Service Design of Mobile Applications in Cruise Context

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Aalto University
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SERVICE DESIGN OF MOBILE APPLICATIONS IN CRUISE CONTEXT

Master's Thesis
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ABSTRACT

Objectives of the Study

The objective of this Master's thesis is to design and propose the service concepts of mobile application based on passenger needs for cruise liners to improve passenger experience and to collect information from passengers on real-time basis to enhance their own performance.

Academic background and methodology

This thesis is produced as a part of Cruise and Ferry Experience Program Turku Triad 2012. Cruise and Ferry Experience Program, funded by FIMECC I&N program and Kaleidoskooppi, makes interdisciplinary efforts to contribute to maritime industry, is organized by Marine Technology research unit in Aalto University. Turku Triad, based in Turku, Finland, is a joint master thesis project linking marine technology, business and design. This study bases its academic research in service design and data-driven decision-making theory, follows design-thinking guidelines and uses need finding, benchmarking and expert interviews to design and propose a range of mobile application service concepts that accommodate passenger needs and in turn benefit cruise liners' operations.

Findings and conclusions

Through two-folded need finding process, passenger needs are identified in the domain of navigation, location, information, relaxation, safety and service quality. A portfolio of front stage and back stage services are design to address passenger needs and facilitate cruise liners in making operational decisions. Based on the information collected from passengers on real-time basis, cruise liners will be able to drive revenue, track performance, manipulate traffic, optimize inventory and facilitate communication. For successful implementation of such services, taking measures to diminish passengers' security concern and encouraging target passenger segments to use the application are essential.

Keywords

Cruise Industry, Service Design, Design Thinking, Mobile Application, Data-driven Decision-Making, Need Finding, Benchmarking

ACKNOWLEDGEMENTS

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1 INTRODUCTION

1.1 Background and Research Problem

This thesis is produced as part of the research project done by Cruise and Ferry Experience Program Turku Triad 2012. Cruise and Ferry Experience program is an academic program organized by Aalto University Marine Technology research unit and that is funded by FIMECC I&N program and Kaleidoskooppi. Turku Triad, as a research project, is comprised of three Master thesis workers from Design, Marketing and Logistics and Service Management background and it is the first Triad Project to be based in Turku, Finland. The author of this thesis joined the research unit with the intention to understand and contribute to logistics and service quality processes in cruise industry. The focus of this thesis was shifted during an observation field study carried out on Mediterranean cruise with MSC. Originally the focus of the study was to find dimensions of service quality in cruise industry and consequently the perceived value of different service offerings onboard. During observation and interviews, disparity between desire of quality service and offerings available onboard was noticed, which inspired the final perspective of this thesis—researching the possibility to use modern tools, mobile application in particular, to bridge the gap between passenger needs and service offerings. The disparity manifested in two dimensions. First is the gap between what cruise liner thinks passengers need and what they actually need. Second is the difference between how passengers like the services and how cruise liner is orchestrating them. Figure 1.1 illustrates the formation of gaps between passenger's needs and the actual service offerings onboard.
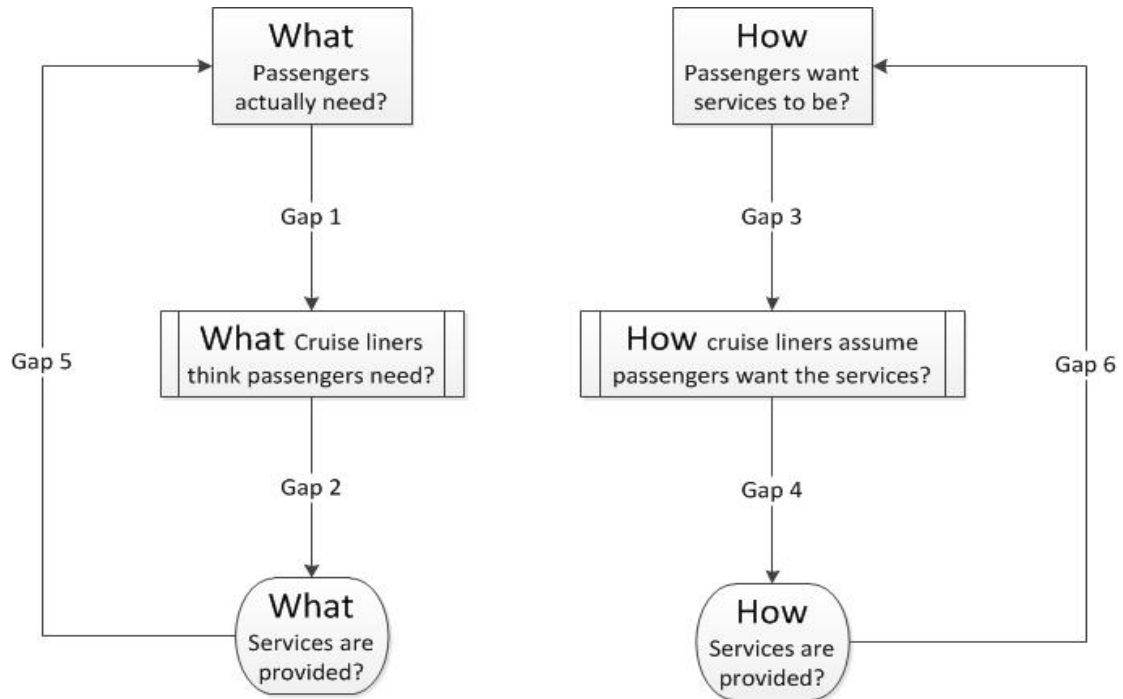
Figure 1.1 Gap Formations between Passenger Needs and Service Offerings

Detailed examples of these gaps observed onboard of the field trip include lack of available information, interrupted communication loop and poor onboard navigation aid. All of these problems inspired the research on utilizing modern tools to provide the desired content and quality of services onboard of cruise ships, so that passenger experience can be improved. Improving service quality and customer satisfaction is proven important to the success of business in hospitality industry (Barsky and Labagh, 1992; LeBlanc, 1992; Stevens et al., 1995; Legoherel, 1998). Customers that had better experience and higher level of satisfaction tend to repeat their purchases (Fornell, 1992), produce positive word-of-mouth (Halstead and Page, 1992) and build loyalty (Cronin and Taylor, 1992) with the service provider. Both positive word-of-mouth and customer loyalty are key to gaining competitive advantage as cruise liners are competing over new and repeat cruise passengers.

It is reported that there will be 30 new vessels coming into the market between 2013-2018 (Amem, 2013), and cruise industry is entering the era of great opportunity

and fierce competition. Cruise liners are now competing over technology and most unique experience in addition to the traditional battlefield of ship size, routes and installations. All these competitions eventually come down to how passengers perceive their experiences onboard. Previous research in tourism had correlated perceived value to perceived service quality and perceived monetary price. (Bojanic, 1996; Jayanti & Ghosh, 1996; Kashyap & Bojanic, 2000). Petrick, Morais, & Norman (2001) have also linked tourists' overall satisfaction to perception of value. Thus, enhancing perceived service quality and overall customer satisfaction can produce better value perception. Value perception can result in repeat purchase (Petrick, 2002) and repeat purchase is essential for cruise liners. Consequently, improving perceived service quality and overall customer satisfaction can be as beneficial for cruise liners, if not more, than occurring massive installation of new facilities.

