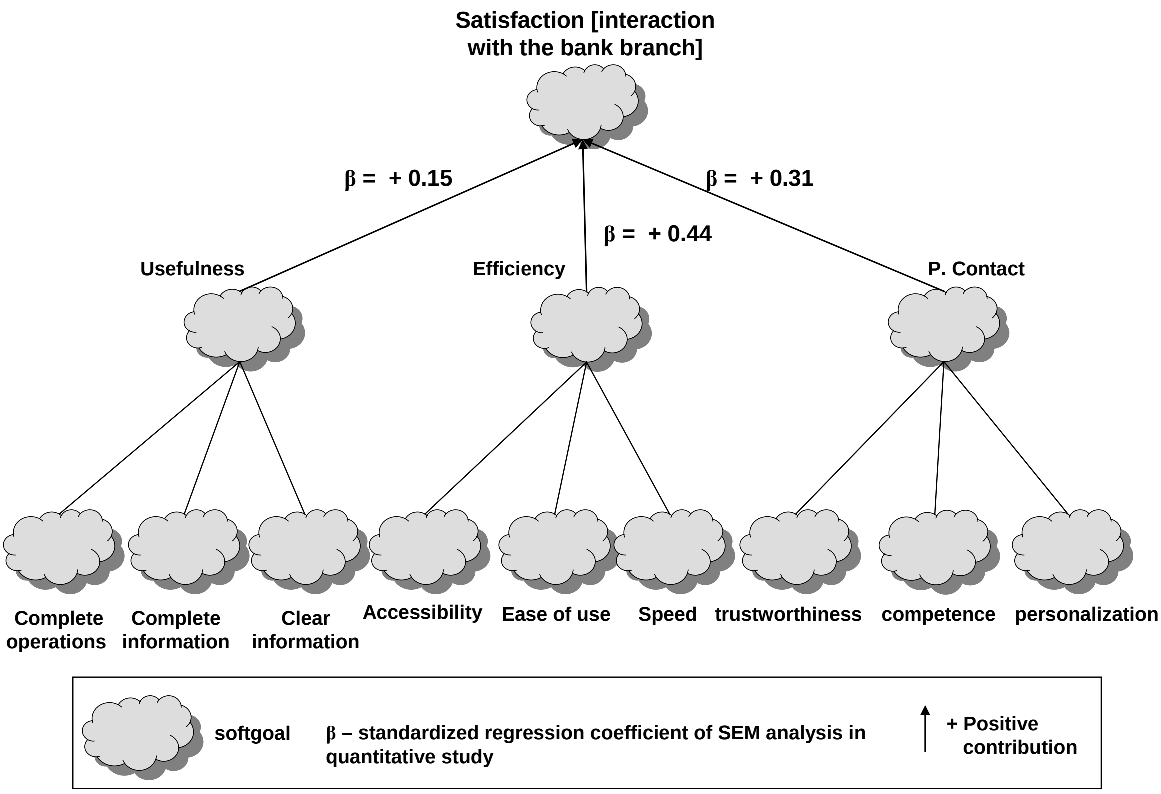

Figure 6-10: Softgoal hierarchy for satisfaction with the bank branch service

The study findings also provided inputs for the decomposition of the satisfaction softgoal for the Internet banking service. In this self-service interface, personal contact is not available, at least as the service is designed by now. Therefore, the dimensions under study are only usefulness and efficiency, as shown in Figure 6-11. Again, the results of the quantitative study show that usefulness has the highest impact on satisfaction with IB, but both dimensions have a significant positive contribution to satisfaction.

The decomposition of softgoals frequently reveals conflicts. Again, the study results show that there is a tradeoff between efficiency and personal contact. When customers want personal contact, they usually need to have less efficient interaction, and if customers want efficient interaction, they usually need to use self-service alternatives, which do not provide personal contact. An important step in the goal-oriented requirements analysis is therefore the analysis of correlations between softgoals, represented by lateral relationships between softgoals (Chung et al. 2000). These correlations can be analyzed at high-level goals, and/or be refined through goal decomposition.

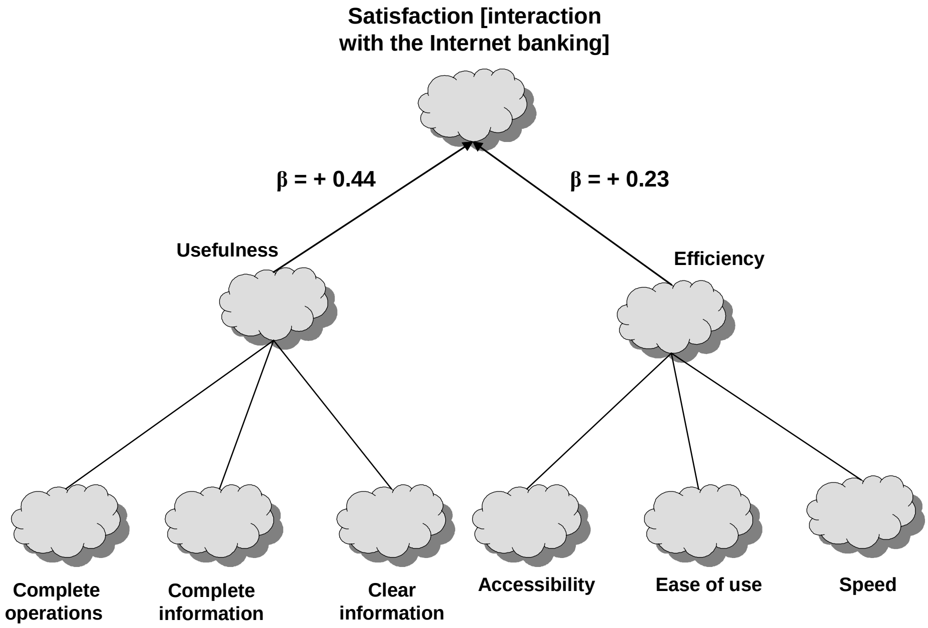

Figure 6-11: Softgoal hierarchy for satisfaction with the Internet banking service

Relating softgoals and functional goals to support design decisions

To help in evaluating design alternatives, correlations must also be established between softgoals and functional goals. If functional goal analysis provides a means for identifying alternative ways to satisfy business goals, softgoal analysis provides the rationale for evaluating those different alternatives in order to better support design decisions. As shown in the functional goal example, customers can interact with the bank through different service interface alternatives, which satisfy the basic functional requirements, but the service interaction experience is quite different.

As previously presented in Chapter 5, the study results provide a clear view of the relative position of each service interface in satisfying the different interaction experience requirements, as shown in Table 6-1. BB provides the best personal contact and the most useful interaction, but is the least efficient of the four service interfaces under study. On the other hand, IB provides the most efficient service, but does not offer personal contact. These results provide the input for establishing the correlations between functional goals and softgoals, as illustrated in Figure 6-12.

Table 6-1: Relative performance of the different service interfaces in satisfying experience requirements

CERs	Service interface performance* IB	TB	BB	ATM
usefulness	8.20	8.34	8.77	7.37
efficiency	9.20	8.95	7.39	8.42
p contact		7.89	8.62	

*Construct means (summated scales) in a 0-10 scale: 0 – totally dissatisfied; 10 – totally satisfied

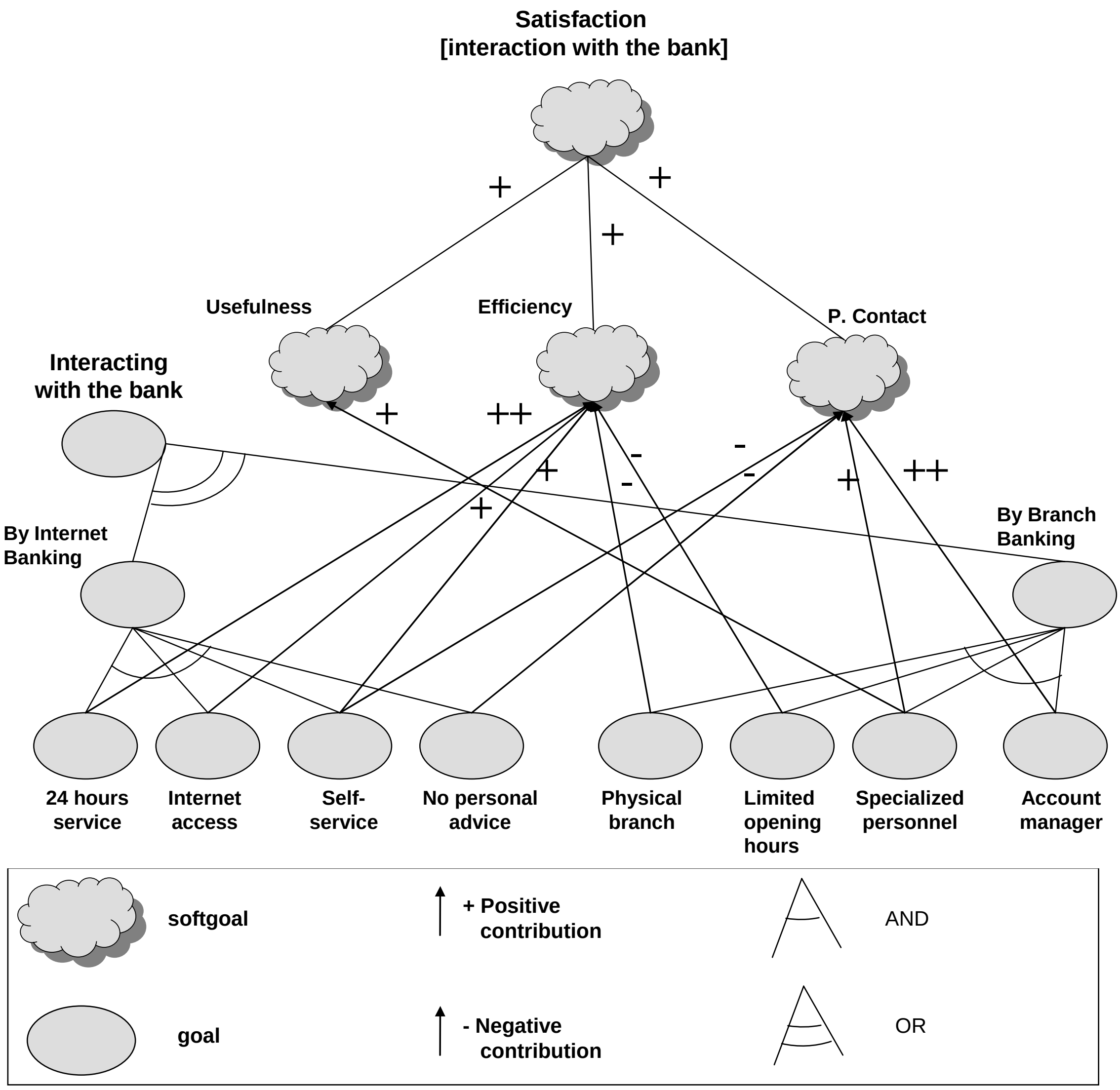

Figure 6-12: Goal correlation analysis for general interaction with the bank

As can be seen in Figure 6-12, the high-level goal of interacting with the bank can be functionally satisfied by going to the bank branch OR accessing the IB service. However, these two alternatives have a very different impact on customer interaction experiences, as can be seen by the correlations between each design alternative's goals and the customer softgoals. To provide personal contact with specially trained bank employees and account managers, the bank branch must operate in a physical store, with limited opening hours. Therefore, although the bank branch makes a strong contribution to personal contact softgoals, it makes a relatively negative contribution to efficiency when compared to the IB alternative. On the other hand, IB service functional characteristics of 24 hour self-service make it the most efficient service interface, but only at the expense of not providing personal contact.