It is evident that nowadays cruise industry is emphasizing on increasing luxury in the facilities onboard, which is manifested by as much as 75% of the space being taken up by accommodation and resort facilities (Dowling, 2006). However, cruise industry is a slow moving industry because a lot of hardware changes needs to be approved by public authority in forms of regulations. In addition, the legal framework regarding the subject is of great complexity ranging from marine pollution (MARPOL), safety (SOLAS) to hygiene and security (MARSEC)(Gibson, 2006). There have been cruise liners that are famed for their innovation and their ability to stretch the boundary of regulations to make room for innovation. However, "big and new" does not necessarily mean better passenger experience. There are many aspects in passenger experience that can be improved without having to install millions of Euros worth of facilities. If we view service as the "software" onboard of cruise ships as opposed to facilities being the "hardware", the betterment of "software" has as much potential to give cruise liners competitive advantage as the improvement of "hardware".

IT investment was proven to be positively correlated with firm performance in terms

of both productivity and profitability (Aral, Brynjolfsson and Wu, 2006; Brynjolfsson and Hitt, 1993). Through design of service concepts involving modern tools, cruise liners would be able to find out what the passengers need or desire on real-time basis, and satisfy those needs and desires in an efficient manner. Furthermore, they have the possibility to monitor the performance of staff, venues and departments onboard simultaneously instead of traditional tracking through data analysis on land. This means possible instant improvement of service quality and amelioration of passengers' perception of the overall experience onboard.

Currently cruise liners differ greatly in regard to the development of modern tools onboard. In accordance with author's interview with cruise liner executives and observation onboard of cruise ships, some cruise liners have implement real-time interactive systems like flat screen in each cabin and portable touch pads, whereas some other cruise liners have very little amount of modern devices installed onboard. Such disparity reflects different strategies cruise liners have as well as their capacity and desire to entertain new technological solutions. This study aims at proposing a suitable modern tool solution and its service design for cruise liners at different technological stage. Such solution will advance the high-tech savvy cruise liners and will allow the lagged cruise liners to skip a technological stage and catch up.

Possible modern tools consist of vast span of possible implementations, ranging from stationary flat screens, to touch pads, to smartphones, to novel gadgets like Google glasses and smart watches. Each of these tools has its advantages and weaknesses. While flat screens have the possibility to offer entertainment such as TV programs or movies, they are not easy to carry around, which limits its competitiveness against the functionalities that portable gadgets can offer. Novel gadgets like Google glasses and smart phones are innovative, easily portable and futuristic. However, these gadgets tend to be expensive and their popularity and acceptance is yet to be proven. Smartphones appear to be suitable choice for cruise liners because of its wide

penetration and acceptance. This study focuses on the service design in the scope of mobile applications. The mobile applications are in this context designed to use smartphones as platform because smartphones are currently widely accepted by consumers and they are portable and affordable at the same time. In the future, these applications can possibly be adapted for new platforms such as Google glasses and smart watches if cost and acceptance of these prove to be suitable for cruise liners.

Mobile application has been the buzzword for last several years. Much like the Dot Com fever in late 1990s, beginning of 2010s is witnessing mobile application fever. Mobile phones have grown into the center of gravity of people's everyday life, and the need to communicate with one another anywhere anytime has become one of the basic needs of social life. Mobile phones not only has facilitated information flow and communication to transcend time and space, but also in some occasions served as identity in countries like India in the form of Nokia Money. Jan Chipchase (2007) had studied anthropology of mobile phones and found out that mobile phones, along with money and keys account for the three essential things people take with them when they leave home.

The reason mobile phones are more popular and essential in our day-to-day life than ever is that it has become "smart" with the addition of operation systems. Smartphones, with the combination of operation systems and mobile applications, have more computing capability compared to feature phones, thus enable people to make more tasks than messaging and phone calls. Since its birth over a decade ago, smartphones have achieved great market penetration.

Table 1.1 Smartphone market penetration Q4 2011(source: comscore)

Country	USA	Japan	Germany	UK	France	Spain	Italy
% of suscription	41.8%	17%	37.0%	51.3%	40.0%	51.0%	43.9%

As seen in table 1.1, in the biggest market of cruise industry—USA, smartphones have achieved more than 40% of entire mobile phone market as end of 2011. Strategy Analytics (October, 2012) estimated the number of smartphones in use worldwide to be just over one billion units at the end of Q3, 2012, 46.6% more than Q3, 2011. (Strategy Analytics, 2012)

As operating systems provide smartphones the "brain" to think, mobile applications determine what the "brain" thinks about. Applications provide content and purpose to all the computing capacity that smartphones offer. With the presence of mobile applications, users are truly able to utilize smartphones to enjoy entertainment, communication, find information, surf the web and make all the other tasks that do not only provide convenience, but essentially improve lives. Table 1.2 demonstrates the purpose that users in USA, Europe and Japan use smartphones for.

Table 1.2 Mobile Behavior in USA, Europe and Japan, Q4, 2010, Age 13+(source: comScore MobiLens)[1]

Country	United States	Europe	Japan
Used connected media			
(Browser, app or download)	46.7%	41.1%	76.8%
Used browser	36.4%	28.8%	55.4%
Used application	34.4%	28.0%	53.3%
Used messaging			
Sent text message	68.0%	82.7%	41.6%
Instant messaging	17.2%	14.2%	3.6%
Email	30.5%	22.2%	57.1%
Accessed entertainment/social media			
Took photos	52.4%	57.5%	62.9%
Social networking or blog	24.7%	18.0%	19.3%
Played games	23.2%	25.3%	16.3%
Recorded video	20.2%	26.1%	15.8%
Listened to music	15.7%	25.0%	12.9%
Watched TV and/or video	5.6%	5.7%	22.8%
Accessed financial services			
Bank accounts	11.4%	8.0%	7.0%
Financial news or stock quotes	10.2%	8.0%	16.5%
Accessed news, sports, weather, search, retail, travel, reference			
News and information	39.5%	32.2%	57.6%
Weather reports	25.2%	16.4%	34.7%
Search	21.4%	14.9%	31.5%
Maps	17.8%	13.0%	17.1%
Sports news	15.8%	12.0%	18.2%
Restaurant info	10.0%	6.5%	9.7%
Traffic reports	8.4%	7.4%	14.0%
Classifieds	7.3%	4.8%	3.6%
Retail site	6.5%	5.2%	8.5%
Travel service	4.4%	4.6%	2.9%

Travel service, where the application from cruise liners belongs, accounts for over 4% of mobile application total usage in cruise industries major markets—USA and

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[1] Surveyed European countries include: UK, Germany, France, Spain and Italy

Europe. IDC (December 2010) predicts that worldwide downloads of mobile applications will top 76.9 billion in 2014 and worth 35 billion dollar, 4% of which presents huge potentials for cruise liners.

In addition to tapping into passengers' day-to-day life and experience onboard and off board, cruise liners also have the possibility to improve their own performance through service design of mobile applications. For instance, they can collect information from passengers, such as preferences and intended daily plan in order to optimize inventory level onboard. Through real-time monitoring of traffic in different locations onboard, cruise liners have the opportunity to dilute people flow during rush hours. This thesis is going to explore the possibility to design service concepts to improve firm performance as well as passenger experience.

1.2 Research Gap

As many previous studies researched the relationship between Information Technology investment and firm performance (Aral, Brynjolfsson and Wu, 2006; Brynjolfsson and Hitt, 1993), Bresnahan et al. (2002) and Devaraj and Kohli (2003) argued that organizational success with IT is varies depending on IT type and usage, management practice, organizational structure and industrial settings. Brynjolfsson et al. (2011) reported the relationship between data-driven decision-making and firm performance but not its application. Where there are more researches on IT investment in general, there is very limited amount of research on mobile applications as mobile application is a relatively new phenomenon compared to traditional IT types. Gans (2012) studied mobile application price and its relationship with platform providers. Some recent researches reported usability characteristics regarding smartphones and mobile applications, such as screen size, resolution, navigation and battery life (Parsons & Ryu, 2006; Ciurea & Pocatilu, 2008; Garofalakis et al., 2007; and Rabi'u et al., 2012). As these researches tapped into user needs in terms of

constructing the usability characteristics of smart phones and mobile applications, they were mainly focused on hardware features and did not report on how user needs translate into specific software features, in other words, functionalities of mobile applications. Pentland (2008) invented the concept of "reality mining", which refers to collecting data from users with mobile phones and studying patterns of user behavior. However, "reality mining" has not been conducted in cruise industry.

Research in cruise specific context, as part of larger tourism studies, has been heavily focused on service quality, customer satisfaction and perceived value (petrik, 2004; petrik, 2004; Duman and Mattila, 2005). Design thinking, as an approach combining business, technology and design point of view, has not been applied in cruise related studies.

The combination of design thinking, mobile application and cruise industry provides the uniqueness and novelty of this thesis. This study aims at providing a modern solution to cruise liners, which is designated based on user desirability and is viable in terms of business and technically feasible.

1.3 Research Purpose

The main purpose of this thesis is to design and propose a series of mobile application service concepts for cruise liners to improve passenger experience and their own performance.

The aim of service design is achieved by studying the needs of cruise passengers, pinpointing pitfalls of current service offerings and essentially bridge the gap between passenger needs and services onboard. On the other hand, the designated service has the goal of facilitating cruise liners making better operational decisions based on information collected from passengers via mobile applications.

1.4 Research Questions

The following are the key research questions that this study is designated to answer:

● What are the needs of passengers that can be potentially addressed?

● What services can be offered to passengers via mobile applications?

● What benefits can mobile applications bring to cruise liners?

Some more concrete and detailed questions were developed to guide and facilitate the study:

● What are the pitfalls of current service offerings onboard?

● What services are other travel industry entities providing that can serve as benchmarks for cruise industry?

● How would passengers perceive mobile application services?

With all these questions answer, this study will provide a blueprint of mobile applications enabled service canvas on cruise ships.

1.5 Research Methodology and Scope

This thesis uses research methods including need finding, benchmarking and expert interviews. Need finding include onboard observation and interview with passengers on a field trip on a Mediterranean cruise and mood maps made by passengers on a Nordic ferry. Benchmarking processes are primarily conducted by studying mobile applications currently offered by other travel industry entities. Expert interviews were conducted with industrial representatives.

Profitability is achieved when customer needs are satisfied with a product that is priced appealingly (Prudhomme *et al.* 2003). Need finding is not only the bedrock of problem formatting, but also is crucial for the final success of the innovation. Need finding is especially important at early stages of the innovation. It identifies the users and the user needs that the design is aiming to solve (Leifer and Steinert, 2011). Identifying user in this study is easy. The passengers onboard of cruise ships will be

the study objects of this research. The actual needs of the passengers are concluded from such processes as semi-structured interviews passengers and mood maps constructed by sample passengers. Both these methods are used because semi-structured interview allows the author to test the assumptions concluded from previous literatures and mood maps enables the pitfalls in current service practice to manifest in passenger's perspective.

Benchmarking, invented by Xerox as a Total Quality Management tool in 1979, has been to a large degree accepted by many industries around the world leading by manufacturing and service industries (Camp, 1989). Benchmarking, as a methodology, is to identify the best practices of certain company or industry, and to result in better organizational performance or success (Chi Lai, et al., 2011). As benchmarking is essential for setting strategy and achieving success, it has been increasingly used as performance management tool to track and improve firm performance through taking notes from other organizations (Francis, et al., 2002). Benchmarking in this study is conducted with the mobile applications offered by other entities in travel industries, including hotels, airlines, travel guides, restaurants and so on.

Expert interviews were conducted with industrial representatives in Finland. Interviews with industrial representatives include one-on-one interviews with cruise and ship building industry representatives, and workshop with experienced industrial and academic experts. The purpose of the expert interview was to understand the current progress and future trends of development of modern tool enabled services onboard and to validate some initial concepts and directions of service design in early stage.

1.6 Thesis Structure

This thesis is comprised of six chapters, namely introduction, conceptual framework, methodology, results, discussion and conclusion.

Chapter 1 introduction will give the readers an overview on the thesis by introducing background of the research problem, purpose of the study, research questions, methodology and scope, together with presentation of thesis structure. By reading chapter 1, readers will have an initial idea about the background and the structure of the study.

Chapter 2 conceptual framework lays the fundamental theories that this study is based on. The chapter consists of two parts. First part will define terms that are commonly used in this thesis and the second part is literature review of the theories in use for this study.

Chapter 3 methodology illustrates how the study was conducted. Need finding, benchmarking and expert interview, as different research methods used in this study, are elaborated in the context of this research. By reading chapter 3, readers can understand how the study was conducted.

Chapter 4 results present the findings of this study. This chapter can be divided into three parts. First part concludes the result from need finding, including the current problems of service offering and the passenger needs that are to be addressed. The second part presents the design of services that are catered to the needs of the passengers. The third part is the validation of service design.

Chapter 5 is the discussion of the results. The benefits and challenges of service design presented in chapter 4 will be discussed in this chapter. In addition, managerial implications for cruise liners are drawn in this chapter.

Chapter 6 is the conclusion of the study. It includes the significance and the limitations of the study, as well as the reflection of the author and the proposal for future research.