When evaluating alternatives with conflicting impacts on different softgoals, it is important to identify priority requirements, which are annotated with an exclamation mark in the non-functional requirements framework (Chung et al. 2000). For example, interaction experience priorities can be different for different customer segments. As the quantitative study results show (see Table 6-2), while IB users give more importance to efficiency and usefulness, IB non-users give more importance to personal contact.

Table 6-2: Construct mean comparison of importance given to experience requirements

	Importance of CERs		
	IB users	IB non-users	Mean Difference
CERs			
usefulness	9,33	9,10	0,23**
efficiency	9,37	9,13	0,24**
p. contact	9,12	9,30	-0,18**

*Construct means (summated scales) in a 0-10 scale: 0 – not at all important; 10 – extremely important
** Statistically significant at p<0.01

Although these differences are tenuous in a 0-10 scale, they are statistically significant and change the softgoal ranking. Efficiency is the most important softgoal for IB users, while personal contact is the most important softgoal for IB non-users. These results were also corroborated by the qualitative study, involving in-depth and focus group interviews with bank customers.

Goal-oriented analysis (GOA)

As seen in the example presented above, goal-oriented analysis can be very useful for the design of multiple interface services, adapting the process proposed by (Mylopoulos et al. 2001).

- Input: a set of functional goals and softgoals (or interaction experience requirements).
- Step 1: the decomposition of goals into an AND/OR hierarchy.
- Step 2: the decomposition of experience requirements into a softgoal hierarchy, involving AND/OR and positive/negative contributions.
- Step 3: the identification of correlations among softgoals or experience requirements.
- Step 4: the identification and analysis of correlations between functional goals and experience requirements.
- Step 5: The evaluation and selection of goals and softgoals that satisfy functional goals and maximize satisfaction of experience requirements.
- Output: a set of functions to be performed by the system that collectively meet functional goals and provide a satisfying interaction experience.

The goal-oriented analysis requires deep input information for the identification of softgoals, its decomposition, customer priorities with regard to different softgoals, and the contribution of each design alternative to softgoal satisfaction. Much of the work on requirements elicitation is still the responsibility of software engineers, who must collect the information from the different system stakeholders, and make most decisions based on their experience and judgment. To help engineers in such a heavy task, requirements engineering researchers have developed non-functional requirements catalogues, which provide guidance into the decomposition and conflict management of standard non-functional requirements, such as security, reliability and performance (Chung et al. 2000). However, for non-standard requirements, such as experience requirements, or for specific business contexts, such as the service environment, non-functional requirement catalogs may not suffice for supporting service interface design.

This dissertation research develops an alternative way to provide the inputs needed for goal-oriented analysis, which may be especially helpful for large scale projects in service provision contexts. The qualitative and quantitative studies allowed for a rigorous elicitation of CERs, identifying customer experience dimensions and their decomposition, analyzing the importance of the different requirements and their impact on service interface satisfaction.

The approach used in the study assures that the findings are rigorously tested and validated, but the methodology is complex and time-intensive, and not viable for all projects. For small and standard software development projects, non-functional requirements catalogs provide an invaluable guidance for engineers, as they offer easy and immediately available information to evaluate design alternatives. However, for large scale projects, with hundreds of thousands of users, with specificities beyond the standard software applications, the requirements elicitation methods used in this study may prove crucial for improving service interface development.

6.3. From Essential Use Cases to the Service Experience Blueprint: the EUC-SEB approach

The goal-oriented analysis made so far illustrates how the study results can be used to support the evaluation of design alternatives offered by IB and BB, taking into account CERs for general interactions with the bank. This approach is in tune with the goal-oriented perspective, which views non-functional requirements as “global qualities of a software system” (Mylopoulos et al. 1999). In fact, the experience requirements identified in the study (usefulness, efficiency and personal contact) have a crosscutting nature, being important for all customers, and influencing satisfaction with the different service interfaces.

However, the importance given by customers to the different experience requirements changes according to the different financial activities or essential use cases at hand. As can be seen in Table 6-3, the results of the quantitative study show that, whereas efficiency is the most important requirement for current account information, personal contact is the priority when applying for a mortgage loan. These differences influence service interface usage, as customers choose the interface that performs best in satisfying their specific needs. Again in this example, IB is clearly the preferred service interface for gathering current account information, whereas BB is preferred for mortgage loan applications.

Table 6-3: Differences in experience requirements and service interface satisfaction and usage for different essential use cases

	Construct means		
	Current account	Mortgage loan	Mean difference
CERs			
usefulness	8,94	9,04	-0,10
efficiency	9,37	8,76	0,61**
p. contact	8,07	9,10	-1,02**
IB			
satisfaction	8,90	4,27	4,64**
usage	8,85	3,27	5,59**
BB			
satisfaction	6,11	7,92	-1,81**
usage	2,51	8,19	-5,68**

Construct means (summated scales) in a 0-10 scale; ** statistically significant at $p<0.01$

Importance of CERs: 0 - not at all important; 10 – extremely important

IB and BB satisfaction: 0 - totally unsatisfied; 10 – totally satisfied

IB and BB usage: 0 – never use this service interface for this financial activity; 10 always use this service interface

In this multi-interface environment, designing satisfying overall interaction experiences requires an understanding of customer needs, not only for global interactions, but also for each EUC, as requirements change according to the specific services at hand. This information should also be complemented with an assessment of each service interface's performance in satisfying those customer needs. With this analysis, technology enabled service designers are better prepared to decide on what services are best suited for each interface before any technology decision is made. To enhance technology enabled multi-platform service delivery systems, it is proposed that the service interface design goes through four stages:

1. First, experience requirements should be elicited and analyzed at the EUC level, and the performance of each service interface in satisfying customer needs should be assessed.

2. Second, according to a goal-oriented analysis, each EUC can be allocated to different service interfaces, according to the match between CERs and the advantages of each service platform.

3. Third, after the EUC analysis, the design can drill down to the CUC level using the Service Experience Blueprint (SEB), where each service interface is designed to support the specific financial activities previously defined, leveraging its capabilities to better satisfy CERs.

4. Finally, as the different interfaces belong to the same service delivery system, the links among them must also be carefully designed, so that customers can seamlessly move between service interfaces and have a satisfying overall multi-service interface experience.

With this EUC – SEB approach, CERs are taken into account at the various levels of technology enabled service design. Moreover, the design of the different service interfaces is more integrated into the multi-interface service, contributing to a better allocation of resources among service platforms, leveraging each service interface's capabilities and enhancing the overall service customer experience. This approach will be exemplified in the next sections with the bank's case for the two EUCs already presented: *current account information gathering* and *mortgage loan application*.

6.3.1. Experience requirements at the EUC level

CERs analysis for current account information EUC

As EUCs are technology-independent, described in terms of user intentions and system's responsibilities, they are especially useful for the design of multiple-platform service delivery systems, such as the one provided by the bank. In Table 6-4, the left column shows the basic EUC description, focused on functional requirements, with customer intentions and bank's responsibilities in providing current account information. This EUC can be completely satisfied in terms of functional requirements by both IB and BB. However, analyzing CERs and relative performance of the two service interfaces shown in Table 6-4, it becomes clear that, as customers give more importance to efficiency, they strongly prefer IB.

Table 6-4: Essential use case (EUC) and experience requirements for current account information

Basic functional-requirements Customer Intentions / Bank responsibilities	Importance of experience requirements	Service interface satisfaction and usage
Request information of account balance Provide information of account balance	1.efficiency 9.4 2. usefulness 8.9 3. personal contact 8.1	IB satisfaction 8.9 IB usage 8.9 BB satisfaction 6.1 BB usage 2.5

Construct means (summated scales) in a 0-10 scale

Importance of CERs: 0 - not at all important; 10 – extremely important

IB and BB satisfaction: 0 - totally unsatisfied; 10 – totally satisfied

IB and BB usage: 0 – never use this service interface for this financial activity; 10 always use this service interface

The integration of CERs and functional requirements at the EUC level can be further systematized through a goal-oriented analysis, to better support the allocation of EUCs across the different service platforms. Figure 6-13 illustrates the goal correlation analysis for current account information gathering.

The lower part of the diagram represents functional goals: current account information can be gathered by IB OR BB. However, each of these service interfaces satisfies the same goal through a different set of functionalities. Whereas IB provides current account information on a self-service base, with Internet accessibility and 24 hour service, BB provides the same service through a bank employee, in a physical store with limited opening hours. The same service is provided (the “what”), but the customer experiences a very different interaction (the “how”).

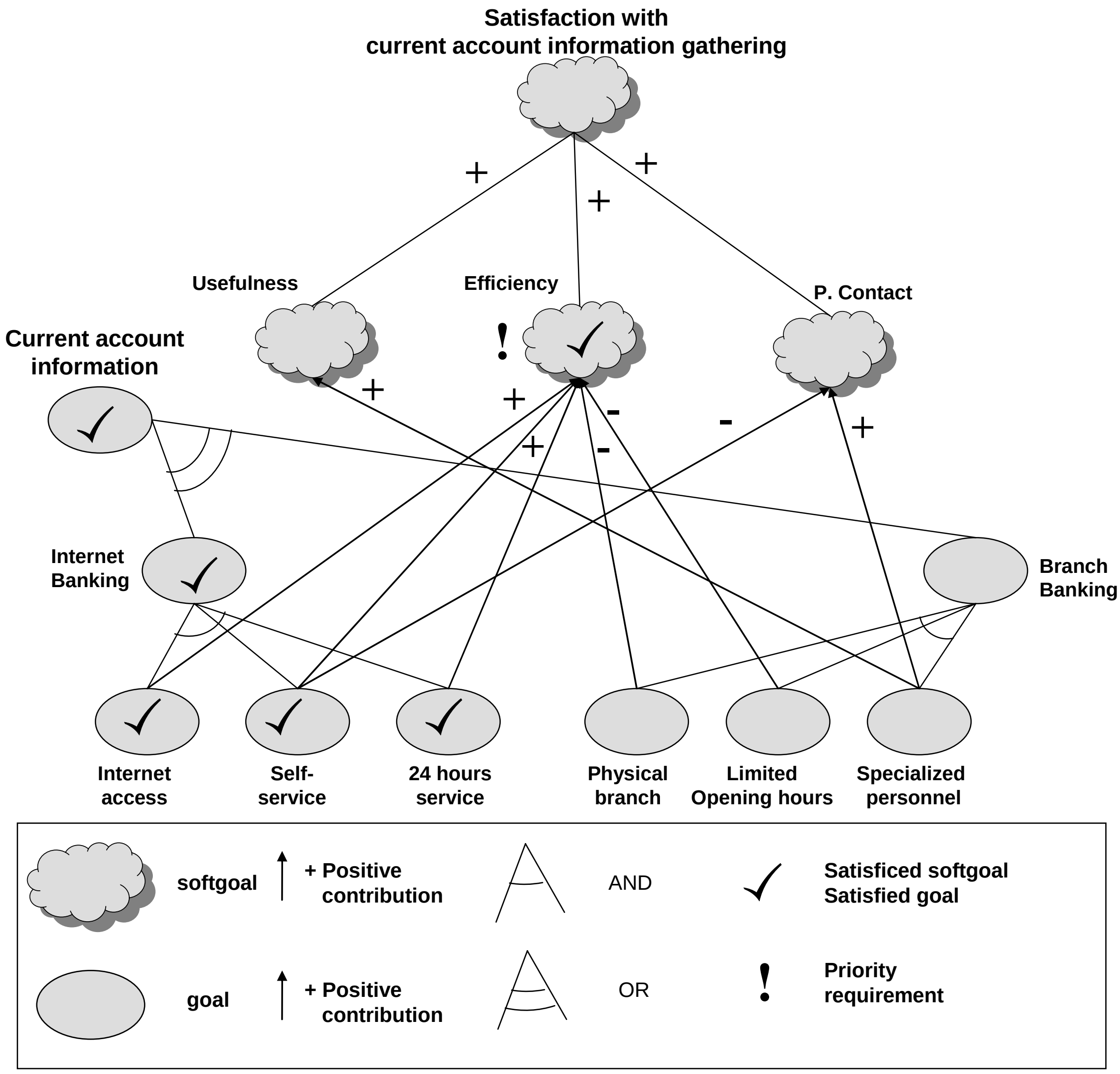

Figure 6-13: Goal correlation analysis for current account information gathering

If functional goals identify different alternatives for satisfying the current account information goal, the experience requirements presented in the upper level of the diagram provide the evaluation criteria for choosing the functional design alternatives that best match customer softgoals. As presented previously, customer satisfaction with each service interface can be decomposed into usefulness, efficiency and personal contact, as these performance dimensions all have positive contributions to satisficing the high-level softgoal. However, the study results show that for this specific EUC, efficiency is the priority, represented in the diagram with an exclamation mark.

Analyzing functional alternatives, it is clear that the different functional sub-goals necessary to satisfy the goal of getting current account information in the IB or BB have important positive and negative correlations with experience requirements. In this case, personal contact in a physical location provided by BB contributes positively to personal contact softgoals, but has a strong negative contribution to efficiency. On the other hand, the 24 hour self-service in IB does not allow personal contact, but contributes to the priority experience requirement of efficiency.

Matching functional goals with softgoals provides an important support for interface design decisions and service management. As IB clearly outperforms BB in satisfying priority experience requirements for this EUC, service providers can concentrate their efforts on offering efficient interaction in IB for current account information, as shown in Figure 6-14, while guiding customers who request this service in BB to automatic channels. This design decision is represented in the goal correlation diagram above by the check marks that sign the goals and softgoals which were decided to be satisficed (Chung et al. 2000).

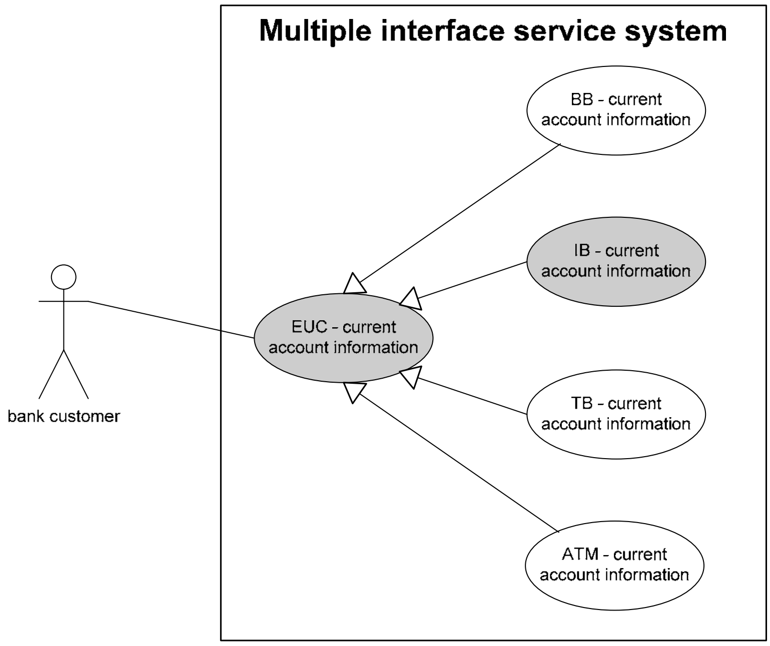

Figure 6-14: Analysis of current account information at the Essential Use Case (EUC) level

After evaluating the two alternatives (BB versus IB), service designers could decide that the current account information use case would no longer be available at BB. This decision would be represented in the diagram by signing BB goals with a cross, representing softgoal and goal denial (Chung et al. 2000). However, while such a decision may be acceptable in the work environment, where employees can be convinced to change their work practices more easily, it may be very dangerous in the service environment, where customers can freely switch service providers. Therefore, instead of simply denying the provision of current account information through BB, service designers may only decide to concentrate efforts on B, while guiding BB customers to automatic interfaces and giving them incentives to use them.

CERs analysis for mortgage loan application EUC

Whereas efficiency is the most important requirement for gathering current account information, priorities shift for mortgage loan applications. As shown in Table 6-5, this financial activity is more complex, and personal contact is the most important experience requirement, closely followed by usefulness. Not surprisingly, customers are much more satisfied with BB, as this interface is the best performer in the two priority softgoals.

Table 6-5: Essential use case (EUC) and experience requirements for mortgage loan application

Basic functional-requirements Customer Intentions	 Bank responsibilities	Importance of experience requirements	Service interface satisfaction and usage
Request loan		1. personal contact 9.1 2. usefulness 9.0 3. efficiency 8.8	BB satisfaction 7.9 BB usage 8.2 IB satisfaction 4.3 IB usage 3.3
	Request formal and informal information about customer		
Provide information requested			
	Analyze information Approve/reject loan Propose loan conditions (amount, price, term…)		
Accept/reject/negotiate loan conditions			

Construct means (summated scales) in a 0-10 scale

Importance of CERs: 0 - not at all important; 10 – extremely important

IB and BB satisfaction: 0 - totally unsatisfied; 10 – totally satisfied

IB and BB usage: 0 – never use this service interface for this financial activity; 10 always use this service interface

Again, goal-oriented diagrams can systematize this analysis at the EUC level. As can be seen in Figure 6-15, goal and softgoal hierarchies show how the mortgage loan application goal can be satisfied by the two alternative service interfaces, and how the different functional solutions may change customer interaction experience. BB functional characteristics provide high-quality personal contact, but have a downside effect in terms of efficiency. On the other hand, IB is more efficient, but does not provide personal contact. However, for the mortgage loan application use case, personal contact is the priority, and BB will be the preferred service interface. Service managers can therefore concentrate their efforts in designing a full personal contact mortgage service at BB, while taking advantage of IB to guide customers who gather mortgage information in this interface to the account managers in BB, as shown in Figure 6-16. This option enhances customer satisfaction in the interaction with the bank, while leveraging the potential of each service interface.

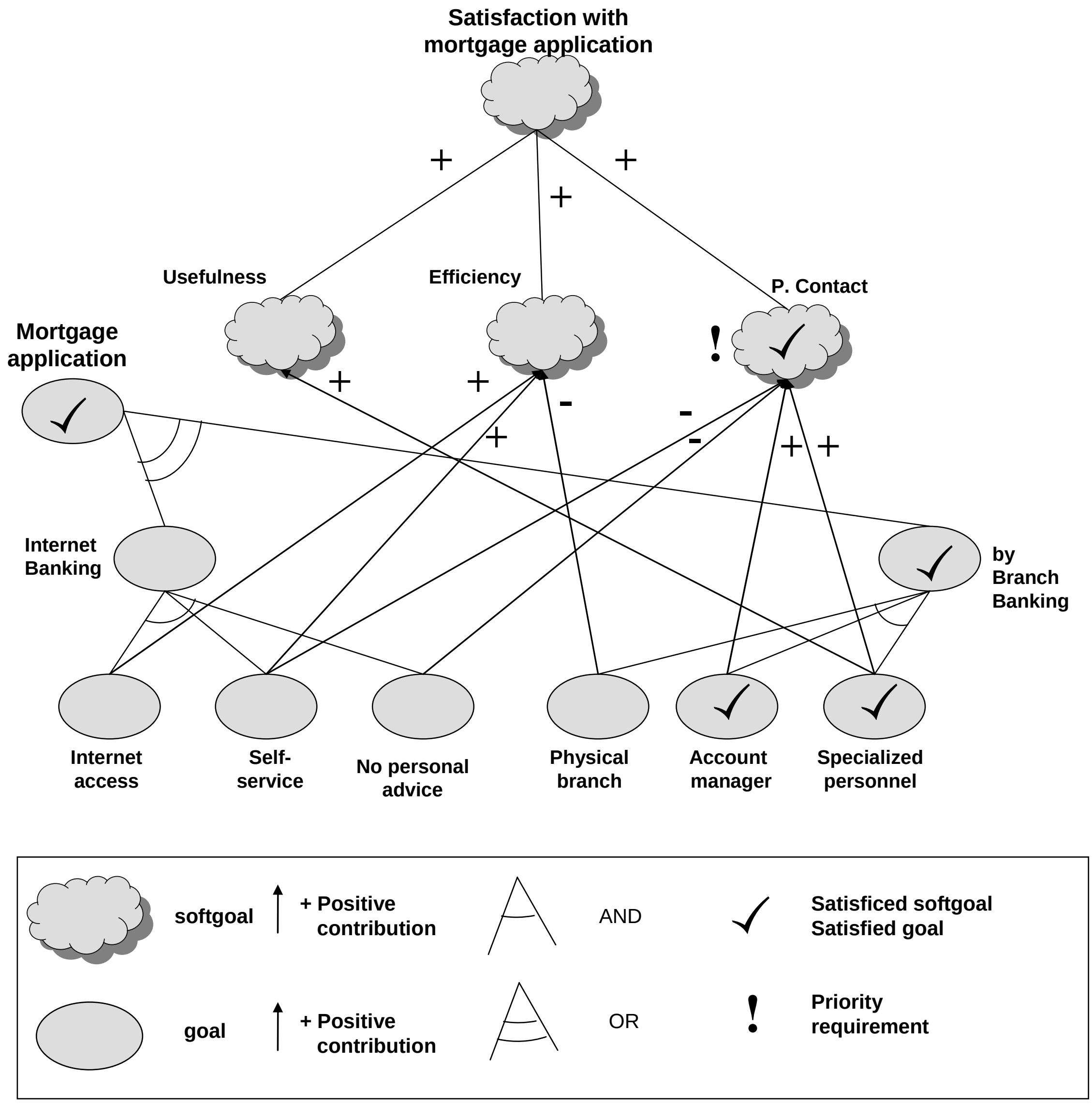

Figure 6-15: Goal-oriented analysis for mortgage loan application

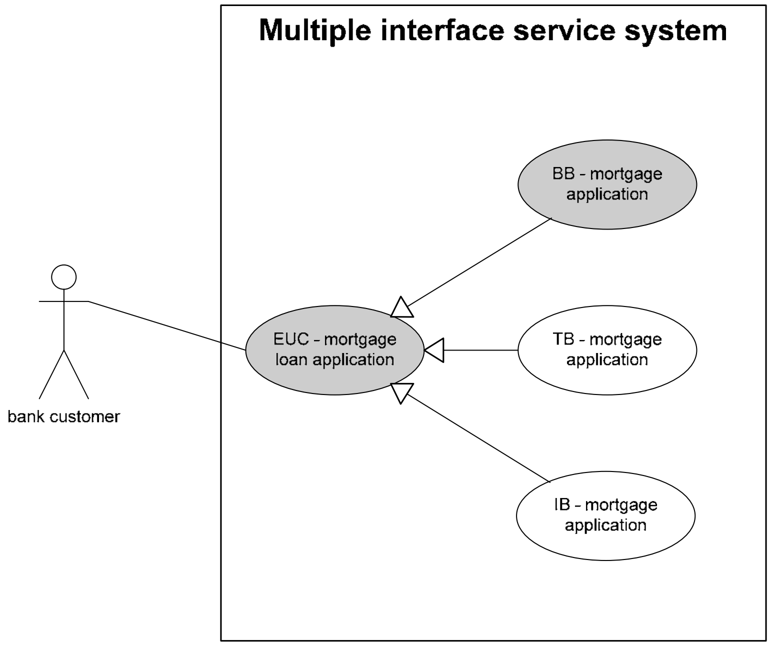

Figure 6-16: Analysis of mortgage loan application at the Essential Use Case (EUC) level

6.3.2. Experience requirements and the Service Experience Blueprint

The two cases presented before show how the analysis of experience requirements at the EUC level can contribute to a better design of the multi-interface service. If experience requirements for current account information had only been analyzed at the CUC level for the BB interface, service managers and interface designers could have been induced to invest heavily in improving the efficiency of BB to overcome this disadvantage. However, from a multi-interface perspective, it may not be worth making such investments, when the IB alternative can easily provide a satisfying interaction experience for this use case.