There are two threads that link all the different chapters of this thesis together. From the cruise liners' point of view, the study bases its research on data-driven decision-making theory, conducts benchmarking and expert interviews and concludes the business case for mobile application from operation's perspective. On the other hand, following design thinking guidelines, this study designs mobile application service concepts based on need finding and benchmarking results and draws conclusion on business case for mobile applications from passengers' perspective. The relationship between the chapters in this thesis is elaborated in figure 1.2.
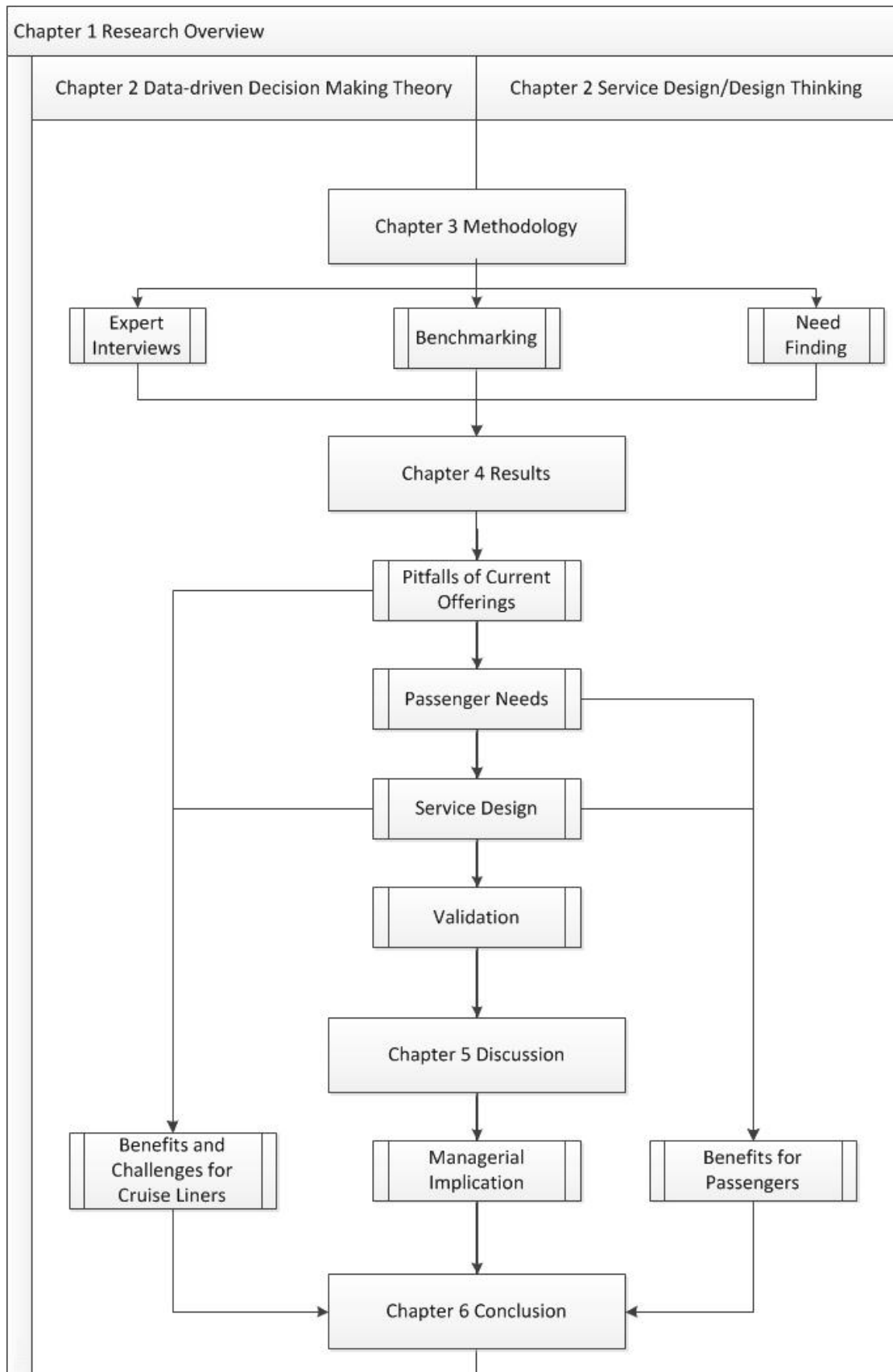
Figure 1.2 Thesis Structure

2 CONCEPTUAL FRAMEWORK

This chapter articulates the principal concepts and theories that are used in this thesis. The theories used include data-driven decision-making and service design theory. Previous researches regarding services in cruise industry are also reviewed in this chapter.

2.1 Definitions of Terms

Smartphone

Smartphone has an operating system, which is the characteristic that separates it from its counterpart feature phone. It has more computing capacity than feature phone, and consequently has more ability to facilitate people with their everyday activities.

Mobile Application

A mobile application, also known as a mobile app, app or smartphone app, is an application software designed for mobile device. Different from integrated software systems on PCs, mobile application provides individual and isolated functionalities.

Reality Mining

Reality mining, invented by Professor Pentland from MIT, uses information collected by cellphone sensors to derive human behavior intentions by applying data-mining algorithms. (Technology Review, 2008)

Design Thinking

Design thinking, invented by world-famous design firm IDEO, is a human-centered approach to innovation that takes into account user needs, technical feasibility, and

business viability. (IDEO, 2013)

Need Finding

Need finding aims at identify essential user needs of a group of users that an innovation focuses on. It generates design imperatives and solutions. Design imperatives refer to features or competences that are necessary to add value to customers in terms of satisfying their needs. Design solutions are concepts and prototypes that follow design imperatives and consequently cater to user needs. (Beckman and Barry, 2007)

Benchmarking

Benchmarking, as defined by its pioneer Xerox, is the continuous process of measuring products, services or practices against the industry leaders or the strongest competitors in the industry. (Sadeghi, 1999)

2.2 Literature Review

This subchapter reviews past academic literatures concerning service studies in cruise industry and two main theories that are used in this thesis, namely data-driven decision-making and service design.

2.2.1 Services in Cruise Context

Traditional Services in Physical Environment

Cruise ships are different from other maritime tourism entities, such as day-ships, yachts and sailboats. Cruise ships enables much longer duration of the trip and more physical touch points with the passengers. According to Diakomihalis (2007), the level of service offered on luxurious cruises is both high and hotel-like, ranging from

restaurants, bars and nightclubs, to library, gym and hairdressers, from casinos, excursions and duty-free shops to laundry, photo studio and room services. All of these items of services, on or off board, requires physical interaction between the passengers and the staff and happens in a physical environments rather than digital. As Datamonitor (2010) put it, innovation and additional services are important for hospitality sector and operators are obliged to change with time and keep up with the fast evolving consumer goods. This study focuses on the possibility of mobile applications providing additional service onboard in digital context.

Diversity and Complexity of Cruise Services

As the range of services accounts for one side of diversity and complexity of cruise services, the cultural factor constitutes the flip side of the coin. According to Cruise Lines International Association (CLIA, 2011), the growth of foreign passengers has well exceeded the growth of North American passengers. Figure 2.1 illustrates the fast globalization development of cruise industry.
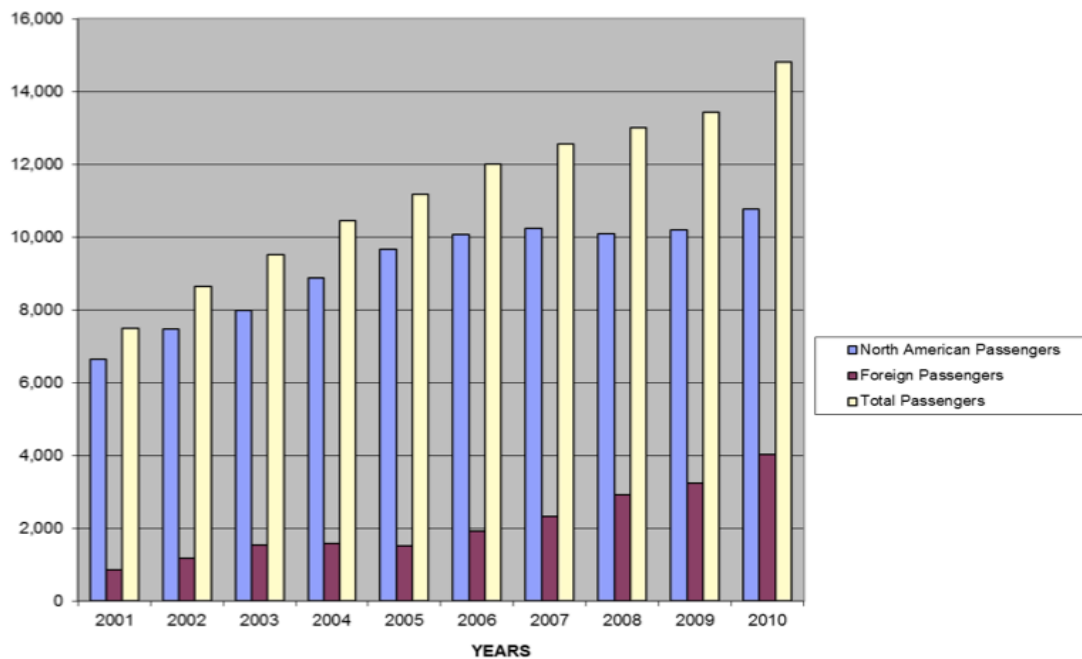
Figure 2.1 Growth of Global Cruise Passengers 2001-2010 (000's, source: CLIA)

Raub and Streit (2006) pointed out that cruise ships operate in different parameters compared to hotels despite the certain similarities in service offerings. The level of interaction between passengers and staff is higher and the duration is longer. Hotel skills are essential on cruise ships as they are the centers of production and staff-guest ratio is relatively higher in comparison to hotel industry (Gibson, 2006). Language skills and cultural sensitivity are at the heart of those hotel skills. However, it is highly unlikely a staff member will speak all the languages that cruise passengers onboard speak as the diversity of cruise passengers continue to grow, how to facilitate the communication and foster the cultural sensitivity is key for cruise liners to continuously satisfy passenger needs in the future. This study takes cultural sensitivity into account and looks into the possibility of using modern technology to overcome language barriers onboard.

Perceived Value in Cruise Industry

Petrick (2002) argued that perceived value is the most significant indicator of behavioral intentions, in other words, future purchase behavior of services. As repeat passengers are essential for cruise liners, the importance of improving perceived value is self-evident. Traditional literatures (Bojanic, 1996; Jayanti & Ghosh, 1996; Kashyap & Bojanic, 2000) link perceived value positively to perceived service quality and negatively to perceived monetary price. Duman and Mattila (2005) proved the positive relationship between perceived value of cruise vacations and affective factors such as novelty, control and hedonics. Mobile application, as a modern tool, represents both novelty and control factor to passengers. Petrick (2004) and Petrick (2004) compared quality model, satisfaction model and perceived value model and their ability to predict passengers' intention to repurchase and also studied the difference of intention to purchase between first timers and repeat cruise passengers. While quality predicted intention to purchase better for repeat cruise passengers, perceived value was proven the dominant indicator for first timers. This study looks

into the possibility to measure and improve service quality on real-time basis with mobile applications in order to increase passenger satisfaction and perceived value.

2.2.2   Data-driven Decision-Making

Data-driven decision-making has been previously researched in the area of educational system (Chen et al., 2005, Choppin, 2002, Mandinach, 2006, Tamara and Foley, 2005) and health care (Wisdom et al., 2006, Patel and Riley, 2007). Some case studies have been used to reveal the relationship between data-driven decision-making and organizational performance (Snipes et al., 2002, Supovitz and Valerie, 2003).

Data-driven Decision-Making and Production and Quality Management

Data-driven decision-making has been mainly researched in manufacturing management and quality management area. Lin (2009) proved that data-driven method could detect bottlenecks of manufacturing system and thus improve productivity. From data mining and process modeling perspective, Kusiak (2006) presented a framework that consists of decision tables, decision maps and atlases in order to organize and apply knowledge for decision-making in manufacturing and service application.

Data-driven Decision-Making and Firm Performance

Regarding firm performance, some studies accredited IT investment and data analysis. Aral, Brynjolfsson and Wu (2006) and Brynjolfsson and Hitt (1993), reported positive correlation between IT investment and both productivity and profitability. Carr (2003) and Edmondson et al (2003) reported that it is IT enabled codified knowledge transfer that improves firm performance while only IT investment, as a commodity, does not matter. Davenport and Harris (2007) looked into a number of firms that have gained

competitive advantage in their respective industries through using data and analytical tools for decision-making. Lavalle et al. (2010) studied organizations that differentiated themselves from other firms with business information and analytics and stated they are twice as likely to be the top performers in their respective industry than other firms. Brynjolfsson et al. (2011) researched 179 large publicly traded firms, and revealed the correlation between management level data-driven Decision-Making and performance measures including productivity, profitability, asset utilization, return on equity and market share. They found that one standard deviation towards data-driven decision-making was correlated with 5-6% improvement in productivity and slightly larger increase in profitability.

Data-driven Decision-Making and Strategy

As firms increasingly adapt IT investment, information today is more accurate and immediate. Decision makers, in other words, management in firms, should reply more on fine-grained information and thus improve the overall quality of decision made. Fine-grained data are taking over as base for decision-making over HiPPOs (Highest Paid Person's Opinions) in a lot of companies (Kohavi et al., 2009). Lots of industrial leaders, such as Wells Fargo, Subway, Amazon and eBay, are implementing data-driven decision-making by sampling methodologies, designing experiments and collect immediate indicators before launching new products, that is so-called "Information-based strategy" (Davenport, 2009). Google trends is another practical example of using data collected from users, in this case, search words, to predict trends in certain industries.

Reality Mining

Pentland (2008) from MIT, predicted an emerging trend of collecting data from users with mobile phones and studying patterns of user behavior, which is called "Reality Mining". Reality mining is able to collect and analyze "people data" with the help of

mobile phones, thanks to such technology like RFID tags. Pilot project of reality mining of voice, communications and mobility patterns have proven to be useful for screening for depression, estimating quality of life metrics and producing neighborhood financial indexes (Pentland, 2008). This study look into how cruise liners can implement mobile applications services to "mine the reality" of passengers to not only improve their experience but also their own performances.

Data-based decision-making is a relatively new theory, however there has been more academic attention on it with the emerging phenomenon of smart phones and user centric studies. Table 2.1 summarizes the previous studies in data-driven decision-making.

Table 2.1 Previous Studies in Data-Driven Decision-Making

Author(s)	Topic	Contributions
Aral, Brynjolfsson and Wu (2006), Brynjolfsson and Hitt (1993)	IT investment vs. performance	IT investment is positively correlated with productivity and profitability.
Carr (2003), Edmondson et al (2003)	IT investment vs. performance	IT investment, as commodity, does not improve performance, and IT enabled codified knowledge transfer does.
Lavalle et al. (2010)	Data-driven decision-making vs. performance	Data-driven decision-makers twice more likely to be top performers.
Brynjolfsson et al. (2011)	Data-driven decision-making vs. performance	One standard deviation in data-driven decision-making results in 5-6% improvement in productivity.
Kohavi et al. (2009)	Refined data vs. HiPPOs	Firms are increasingly using fine-grained data to make organizational decisions.
Davenport (2009)	Information-based Strategy	Impact of sampling methodologies on corporations' new product launch.
Pentland (2008)	Reality Mining	Predicting method of using information collected by mobile phones to infer human behavior.