Similarly, although many banks have offered mortgage loan application full service through IB, customer adoption has been disappointing. By understanding that personal contact is still very important for a satisfying customer experience in this EUC, service managers and interface designers can concentrate their efforts on designing an IB mortgage service that takes advantage of its capabilities and guides the customer to BB when personal contact is most needed.

Following this approach, after analyzing CERs at the EUC level, and assessing the performance of each service platform in each of those requirements, designers are better prepared to analyze each service interface at the CUC level. However, neither Service Blueprints, nor activity diagrams capture the necessary blend of technology and service in service interface design. The SB technique provides a visual representation of the service delivery process, which can be easily understood by managers, but is not specifically adapted to technology enabled services. On the other hand, activity diagrams use the standard UML, which is widely used by software engineers to detail use cases, but are much focused on the technology component of service provision.

Service Experience Blueprint (SEB)

As technology enabled services blend technology and service, a new technique was developed, joining SB and activity diagram representations: the *Service Experience Blueprint* (SEB). The SEB is a visual representation of the service process at a CUC level, which can be easily understood by service managers, while being useful for subsequent stages in the software development cycle. Therefore, the SEB can be used at the service interface design stages where service and technology issues are more intertwined and have to be addressed simultaneously.

As illustrated in Figure 6-17 for current account information gathering through IB, the SEB mimics activity diagrams in its visual representation of activities, beginning of process, end of process, transitions and swimlanes. In this example, two actors are involved in service provision (customer and technology enabled system), each being responsible for a swimlane of different activities in the service delivery process. The visual representation of activities is also maintained, as well as the signs for beginning and end of process. However, the flow of activities changes from a vertical presentation to a horizontal presentation, borrowed from the SB.

On the other hand, the SEB also incorporates some important concepts from SB, which can be useful for both service managers and interface designers. First, the line of interaction is used to divide the actions of the different participants in the service process. In this example, the line of interaction separates the activities of the customer from the activities of the technology enabled service system. This line of interaction corresponds to the separation of two swimlanes in activity diagrams, but it assumes a more prominent role in the SEB, as moving this line has strong implications in the level of customer co-production of the service and in the customer interaction experience.

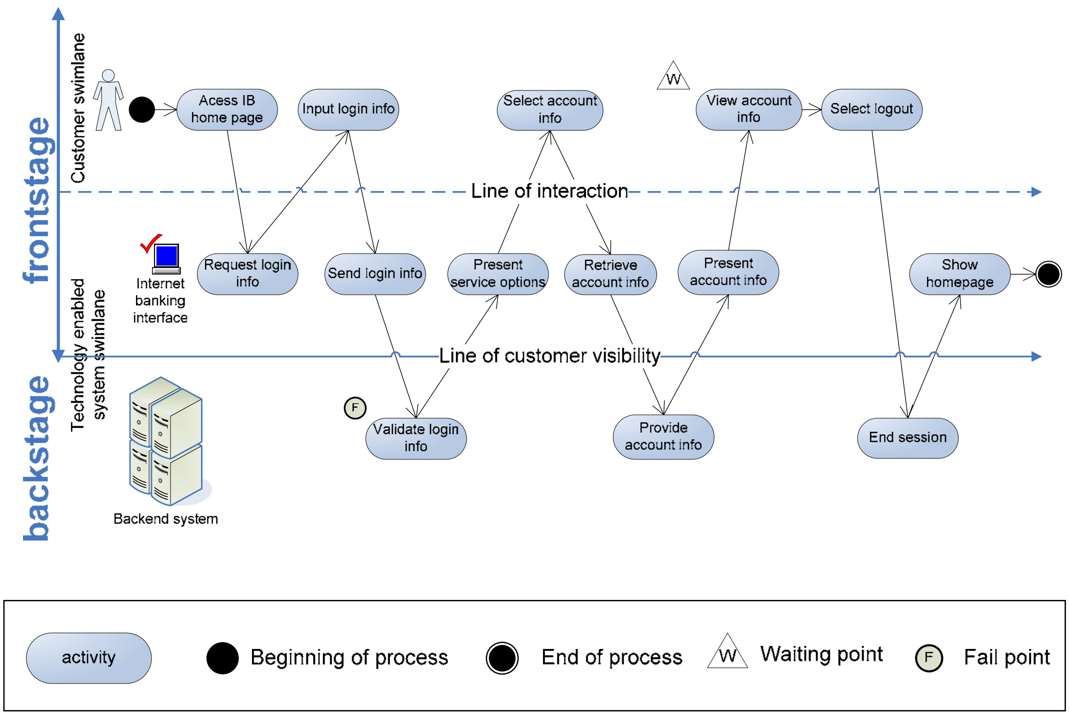

Figure 6-17: Service Experience Blueprint for gathering current account information in the Internet Banking

The SEB also borrows the line of visibility from SB, here called line of customer visibility, which separates frontstage operations that are visible to the customer, from backstage operations that the customer cannot see. This line of visibility, although not present in activity diagrams, has strong implications for interface design, as it separates the visible component of the system (interaction system) from the invisible component of the system (backend). If different swimlanes, separated by lines of interaction, represent the activities that are the responsibility of different actors, the line of visibility separates, within one swimlane, the actors' activities that are visible from the ones that are hidden. Especially for interface designers, the line of visibility and the distinction between interaction and backend systems represent crucial design decisions which have a strong impact on customer experience.

The SEB can also be developed for the same use case in the BB, as shown in Figure 6-18. In this case, the self-service provision is substituted by the personal contact provided by the bank employee. To gather current account information, the customer only has to make the request and wait for the employee to retrieve the information from the technology enabled system and print it.

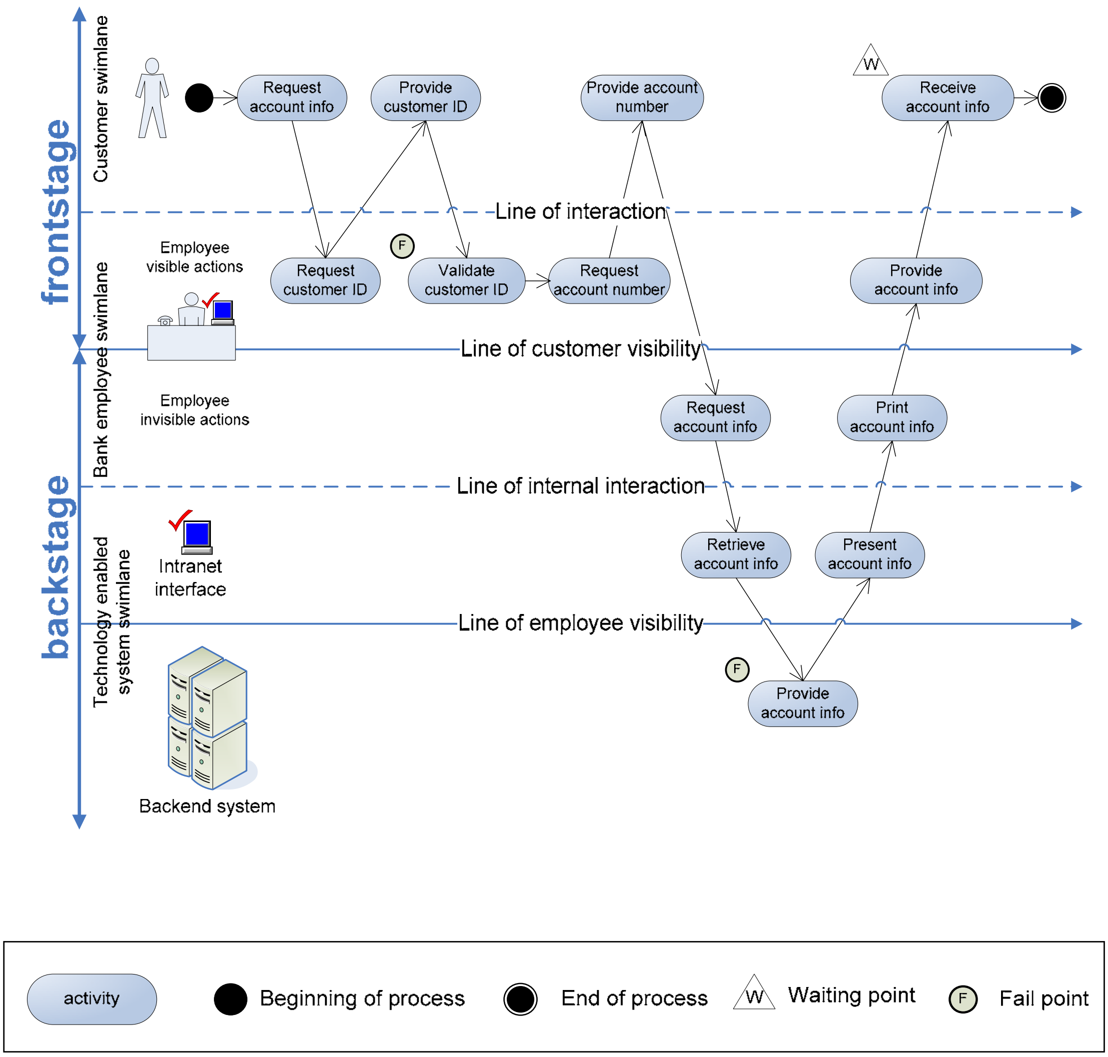

Figure 6-18: Service Experience Blueprint for gathering current account information in the Bank Branch

The BB SEB has one more swimlane than the IB SEB, representing the bank employee's participation in the process of service provision. Therefore, two lines of interaction are designed: the line of interaction between customer and employee, and the line of interaction between employee and technology enabled system. These two lines are important for both service managers and interface designers. Although interface design focuses on the human-computer side of interaction, the customer-employee interaction should also be taken into account, as it is part of the overall service process that the technology enable system is supporting.

The BB SEB also includes a second line of visibility. In this case, the line of customer visibility separates the employee's visible and invisible actions, while the line of employee visibility separates the technology enabled system's visible and invisible actions. To provide a satisfying customer experience, service managers and interface designers must make decisions, not only on what is visible and invisible for the customer, but also on what is visible and invisible for the bank employee when using the technology enabled system to support service provision.