2.2.3   Service Design

Design Thinking

Service has many definitions. For instance, in service engineering, service is defined as an activity via which the service provider changes the status of its receiver (Shimomura and Tomiyama, 2005). As this study is exploring the possibility of designing a portfolio of service concepts that benefit both service provider and service receiver, the definition from user-centric design thinking point of view is used. Thus, here the definition of service is "the interaction between two parties that co-create value for both" (Katzan, 2008). Service design, as an organizing framework, is needed when the volume of those interactions between the two parties is high (Saco, 2008). Guided by the identified problem statement, with the help of a combination of approaches, service design is to create user experience based on real user needs. Stickdorn and Schineider (2010) reported five principles of service design, namely user-centered, co-creative, sequencing, evidencing and holistic. User-centeredness states the purpose of service design, which is meeting user needs. Co-creation emphasizes the approach of service design, which is stakeholders collaborating to create value. Sequencing refers to the timeline that reflects design process and stakeholder status. Evidencing is stating the value of designed service shall be manifested clearly. Holism is stating service design is embedded in users' culture. These principles provide high-level guidelines for service design process used in this study. IDEO (2013), the origin of design thinking, stated that the innovation should be located at the intersection of user desirability, business viability and technical feasibility. As a part of Cruise and Ferry Experience Program, which is an interdisciplinary Master's thesis project, and understand guidelines of design thinking, this study intends to take into account all three aspects using a variety of approaches.

Service System

Service delivery can be divided into "front stage" and "back stage". Separated by the "line of visibility", the part of service delivery that constitutes the service encounter between customer and service provider is called "front stage" whereas the activities and services that are invisible to customers are "back stage" (Teboul, 2006). Blushko and Tabas (2009) developed a methodology to form "front stage" and "back stage" into an end-to-end service system for information-intensive applications design. This study designs both "front stage" for passenger encounter and "back stage" for operations. "Front stage" services are designated to satisfy passenger needs and collect information from passengers. "Back stage" services utilize the information collected from passengers and facilitate staff members to make operational decisions. On the other hand, "back stage" services also control and update the information that passengers will get through mobile application. "Front stage" and "back stage" services form mobile application service system onboard. Patricio et al. (2008) stated that service systems could be multi-channeled. Mobile application will serve as one channel that cruise liners offer their service system to passengers in addition to online channel and physical channel.

Design Framework

Figure 2.2 showcases the design framework that Katzan (2011) concluded incorporating service design thinking principles, service design methods, customer needs and service design feasibility. Service design thinking principles are the guidelines that govern service design procedures. Different service design methods are selected based on specific characteristics of the problem and needs of the design. Taking into account the needs of the end users and technical feasibility, service design process produce the service solution to answer to the initial problem service design aims to solve.
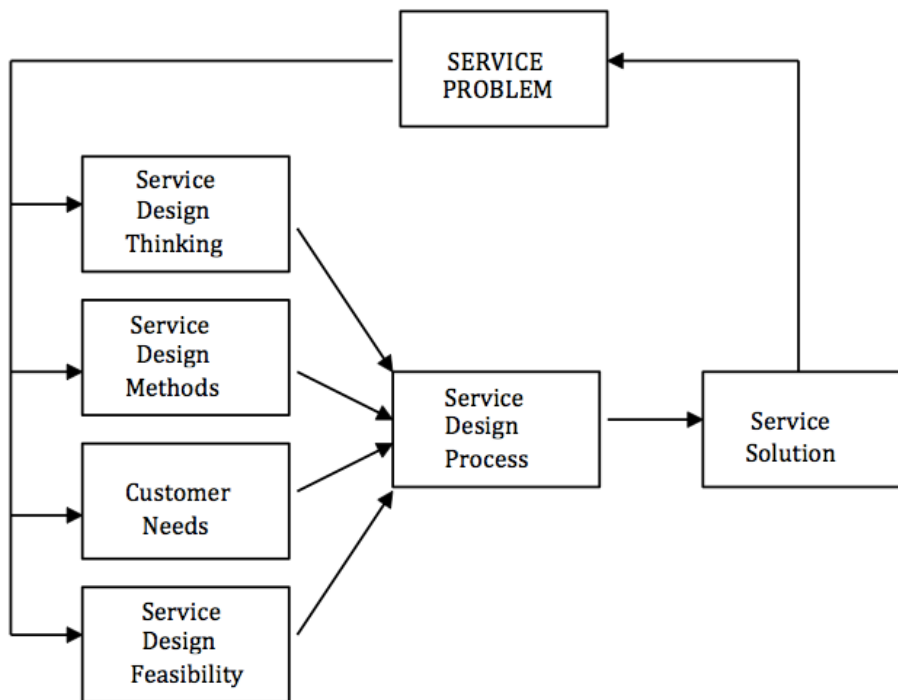
Figure 2.2 Service Design Framework (Katzan, 2011)

This study adapts Katzan's framework into cruise context. While following service design thinking guidelines, benchmarking method is used to draw best practice from adjacent industries. On the customer side, passenger needs are concluded from the need finding process and l feasibility of the service design is constrained by expert interviews from management and technical point of view. The details of the adapted framework are presented in the next chapter. Table 2.2 summarizes frameworks, concepts, processes and principles this study uses based on the conclusion of previous studies.

Table 2.2 Service Design Based on Previous Studies

Author(s)	Topic	Adaptation in the Study
Stickdorn and Schineider (2010)	5 Principles of Service Design	Service Design Guidelines
Blushko and Tabas (2009)	Service System	Integration of "Front Stage" and "Back Stage"
IDEO	User Centric Approach	Processes such as Need Finding, Benchmarking
Katzan (2011)	Service Design Framework	Methodology

3 METHODOLOGY

This chapter will introduce the methods in which this study was conducted, namely need finding, benchmarking, and expert interviews. Previously mentioned five principles for design thinking will provide guidelines for service design. Need finding will discover passenger needs. Benchmark as a design method will manifest the best practices used in adjacent industries. Management viewpoint derived from expert interview with industrial experts will constrain the scope and feasibility of the design.
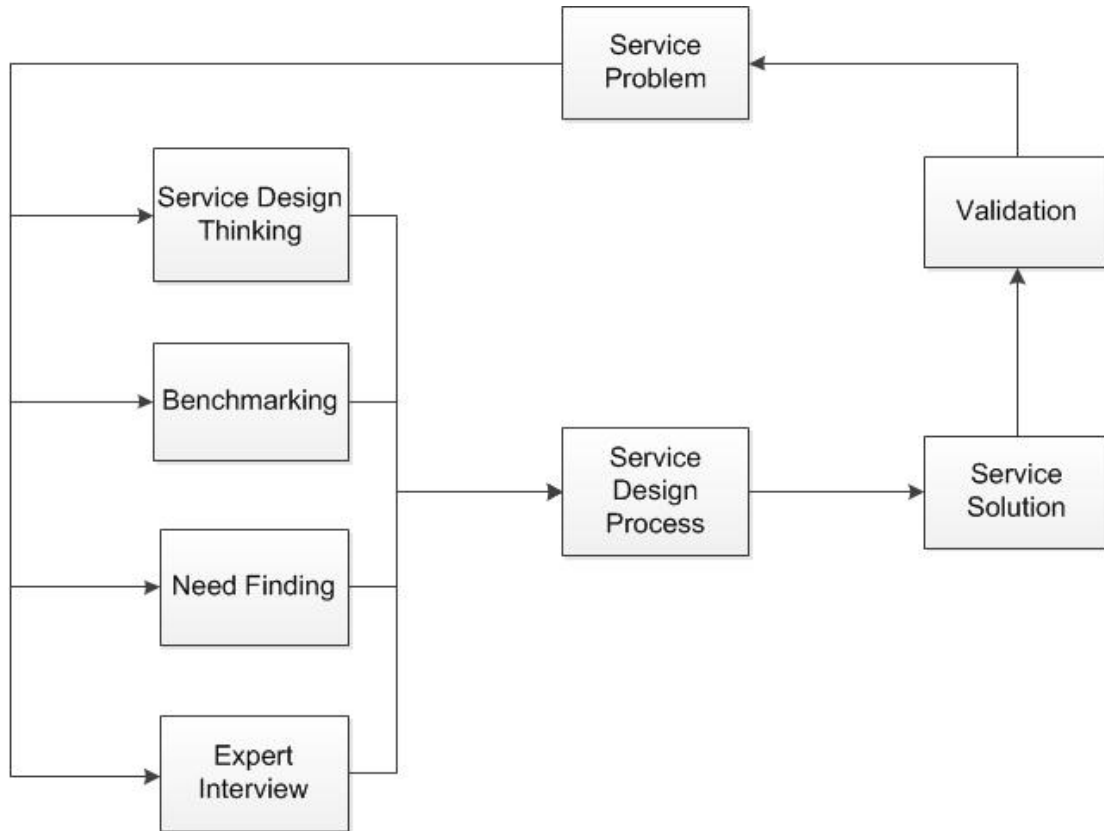
Figure 3.1 Thesis Methodology

Figure 3.1 explains the adaptation of Katzan's framework in this study. Service design thinking serves as guidelines for the research. Principles such as co-creation of value and user-centeredness are applied throughout the process of the research. Benchmarking, as a design method, is chosen to draw experience and lesson in mobile application service design from adjacent industries. Need Finding is specifically applied here to find out passenger needs and expert interview is conducted to make sure the solution is technically feasible and valuable to cruise liners. As all these methods are incorporated in service design process, the solution that the process produced undergoes a validation process and the validated results will answer to the design problem.

3.1 Need Finding

Need finding can be divided into two parts. First part is the semi-structured interviews. Second part of the need finding is mood mapping. Semi-structured interview leads interviewees to discuss certain needs that were pre-determined based on literature review. Mood mapping allows needs to be manifested without pre-designated framework in order to discover hidden needs that were not included in the interview questions.

3.1.1   Passenger Interview

Interview, as a method, was used in this study because the interviewees have first-hand experience on the topics of interest (Merton and Kendall, 1946). Semi-structured interview is a viable method to collect qualitative data in light of its structure and openness. Semi-structured interview, while being controllable, gives interviewees and interviewer some space to elaborate beyond script. In this study, 7 personal interviews were conducted with passengers onboard of MSC Sinfonia. Precise interview questions and interviewee profiles are illustrated in Appendix A.

3.1.2   Mood Map

Mood map is a method that is used sometimes by design agencies to identify the highlights and pitfalls of current experience. Mood map is constructed completely by users themselves after initial instructions. It gives researchers and designers a comprehensive view of user experience from their point of view. Mood map is valuable in identifying aspects that researchers and designers have not considered before.

In this study, the mood map was carried out on a Nordic ferry trip. Three participants were asked to take pictures on the journey of the ferry in order to record the events

happened that affected their mood and their respective mood at that particular moment. Mood maps were the production of analyzed data. The idea is to pin point the peaks and low points of passenger's mood during the ferry experience and consequently identify current best practices and pit falls of current service offering and passenger needs.

Mood map was carried out on a ferry because the entire journey of a normal cruise (usually 7 days) will produce too many data entries and was not feasible give the time and budget limit. The mood maps made for Nordic ferry can be seen in Appendix B.

3.2 Benchmarking

Initially developed by Xerox in 1979 as a total quality management tool, benchmarking is now greatly accepted by the industry as a method to define best practices and result in better organizational performance (Camp, 1989, Chi Lai, et al., 2011). Benchmarking usually incorporates performance measures, comparison, best practices and improvement (Geerlings et al., 2006). There are four types of benchmarking, namely internal, competitive functional or industry and generic benchmarking (Elmuti, 1997, Chi Lai, et, al., 2011) In this study, functional benchmarking is used in adjacent industries to help designing mobile application in cruise industry.

Benchmarking in this study was done in adjacent industries on two levels. The first is to look at the different services they offer that could potentially be used in cruise industry. The second is to study the service impact the mobile applications have brought to the adjacent industries. The industries the study includes are travel, restaurant, hotel and other industries such as E-payment, electronic post and location services. Figure 3.2 shows all the applications that were benchmarked in this study.

Travel	Hotel	Restaurant	Others
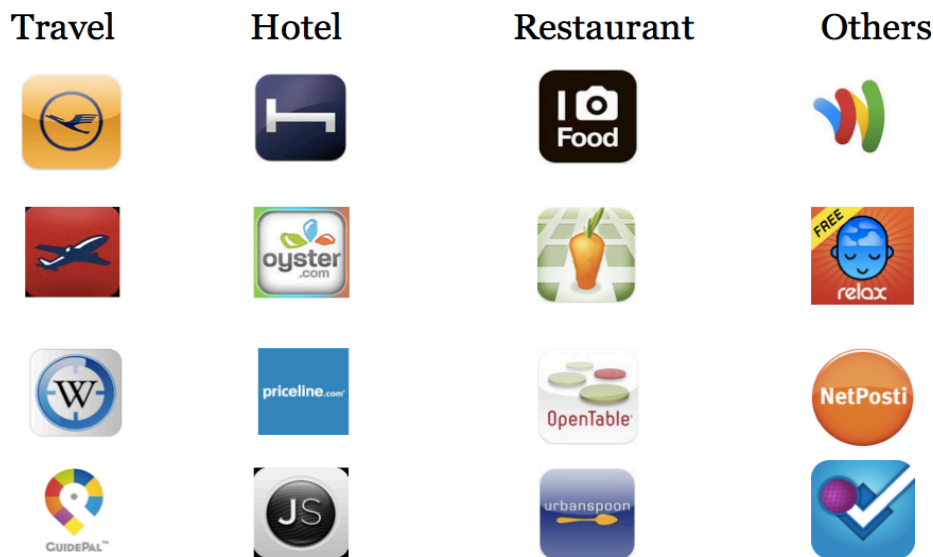
Figure 3.2 Benchmarking Applications

The benchmarked application include Norwegian, Lufthansa, Wikihood and Guidepal from travel industry, Hotel Tognight, Oyster, Priceline and Jetsetter from hotel industry, Foodspotting, Vegout, Opentable and Urbanspoon from restaurant industry and Google Wallet, Netposti, Relax and Foursquare from other industries. Specific features from different applications were analyzed for cruise industry's reference. Various benefits that these applications produced were categorized and documented.

3.3 Expert Interview

As passenger interviews gather insights from user point of view, expert interview is served to represent industry's opinion. Thus, the two are separated and conducted at different stages of the research. Passenger interviews were carried out during observation trip after initial research on previous literatures about cruise services. Passenger interviews were part of the need finding process and formed part of the problem statement and need statement of the design challenge. On the other hand, expert interviews were carried out when certain data from passengers had been gathered and analyzed and initial design of the service portfolio was carried out. Expert interview in this study was conducted in order to testify the feasibility of the

mobile application and validate certain features. In addition to expert interviews, a workshop was organized with cruise industry representatives and academic experts to further clarify certain issues in service design and functionality provision. Three expert interviews and one workshop were conducted during the course of study. The list of expert interviews and workshop can be found in Appendix C.