Similarly to the EUC analysis, softgoals provide the rationale for evaluating the different design alternatives that are functionally available at the CUC level. Each SEB for each specific CUC represents a given set of design options that should be soundly grounded on a softgoal analysis. The SEB examples that will be presented in this section focus on the issues related to multi-service interface design, and as such, the design rationale is built upon the goal correlation analyses previously presented for EUCs. However, if justified, the goal-correlation analysis can be further developed for each specific SEB, to better support the design decisions at the CUC level.

Using SEB and CERs to design the links between service interfaces

In the previous examples, two SEB's were developed for the current account information CUC at IB and BB. However, based on the goal correlation analysis made at the EUC for this financial activity, efficiency is the priority softgoal, and IB is the most suited service interface to provide the desired customer experience. Therefore, the IB SEB represents the preferred pattern of service provision.

Nevertheless, a segment of customers still continues to request current account information in BB, which is less efficient for the customer, and more costly for the bank. Clearly, not all customers are eager to use the Internet, and some segments will remain technology averse. But some customers may only need some incentive and support for adopting new technology interfaces. Therefore, based on the priorities shown by the softgoal analysis, the BB service for current account information can be redesigned to guide customers to self-service interfaces, whenever this type of interaction provides a more satisfying experience.

Figure 6-19 presents the SEB for a new use case of the BB service: *explaining the IB service for current account information*. When customers arrive at the BB to request current account information, the bank employee may suggest the IB service, with the argument of increased service efficiency. Some customers will reject the idea, and the employee will continue with the regular process of providing current account information in BB.

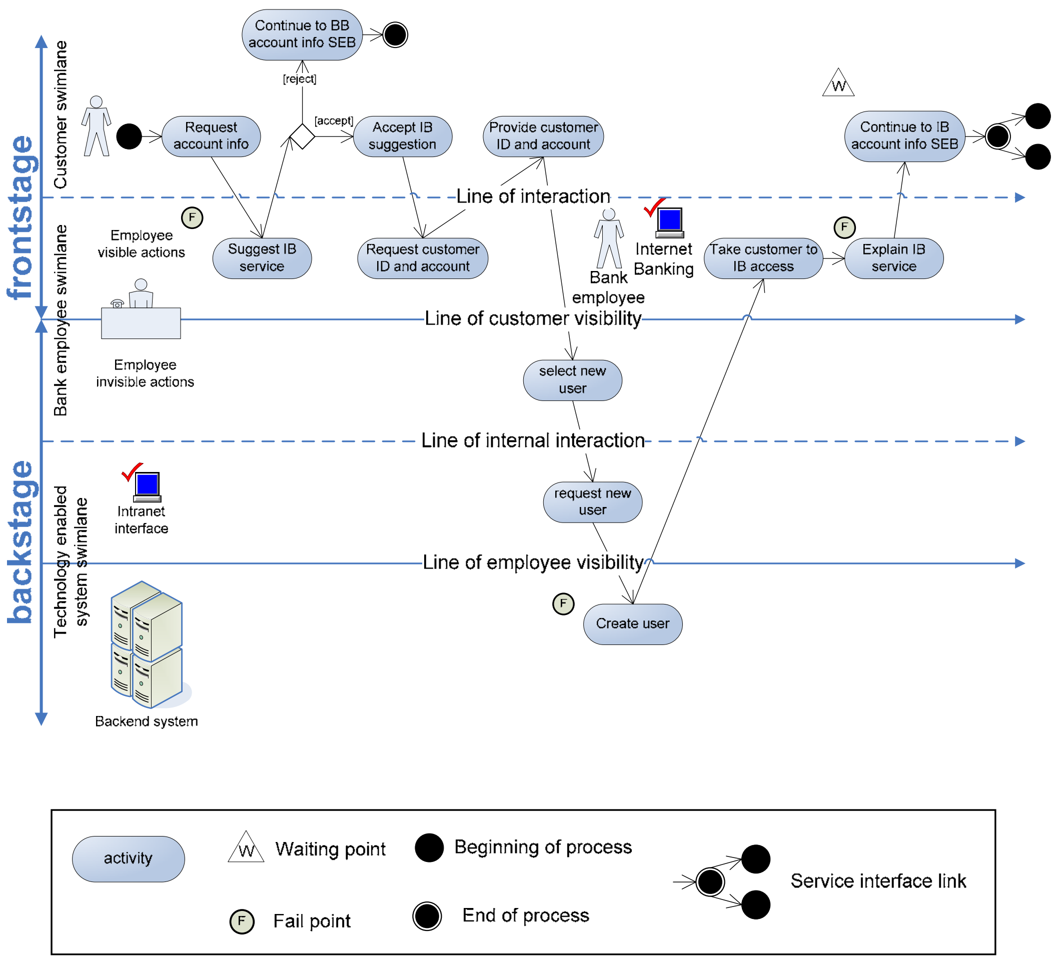

Figure 6-19: Service Experience Blueprint for explaining IB service for gathering current account information

However, if the customer accepts the idea, then the bank employee creates a new user in the technology enabled system, takes the customer to the IB service interface available in the BB, and explains IB usage for current account information, until the customer can get the information needed on his/her own. The connection flow between service interfaces is represented in this SEB by a *service interface link*. The service interface link is represented by a triangle made up of one end of process circle and two begin of process circles. This means that the service delivery process in this service interface (BB) will continue in another one (IB).

By taking explicitly into account the links between service interfaces, this BB service redesign builds upon BB personal contact advantage to suggest and explain the efficiency attributes of IB to bank customers. Some customers, who would otherwise continue using the inefficient BB for current account information, can smoothly be guided to a better service interface alternative. This integrated perspective, which takes non-functional requirements form the EUC level to the CUC level, can both reduce bank costs and enhance customer service experience.

The same approach can also be used to design the IB mortgage service. Although many banks have offered Internet mortgage applications, customers still go to BB for the personal contact when they want to come to a decision. IB has strong information capabilities and can be easily accessed at any time, but cannot offer personal contact, at least with the technology now available. Based on the goal-oriented analysis made at the EUC, and integrating the service provided by the different interfaces, the IB mortgage service can be redesigned to satisfy customer mortgage information needs, while guiding him/her to BB when personal contact is most needed.

Figure 6-20 presents the redesign of the IB mortgage service to take advantage of IB information capabilities and BB personal contact. As usual, the IB service offers mortgage loan simulation to both customers and non-customers of the bank. Through this service, the customer can simulate loan conditions by providing some information, such as house price, loan amount, and time frame. The customer accesses the IB homepage, selects the mortgage simulation option, inputs the necessary data and visualizes simulation results. However, the redesigned IB SEB goes beyond the regular service, to guide customers to personal advice in BB by offering a schedule meeting option.

In this SEB, when the customer requests a mortgage simulation, the backend system saves the mortgage conditions and the simulation. When the interaction system presents the simulation results to the customer, it also shows an option of scheduling meeting with a BB service representative. If the customer selects to schedule the meeting and to send the simulation information, he/she can then choose the bank branch, and wait for the bank's contact. For bank customers with an account manager, an option can also be created to schedule the meeting with the respective account manager.

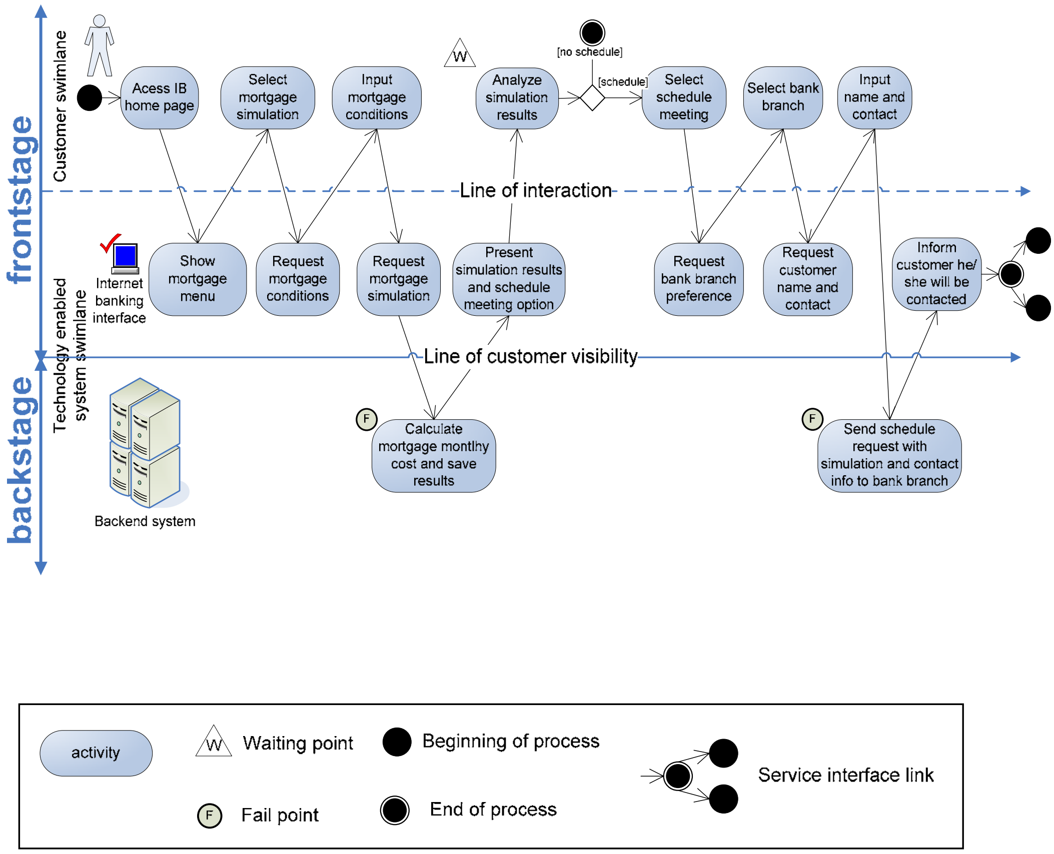

Figure 6-20: Service Experience Blueprint for gathering mortgage information in the Internet Banking

In the end of IB mortgage scheduling process, the backend system sends a trigger to the BB, which shows up in the Intranet to the selected bank employee, as shown in Figure 6-21. This trigger informs the employee of the customer meeting request, including the mortgage simulation information. The service representative can then prepare the meeting by analyzing simulation results, customer available information, and even preparing a pre-proposal. After this backstage work, the employee can then call the customer to confirm the meeting, being much more prepared to provide a good personal contact service.

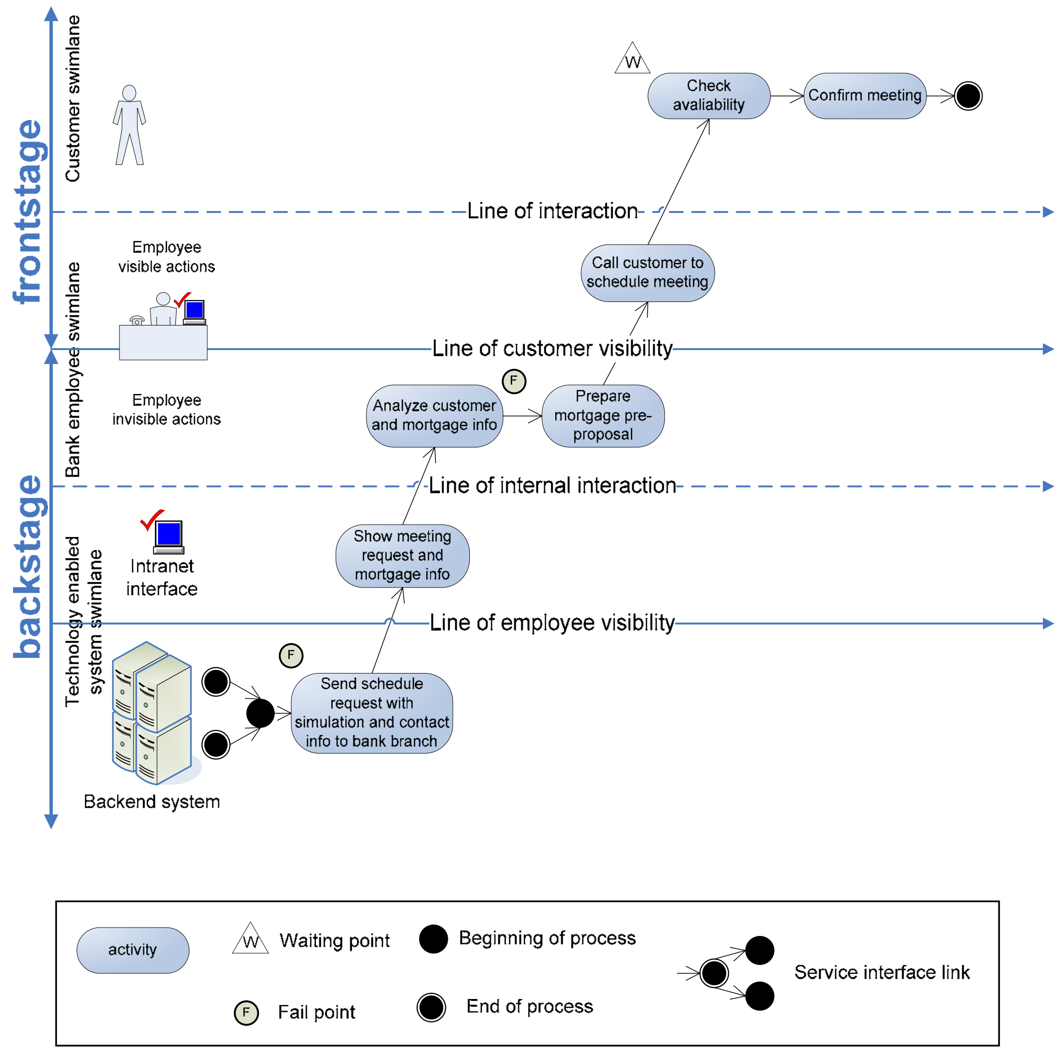

Figure 6-21: Service Experience Blueprint for scheduling meeting in the Bank Branch for mortgage loan application

Again, this service redesign leverages each service interface capabilities, developing an integrated service that enhances customer overall experience. Through the design of a good mortgage information service in IB, the bank takes advantage of Internet information and interactive capabilities. By designing a good linkage between IB and BB when personal contact is needed, the bank increases the chances of transforming the customer interest expressed at IB in a mortgage application at BB. Finally, by getting information in advance, the bank employee can better prepare the meeting, providing a higher quality personal service to the customer. The integrated design of the different service interfaces, taking experience requirements to all levels of service design, can improve customer overall experience, while helping attain service provider's business goals.

6.4. Conclusion and Implications for multi-interface service design

The approach just presented represents a first effort to join services marketing and interaction design perspectives to address technology enabled multi-interface service design. Although the research study involved a deep analysis of the bank's overall service, it would be important to extend the application of this approach to other multi-interface service contexts, in order to evaluate its applicability to other service environments. Moreover, the extension and replication of this method to other service interface design cases would help refine the approach with the feedback received from the different stakeholders involved in service interface design.

This EUC-SEB approach aims at supporting both service managers and interface designers in the difficult task of designing technology enabled multi-interface services. The widespread usage of the Internet for service provision has hugely increased the number of potential users of a technology enabled service system, and has led interface design to a new service environment. In this multi-interface service context, existing requirements engineering methods may not suffice, especially when dealing with a large number of heterogeneous customers, in a non-controlled and service specific environment.

The proposed approach provides a rigorous elicitation of CERs in a multi-interface service environment, involving both a qualitative stage and a quantitative stage. Although it may be considered heavyweight for an average interface design project, it may provide crucial information when dealing with specific projects that have a large potential impact, and therefore require a more thorough and rigorous requirements analysis for a large set of customers. In this case, the qualitative and quantitative findings provide the necessary input information to identify softgoals and its decomposition, establish priorities, and assess the contribution of each design alternative to softgoal satisfaction.

By starting with a goal-oriented analysis at the EUC level, where each service interface alternative is evaluated in terms of experience requirements, service designers have better support for deciding which service platforms are best suited to each EUC. With this approach, instead of designing each service interface in isolation, service providers can better allocate available resources among the different service interfaces, taking advantage of each one's best contribution to the overall service.

After this EUC stage, the service can then be designed at the concrete level, with the help of the SEB, using the goal-oriented analysis to leverage each service interface's specific capabilities. Although designing each service interface at the concrete level, the multi-interface service perspective is still maintained. With this approach, CERs are used at both the EUC and CUC levels to support the evaluation of design alternatives and enhance customer overall service experience. This integrated perspective is also considered at the SEB, as the links between service interfaces are explicitly designed, in order to leverage each platform's capabilities in contributing to an overall service satisfying experience.

This approach takes CERs from beginning to end in the multi-interface service design process. By designing each service interface to best contribute to the overall service, and by designing links to other interfaces whenever it improves the customer experience, the multi-interface service design is better integrated to enhance customer overall service experience.

Finally, the SEB joins elements of SB and activity diagrams, retaining those elements that provide more useful information for design, and can be easily understood by both marketers and interaction designers. Through the development and analysis of SEB, marketers and interaction designers can better communicate and address the service interface design issues for which service and technology are closely intertwined. With this approach, service managers are better prepared to better allocate their resources, to take advantage of each service interface's unique capabilities, and to provide a better customer service experience.

7. Conclusion and future research

The increased usage of the Internet for service provision has deeply changed the environment for which service marketers and interface designers develop interactive systems. Technology is now used in almost every kind of service delivery and is increasingly used as a component of a multi-interface offering, which is composed of a mix of service interfaces, such as person-to-person, telephone, or interactive kiosks.

In this new environment, service marketers have to cope with the infusion of technology in the service delivery process, whether it is person to person or self-service. On the other hand, technology use in service provision also represents a radical change in the interface design context. Technology enabled interaction systems are now designed for a wide and diversified set of users, in a non-controlled environment. In the Internet service context, customers have to be convinced to use the service through a satisfying interaction experience.

The challenges posed by this new environment were the main motivations for the dissertation research. First, Internet services are increasingly used, not as a stand alone operation, but as a component of a multi-interface service delivery system, where it is but one alternative of interaction between the customer and the service provider. In this context, it is important to understand customer satisfaction with Internet services and to design this service interface integrated in the overall service offering. However, although extensive research has focused on e-service quality and requirements, most of these studies addressed Internet services in isolation, without an integrated multi-interface perspective.

Second, in the technology enabled multi-interface service, where customers can freely choose between different interface alternatives that provide the same functionalities, the experience provided becomes more important for the success of service systems. Therefore, it is important to analyze customer experience requirements (CERs) for Internet services within a multi-platform offering, and to address these requirements from beginning to end in the design process. However, it is recognized that experience requirements, although extremely important, are difficult to address, and software engineering has traditionally focused on functional requirements.

Finally, Internet service design blends technology and services, which cannot be addressed from technology only perspective or a service only perspective. In this new context, the complementary contributions of marketing, requirements engineering and interface design are all useful to understand and design a satisfying customer interaction experience. However, although many researchers have called for a multidisciplinary approach to Internet service design, further work is still needed to join these different perspectives.

These challenges provided the main motivation for the dissertation research, as presented in Chapter 1. Based upon the study of a multi-interface Portuguese bank, the study main objective was enhancing service delivery systems through technology, focusing on the three research vectors that deserved special attention:

1. The analysis and design of Internet services within a multi-interface service offering;
2. A rigorous elicitation of CERs and their incorporation in all stages of multi-interface service design.
3. The adoption of a multidisciplinary approach, to address the interrelationships between technology and services in technology enabled service interface design.

The study objective comprised two subgoals. The first one was to better understand customer satisfaction and usage of technology enabled multi-interface services, which involved identifying CERs and understanding how they influenced service interface satisfaction and usage. The second goal was to translate these CERs into service interface design, from multidisciplinary and multi-interface perspectives, which involved the development of a new approach to multi-interface service design. To pursue these goals, the dissertation research comprised four stages, as shown in Figure 7-1: the conceptual model and research design, a qualitative study, a quantitative study, and the development of a new approach to technology enabled multi-interface service design. The next sections present the main contributions and limitations of each one of these research stages.

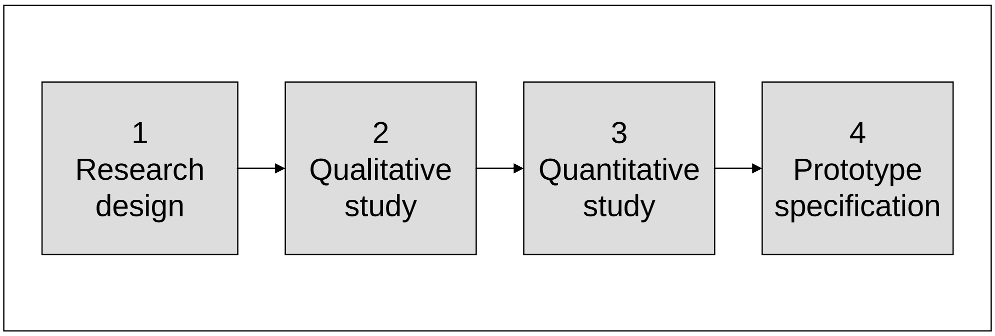

Figure 7-1: The fours stages of research design (completed)

7.1. Contribution of conceptual model and research design

Previous to the development of the conceptual model, the research entailed a review of extant literature, from different fields of study, related to technology enabled service delivery systems. This review focused on CERs and service interface performance factors that could be relevant for satisfaction and usage of Internet services within a multi-interface context. From this conceptual background, three broad categories of factors emerged: customer characteristics or user profiles; service characteristics or use cases; and service interface performance or customer interaction experience requirements.

The conceptual background entailed studies from service quality research in general, financial services quality, innovation adoption, human-computer interaction (HCI), information systems, requirements engineering, e-service quality and e-satisfaction. These different studies provided a complementary view of the different issues and perspectives related to technology enabled service interface design. In fact, many apparently different concepts and perspectives from marketing and HCI were revealed to be quite similar: Internet service provision relates to Web interaction; customers relate to users; specific service activities relate to use cases; quality and satisfaction attributes correspond to user requirements.

On the other hand, services marketing and HCI have different, but complementary perspectives on other aspects of technology enabled service design. Marketing has a strong focus on understanding customer attitudes and behaviors, through the usage of perceptual and attitudinal measures, developed through interviews, focus groups and survey methods. HCI has a strong focus on identifying user requirements in order to translate them into interface design, predominantly using behavioral measures, captured through methods such as usability testing, cognitive walkthroughs, or expert reviews.

The multidisciplinary literature review presented in Chapter 2 offered a rich and diversified view of the factors underlying satisfaction and usage of the different service interfaces, and provided a sound basis for the development of the conceptual model and research design. Services marketing contributed with a strong customer focus, the integration of technology in the overall service, and well tested methods for understanding customer perceptions, attitudes and behaviors, which are especially useful to elicit CERs. Human–computer interaction brought insights into the specific issues related to computer generated service provision, such as usability factors. Requirements engineering brought the focus on eliciting CERs and translating them into interaction system requirements. Interaction design contributed with a focus on translating CERs into Internet service characteristics.

This literature review showed that there was extensive research on topics related to technology and services, but some knowledge gaps still existed in technology enabled service interface design, especially in the three research vectors previously defined: the analysis and design of Internet services within the multi-interface offering; the elicitation and incorporation of CERs; and the adoption of a multidisciplinary perspective. In the face of the challenges posed by the Internet service environment, and based on the literature review, the dissertation conceptual model and research design was developed, as presented in Chapter 3.

As previously explained, the objective of enhancing service delivery systems through technology entailed two subgoals. First, it was necessary to identify the factors influencing customer satisfaction and usage of Internet services within a multi-interface environment, which would enable the identification of CERs. Second, it was necessary to use these experience requirements to enhance Internet services, developing new design methods that adopted an integrated and multidisciplinary perspective. To pursue these objectives, the dissertation research design comprised four stages.

The first stage of research entailed a careful development of the conceptual model and the research design, which was crucial for the quality of the study results. To attain the first goal, the research design included a study of the factors underlying customer satisfaction and usage of Internet services in a multi-interface Portuguese bank. In order to study Internet banking (IB) integrated in the overall offer, the other existing service interfaces were also analyzed: bank branches (BB), telephone banking (TB) and automatic teller machines (ATMs).

Building upon the literature review, the conceptual model hypothesized that customer characteristics and service characteristics influenced CERs, as shown in Chapter 3. Customer satisfaction with each service interface was then influenced by the fit between CERs and the performance of each service interface in satisfying those needs. This model conceptualized Internet services, not in isolation, but integrated into the multi-interface service; it addressed CERs at the essential use case level, in order to support both multi-interface and specific service interface design; finally, it adopted a multidisciplinary view, including the contributions of the different fields in the analysis. This conceptual model made an important contribution to the research process, as it represented a conceptual change in the approach to the study and design of Internet services, and defined the research plan to pursue the more general objectives stated before.

To assess the level of fit between customer requirements and service interface performance, it was necessary to evaluate the two with the same battery of attributes. However, as most of the reviewed studies focused on one service interface at a time, there were no previously developed measures applicable to the multi-interface context that addressed this fit. Therefore, the research design applied a scaled development approach to develop and test the measures of CERs and service interface performance in this multi-interface service setting.

The dissertation research design involved a qualitative study to elicit a sample of all potentially relevant CERs and service interface performance factors. This qualitative study provided a deeper understanding of the phenomena and identified a large sample of factors that was further used to develop the survey questionnaires that served as the basis for the quantitative study. The analysis of the survey data collected allowed for the refinement and validation of the measurement scales, through an exploratory factor analysis (EFA) – to identify the dimensions of CERs, and a confirmatory factor analysis (CFA) – to assess the reliability and validity of the measurement scales. After validating the measurement scales, the structural model analysis (SEM) studied the relationships between CERs, service interface performance, and service interface satisfaction and usage. The results of the quantitative study were finally applied to the specification of service interface improvements, leading to the development of a new approach to designing the multi-interface service experience.

The conceptual model and research design stage was crucial to set a research plan where the study objectives were clearly stated, the domain of the concepts were defined, and the methods were selected to best attain the study goals. The broad dissertation goals led to the definition of the main concepts under study – CERs and service interface satisfaction within a multi-interface setting. Through the conceptual model, the main concepts and the hypothesized relationships between them were defined. The research design established a plan, involving the identification of methods that were best suited to test the model and attain the research objectives.

The conceptual model and research design guided the subsequent research stages, assuring that the study objectives were pursued and contributing to the quality of study results. Moreover, the conceptual model was already a first step to the development of a new approach to Internet services design, where Internet services were studied within the multi-interface service, focusing on CERs, joining the contributions of services marketing, HCI and requirements engineering.

7.2. Contribution of qualitative study

The qualitative study presented in Chapter 4 focused on better understanding satisfaction and usage of technology enabled service interfaces within a multi-interface service, with a special emphasis on identifying a large sample of CERs and service interface performance factors. This research stage involved in-depth and focus group interviews with 36 bank customers and 13 bank personnel in three Portuguese cities. The sample was defined according to the theoretical relevance of cases, including users, non-users and ex-users of both Internet banking and telephone banking. The qualitative data analysis of literally transcribed interviews involved the categorization of data, according to factors influencing positively and negatively satisfaction and use of each service interface.

The qualitative study contributed to a deeper understanding of customer satisfaction and usage of the different service interfaces within the multi-interface environment. First, customers spontaneously did not express their preferences for each service interface with technology features and functionalities, but with the experience they could get. Faced with different functional alternatives to undertake the same financial activity, they selected the one that provided the best interaction experience, influenced by requirements such as convenience, feedback control, or mutual knowledge between the customer and the bank employee.

The qualitative study also corroborated the conceptual model, as its main building blocks (customer characteristics, financial activity characteristics or EUCs, CERs and service interface performance) were all found to influence service interface satisfaction and use. Moreover, most customers used a mix of service interfaces in their general interaction with the bank, from which they then chose according to the specific needs generated by each financial activity. These findings showed that the different service interfaces were interrelated, and a multi-interface approach was needed.

Through the analysis of the qualitative data, a large sample of CERs and service interface performance attributes were identified and the relative performance of service interfaces was better understood. In the customers' perspective, IB was seen as a more efficient interaction with better accessibility, convenience, ease of use and time saving, but also had strengths in terms of usefulness of operations and information available, autonomy and feedback control. However, even IB users had security concerns when interacting with the bank through the Internet.

The great advantage of BB was the ability to provide high quality personal contact, involving mutual knowledge between customers and bank employees, individualized attention, personalization of the service provided and even some social interaction. However, BB had a downside effect in terms of efficiency, due to restricted opening hours, the need to go to a physical store, and the need to wait before being attended.

TB and ATMs had an intermediate role in the overall service. TB was considered an efficient service interface, providing an intermediate level of personal contact. However, when compared with IB, TB lacked visual feedback control; when compared with BB, TB lacked a real personalized contact. ATMs were viewed as efficient service interfaces for a narrow set of financial activities, which customers used when the only alternative was BB.

The qualitative results allowed the identification of the most relevant customer interaction experience requirements for the technology enabled service interfaces under study. Moreover, they also showed that these requirements changed according to different user profiles and EUCs. From data analysis, two IB user groups and two IB non-user groups were identified. All groups under study valued the convenience, ease of use, accessibility and time saving of IB, but the most intensive IB users were more demanding in terms of functionalities and information available. For non-users, two main reasons emerged for not-adopting IB: for one group, non-usage of IB was mostly related to technology aversion, whereas for the other group, IB non-usage was mostly related to lack of financial involvement with the bank.

The qualitative results also revealed how CERs changed for different financial activities. For simple and routine operations, such as simple information, customers preferred the efficient IB interaction. For complex financial activities, such as problem solving, customers valued personal interaction of BB.

Based on these results, an important contribution of the qualitative stage was to extend the concept of essential use case (EUC), which describes user intentions and system's responsibilities in a technology independent way, to also include CERs. As many financial activities were functionally available in different service interfaces, channel choice was strongly influenced by the fit between customer interaction experience needs and service interface performance in satisfying those needs. So far, EUCs had traditionally focused on functional requirements. However, the study showed that, in the new Internet service environment, the inclusion of CERs in EUC analysis was crucial to improve multi-interface service design. With this EUC and multi-interface approach, service providers could better allocate the different EUCs among service interfaces, in order to leverage each one's unique capabilities and offer an overall satisfying experience.

The qualitative study provided a better understanding of customer satisfaction and usage of Internet services in a multi-interface environment, identifying CERs by user profile and EUC. However, although the sample was purposely selected to include a diversified and rich set of interviewees, it might not be representative of the population of bank customers, and therefore did not allow generalization of the findings. Nevertheless, the qualitative study played an important role in the dissertation research strategy, as it elicited a large sample of indicators that could be used to measure CERs and service interface performance. Therefore, the qualitative results also served as the basis for the quantitative study that followed.

7.3. Contribution of quantitative study

The quantitative study involved two surveys, built upon the results of the qualitative study. As the qualitative results indicated that CERs changed for different EUCs, two models were tested, as previously explained in Chapter 5.

The first model analyzed each service interface profile. It addressed interaction experience requirements for customer general relationship with the bank. On the other hand, it also measured each service interface performance in satisfying those customer needs. The model hypothesized that the fit between general CERs and service interface performance influenced general satisfaction and usage of each service interface. To test this model, a telephone survey was undertaken with 2142 bank customers, stratified by user group (users and non-users of IB and TB).

The second model analyzed IB satisfaction and usage for specific financial activities. It addressed CERs for specific EUCs, and also measured how IB satisfied those needs. The model hypothesized that the fit between financial activity's specific CERs and IB performance influenced IB satisfaction and usage for that particular financial activity or EUC. To test this model, a Web survey was undertaken with 1934 IB users.

The quantitative analysis of the survey data allowed for the identification and validation of customer experience requirements and service interface performance scales, through exploratory and confirmatory factor analyzes. The quantitative results showed that three main factors emerged in this multi-platform context.

- *Usefulness,* comprising clearness of information, completeness of operations and information available.
- *Efficiency,* comprising accessibility, ease of use and speed of delivery.
- *Personal contact*, comprising personalization, competence and trustworthiness of employees.

After assessing the reliability and validity of the scales, the quantitative analysis continued with the examination of the relationships between experience requirements, service interface performance and service interface satisfaction, using a structural equation modeling approach. The quantitative results contributed to identifying the most relevant dimensions of CERs for multi-interface services, and to better understand the contribution of each interface to overall service satisfaction. In particular, the multi-interface view brought new insights that studies only focused on one service interface in isolation could not reveal.

The quantitative findings showed that no service interface is best in every attribute, but instead, each one has its unique advantages and disadvantages, adding value to the overall multi-platform service. On one hand, Internet banking (IB) is the best performer in terms of efficiency, but does not provide personal contact. On the other hand, the bank branch (BB) offers the best personal contact and the most useful service, but underperforms all other service interfaces in terms of efficiency. The ATM is less efficient than IB, but it clearly outperforms BB on this dimension, and is therefore the preferred channel for routine operations for less technology savvy customers, as well as for operations that are still not available in IB, such as cash-withdrawals.

Telephone banking (TB) falls in between IB and BB. It is more efficient that BB but less efficient than IB. On the other hand, it provides some personal contact, but it clearly underperforms BB in that dimension. Viewed in isolation, TB could be seen as the service interface that best balances the different performance dimensions. However, viewed from a multi-interface perspective, where customers can seamlessly move between interaction channels, TB does not seem to add value to the overall service, as it is not the best on any dimension. This lack of contribution may be an important factor underlying the decrease in TB use in the recent past, as more competitive interfaces, such as IB, are added to the overall service.

The quantitative results also showed that customers do not use only one service interface, but instead use a service interface mix in their regular interactions with the bank. The great majority of customers used at least the ATM and BB, even if the frequency of usage of each channel was quite different. However, if they tended to use a mix of service interfaces in their general relationship with the bank, they tended to choose a specific one when they wanted to deal with a concrete financial activity.

The comparison of the telephone survey and the Web survey findings revealed that in general, the different experience requirements dimensions (*usefulness, efficiency* and *personal contact*) are almost equally important for all customers. However, this importance changes significantly when customers are dealing with specific financial activities. For frequent and routine operations such as current account information gathering, efficiency is most important and IB is clearly the preferred interaction channel. For complex financial activities such as mortgage loan applications, personal contact is of uppermost importance and BB is clearly the preferred service interface.

These findings indicate there is a tradeoff between the different service interfaces, especially when comparing IB and BB. When using IB, customers have to tradeoff personal contact for efficiency. When using BB, customers have to tradeoff efficiency for personal contact. IB and BB act as substitutes for each specific interaction between the customer and the service provider, but act as complements in providing a satisfying overall service experience. The quantitative study results showed that all service interfaces make a significant contribution to customer overall satisfaction with the bank, for all groups of users. BB continues to be the service interface with the strongest impact, even for IB users.

Although the qualitative and quantitative studies provide a better understanding of Internet service provision in a multi-interface context, they have some limitations. First, the multi-interface approach imposed limitations to the size of the battery of attributes analyzed, and satisfaction was measured with a single item scale. Future work could focus on person-to-person interaction versus Internet services, with a larger sample of items that could allow a deeper level of analysis. Second, although the banking industry has been considered a rich empirical ground for studying technology enabled multi-interface services, the robustness of study results could be improved through the inclusion of other retailing multi-interface services. Finally, a longitudinal study would be very useful for understanding the impact of Internet services adoption on customer satisfaction and usage of other service interfaces. Customer perceptions and preferences are dynamic. Analyzing their evolution could bring important insights for multi-interface service design.

Nevertheless, the qualitative and quantitative studies made important contributions to better understanding Internet service satisfaction in a multi-interface service, and for a new approach to the study and design of technology enabled service interfaces. Both studies supported the idea that customers use different service interfaces in a complementary way and that all of them contribute significantly to overall satisfaction with the service provider. As such, an integrated, multi-interface perspective is needed for a better design of Internet services. The findings also showed that CERs are crucial for understanding and designing Internet services, and that they should be addressed in all stages of the service interface design process. Finally the contributions of services marketing, HCI and RE all proved to be useful in understanding customer satisfaction with technology enabled service interfaces, and a multidisciplinary perspective could also be useful for service interface design.

7.4. *Improving the design of multi-interface service experiences*

As previously explained, the study main objective of enhancing service delivery systems through technology involved two sub-goals: understanding CERs in new technology enabled service interfaces, and applying these results to enhance the design of multi-interface service experiences. These sub-goals were reflected throughout the dissertation research in a special concern with the application of study results to interface design. Therefore, the final stage of research comprised the application of study results to the analysis of CERs and the specification of service interface improvements for the Bank under study.

As technology enabled multi-interface services pose new challenges for which traditional methods may not suffice, a new approach was developed to address CERs in the design of multi-interface services. This approach blended the contributions of both requirements engineering and services marketing to address the intertwined technology and service issues that emerge in the design of multi-interface service experiences. This work, already presented in detail in Chapter 6, was used to specify prototype improvements in both IB and BB for two financial activities: current account information gathering and mortgage loan application.

This last research stage started with a review of the main modeling and design methods used in services marketing, requirements engineering and software engineering. These methods were divided into two groups. One group of methods focuses on designing the *process* of interaction or service delivery. The process oriented methods reviewed were the Service Blueprint (SB) developed in services marketing, and UML use case and activity diagrams from software engineering. The other group of methods focuses on translating CERs into design. The methods reviewed were Quality Function Deployment (QFD) from quality management and Goal-Oriented Analysis from requirements engineering.

The goal-oriented analysis proved to be particularly useful, as it provides a systematic way to link non-functional requirements or softgoals to functional requirements or goals. The goal-oriented analysis is especially useful to evaluate different functional alternatives that satisfy the same functional requirements, but with different interaction experiences, which is the case of multi-interface services.

The results of the qualitative and quantitative studies and the review of existing design methods reinforced the idea that a new approach was needed to the design of multi-interface service experiences. Again, the same three research areas deserved special attention: multi-interface integration, the incorporation of experience requirements, and the need for a joint work of different fields of research.

- Although Internet services are increasingly used within a multi-interface environment, service interface design is usually undertaken with a specific interface technology in mind and in isolation. EUCs capture functional requirements independently of the technology used, but interaction is usually designed with a CUC perspective, and the alternative of person-to-person interaction is almost never considered in the process of interface design.

- Software engineering has traditionally focused on functional requirements. Experience requirements have only recently gained attention, but are still considered difficult to address, and are frequently relegated for a second plan as "non-functional requirements". In this regard, the goal-oriented analysis can provide a useful framework to systematically analyze and evaluate how different functional alternatives satisfy CERs.

- Finally, although several researchers have called for a multidisciplinary approach to technology enabled interface design, there is a tendency for software engineers to take existing business models and service processes as a given. With this approach, service interface design tends to mimic existing service processes, without taking full advantage of an integrated approach to technology and service to redesign the customer experience. Not surprisingly, the existing methods reviewed are often used separately by marketers, requirements engineers and software engineers.

Therefore, based on the study results and based on the contributions of the different methods reviewed, a new approach was developed to the design of multi-interface service experiences, which incorporates CERs from the Essential Use Case level to the Service Experience Blueprint – the EUC-SEB approach. This method was applied to improving IB and BB service interfaces for current account information gathering and mortgage loan application, involving the following stages:

1. First, CERs are elicited and analyzed at the EUC level, and the performance of each service interface in satisfying those customer needs is assessed. This step corresponds to the qualitative and quantitative stages of the dissertation research.

   The study results showed that for current account information gathering, efficiency was the most important experience requirement and IB was the best performer in that dimension. On the other hand, for mortgage loan applications, personal contact was of utmost importance and BB offered the highest level of personal contact.

2. Second, according to a goal-oriented analysis, each EUC can be allocated to the different service interfaces, according to the match between CERs and the advantages of each service platform. This stage corresponds to the examination of CERs at the EUC level, supported by a goal-oriented analysis, which used the qualitative and quantitative results.

   Current account information and mortgage loan applications are functionally available at both IB and BB. However, the goal-oriented analysis showed that each EUC had very different CERs, and IB and BB provided very different service interaction experiences. Through this analysis, it could be seen that the IB was better positioned to offer a satisfying interaction experience for current account information, whereas BB was better positioned for mortgage providing loan applications. This analysis provides a multi-interface view that can help managers allocating the EUCs to the service interfaces that best satisfy customer experience requirements in a way that contributes to a better overall experience.

3. Third, after the EUC analysis, the design can drill down to the CUC level, where each service interface is designed to support the specific financial activities previously defined, leveraging its unique capabilities to better satisfy CERs. As the different interfaces belong to the same service delivery system, the links among them are also carefully designed, so that customers can seamlessly move between service interfaces and have a satisfying overall multi-interface service experience. This stage corresponds to the development of a SEB for each CUC, also supported by goal-oriented analysis.

   At this stage, the SEB for each CUC were designed for both IB and BB, taking CERs into account. Moreover, the links between service interfaces were also addressed. As IB generally provides a better experience for current account information, the BB SEB for this financial activity was redesigned so that bank employees could use a PC with Internet assess to explain the IB service to customers, so they could thereafter use the IB. On the other hand, the IB service for mortgage loan application was designed in order to provide information and simulations for mortgage loans, but also to conduct the customer to BB when personal advice is most needed.

This EUC-SEB approach aims at enhancing the design of technology enabled multi-interface service experiences and responding to some of the challenges posed by the new Internet service environment. The increased usage of Internet services in multi-interface services increases the need for an integrated approach to service interface design. By eliciting CERs at the EUC level, the EUC-SEB approach contributes to a better understanding of customer overall service needs and to the identification of the service interfaces that are best positioned to provide the desired experience. With this approach, instead of designing each service interface to provide the best service in isolation, each interaction channel is designed to best contribute to the overall multi-interface service experience.

In the Internet service environment, CERs become increasingly important, but are difficult to address. Through the usage of well tested marketing methods, this approach allowed for a rigorous elicitation of CERs, providing ways to bridge requirements analysis with service interface design. Specifically, the goal-oriented analysis provides a systematic way to link CERs with functional requirements, using CERs to provide the rational for choosing between different functional design alternatives. The EUC-SEB also allows for the incorporation of CERs at all stages of the service interface design process, from the EUC, multi-interface perspective, to the CUC – SEB perspective.

Finally, in the Internet service environment, a multidisciplinary approach is needed to address the interrelated technology and service issues in design. The EUC-SEB method joins the contributions of different fields of research. It uses marketing methods for the difficult task of eliciting CERs. It adopts the marketing and HCI customer and user focus. It makes use of the goal-oriented analysis to analyze the relationships between CERs and functional requirements, and to provide a rational for deciding between design alternatives. Finally, it employs use case diagrams for the EUC analysis, and incorporates elements of both UML activity diagrams and marketing Service Blueprinting to develop SEB. By making use of the contributions of the different fields, the EUC-SEB approach creates a language that can be easily understood by marketers and interface designers, incorporating both technology and service elements to better design technology enabled service interfaces.

The EUC-SEB method still has limitations. Further developments and applications to other contexts can enrich the approach and lead to improvements. The use of qualitative and quantitative studies also turns it into a heavyweight approach. The EUC-SEB may not be justifiable for small scale projects, but may prove invaluable for projects involving a large set of heterogeneous customers, which is the case for many multi-interface services. Further applications of this method to other projects, and the accumulation and reuse of the knowledge thus obtained, could also offer useful guidance for smaller projects, for which developing the whole methodology may not provide sufficient cost-benefits.

7.5. Overall contribution of dissertation research

Overall, the dissertation research makes three contributions. First, it makes a conceptual contribution, developing a new approach to the study and design of technology enabled multi-interface services. This approach joins the perspectives of different fields of study to better understand and design technology enabled service interfaces. Service interfaces are addressed, not in isolation, but integrated in the overall service. CERs are rigorously elicited and incorporated in service interface design. With this approach, each service interface is designed to best contribute to an overall service interaction experience.

Second, the empirical studies contribute to a better understanding of customer satisfaction with Internet services, integrated within a multi-interface service environment, which contrasts with most of the reviewed studies that address each service interface in isolation. The dissertation study provided a rigorous elicitation of CERs, and uncovered important issues related to the multi-interface service context, such as the complementary role played by the different service interfaces in providing an overall service experience.

Finally, the dissertation research applies the study results to service interface design, through the specification of prototype improvements in IB and BB for two EUCs. As existing methods could not suffice, a new method was developed for designing multi-interface service experiences. This method helps bridging the gap between marketers and interface designers, linking CERs with functional requirements to evaluate and choose among design alternatives.

This study represents a first step in responding to the challenges posed by technology enabled multi-interface services. The study results and the approach developed should be further developed and tested, applying it to a more extensive set of EUCs'. The application of this method to other service contexts, such as retailing, or to other technologies, such as 3G services, could also bring new insights and further developments.

The multi-interface approach also deserves more attention. As these services gain importance, it would be desirable to further study what makes a multi-interface service a satisfying overall experience and how can service providers design it. This issue becomes especially challenging as the interaction experience is co-created by both service providers and customers, and as such, depends on both sides of the interaction.

The infusion of technology into service interfaces, leveraged by the widespread use of the Internet for service provision, has deeply changed both the human-computer interaction environment and the service delivery context. This new environment poses challenges to which both marketers and software engineers try to respond, but further research is still needed in this regard. This dissertation research contributes to enhancing service delivery systems through technology, by developing a new approach that integrates Internet service design in the multi-interface service, addressing CERs in all stages of design, and joining the intertwined perspectives of services marketing, HCI and requirements engineering. With this approach, each service interface can be designed to best contribute to an overall service experience, taking advantage of both service and technology elements.

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