3.4 Research Strategy

Research strategy is about data was collected and processed and design results were validated for service design. Data collection took place onboard of MSC Sinfonia during the observation trip and onboard of Viking line Ferry in Baltic Sea, in office of cruise liner, University of Aalto and online with the application stores. Collection was facilitated by modern technologies such as tape recorders and video cameras. Data processing were conducted using visual tools like Microsoft Visio and Excel sheets. Validation of the results was organized as a workshop with the students from Turku University of Applied Science through live acting and voting.

3.4.1   Data Collection

Data collection of this study can be divided into three parts: need finding, benchmarking and expert interviews. Need finding part of data collection is conducted through semi-structured interviews on the Cruise MSC Sinfonia and mood maps that three passengers on onboard in Baltic ferry Viking Line. Benchmarking was done through collecting most popular mobile applications in adjacent industries online. Expert interview's data is collected through semi-structured interviews and workshop with industry experts and professors. Table 3.1 illustrates details about data collection used in this study.

Table 3.1 Data Collection Details

Procedure	Methodology	Formation	Subjects	Location	Documentation
Passenger Interview	Need Finding	Semi-structured Interviews	Passengers	MSC Sinfornia	Tape Recording
Mood Map	Need Finding	Experience Narration	Passengers	Viking Line Ferry	Notes and Pictures
Benchmark	Benchmarking	Search, Select, Study	Mobile Applications	Online	Notes and Flowcharts
Expert Interview	Expert Interview	Semi-structured Interviews	Industry Experts	Turku and MSC Sinfonia	Tape Recording
Expert Workshop	Expert Interview	Group Discussion	Industry/Academic Experts	Espoo	Videos

3.4.2 Data Processing

Data collected was processed using modern tools. Passengers interviews were concluded using excel sheets. Mood maps were analyzed and pitfalls and peaks of passenger emotional journey onboard were highlighted. Data of applications used in travel industry was consolidated using Microsoft Visio (Example in appendix D).

Table 3.2 Data Processing Details

Procedure	Methodology	Formation	Process Tool	Result
Passenger Interview	Need Finding	Semi-structured Interviews	Microsoft Word	Passenger Needs
Mood Map	Need Finding	Experience Narration	Microsoft Word and Visio	Passenger Needs
Benchmark	Benchmarking	Search, Select and Study	Microsoft Excel and Visio	Possible Features
Expert Interview	Expert Interview	Semi-structured Interviews	Microsoft Word	Technical Constraints
Expert Workshop	Expert Interview	Group Discussion	Microsoft Word	Feasibility

Details of data processing are shown in table 3.2. Mostly Microsoft Word, Excel and Visio were used to analyze the data and conclude the results.

3.4.3   Validation of the Result

Design thinking is a user-centric approach. When design is drafted based on need finding and benchmarking processes, validation is needed to obtain proof of concept. There are many advantages of direct feedback with testing service concepts with users (Scheuing & Johnson, 1989). However, when testing with a group, groupthink and social desirability bias often come to play and influence the result (Morgan, 1996). Thus, the validation workshop took form of anonymous voting and open discussions. The workshop took place in Turku University of Applied Sciences. 89 university students participated in the workshop and everyone was given a clicker in order to vote and indicate their opinions. Different scenarios were presented to participants together with the service designed to tackle the situation. Actors were acting live to illustrate different scenarios while backgrounds of different situations were indicated to participants on screen. The Participants were asked to vote on whether indicated services will improve their experiences onboard. More details of validation workshop can be found in subchapter 4.3.

4   RESULTS

The results are presented three-fold. First, the result of need finding procedures will be articulated in forms of problem statement and need statement. Then, the services designated to address passenger needs are introduced. Last but not least, the validation of service design, which was concluded from the Turku workshop, will be presented.

4.1 Problems and Needs

This section will present passenger needs manifested through identifying current service offering pitfalls onboard on cruise ships and Nordic ferries. The result is concluded from need finding processes include passenger interviews and mood maps.

4.1.1 Problem Statement

Difficult to Navigate

"You get the excitement when you first come onboard. You want to go and explore the ship, but after a while you just want to get to places when the excitement wears off. "

--22 year-old first-time German passengers

"This ship is not big, and it is designed in the old-fashioned way. When you have been on many cruise ships, you have a pretty good idea on what is where, but of course every ship is still different, it would be good to have some help when needed. "

-- A 58 year-old Chinese-American repeat cruise passenger

As the modern cruise ships increase in size, as well as volume and variety of facilities onboard, it is evident that passengers will need more facilitation when navigating around the ship, especially in the beginning of the journey when the passengers are not yet familiar with the environment onboard. When navigation service is not well constructed, the slightest feeling of confusion or lost will impair passenger's mood and consequently their experience onboard. Evidently the navigation ability of passenger varies depending on personal sense of direction and familiarity with cruise ships. Repeat passengers tend to do better in navigation if the ship follows traditional layout in ship design. For both first timer and repeat passengers, it is important to navigate, as knowing where one is and getting around is the basic element of

passenger experience.

Struggle to Find People

Elisa, one of the passengers making mood maps, marked 2/5 in her mood map for a moment when she lost sight of her travel mates while trying to find the cabin. All mood maps show low scores on mood when there is a crowd.

"When my husband is in the library reading and I want to go to the sun deck, I want to know if there are a lot of people there, because I do not want to be there alone."

--54 year-old Australian passenger

Life on a cruise ship follows certain schedule, which produces rush hours onboard. Even though cruise liners have existing tactics to tackle with the problems, namely a variety of choices for restaurants and other entertainment to dilute traffic. However, popular entertainment venues and restaurants still experience rush hours and long waiting time. Long waiting time, as the mood map process made clear, is one of the leading factors to negatively affect passenger's experience onboard. Consequently, passengers need to know where the crowds are on the vessel, so they can avoid it if they want to. On the other hand, sometimes passengers want to know where people are because they want to have some company.

Trouble to communicate with People

"I am travelling with a group of my girlfriends, and everybody is off doing different things in the afternoon. If we set a specific time to meet for dinner and I get caught up with something, there is no way to let others know."

--54 year-old German passenger

"I have daughters at home and they have young children. As much as I appreciate the escape, I sometime really miss them. "

-- A 58 year-old Chinese-American passenger

Passengers rarely go on cruise trips alone. They usually go on a cruise with a group or a partner. In both cases, they need to stay connected with the people they go onboard with. Passengers who travel together tend not to stay together all the time because there are usually a variety of activities to choose from onboard and everyone has different interest. As the mobile phone coverage is next to zero when the cruise ship is sailing on high seas, communication can pose a challenge. Current installation on most cruise ships allows passengers to call the cabin from certain locations onboard, for instance, stairways or entrance of the restaurants. This solution may work well if passengers spend most of their time in the cabin, which is not the case in reality. That is to say, current communication means onboard does not provide a solution for passengers who want to communicate with their travel partners who are not in the cabin. Not only the communication with travel partners is needed, passengers also desire communication with outside world. Because the Internet onboard is expensive and slow, another communication means to stay connected with outside world is appreciated by the passengers.

Trouble to Find Right Information

"It is really hard to find the information here. Schedule of all activities is printed on daily program newsletter. If you left the newsletter in the cabin, it is difficult to stay aware of what is happening onboard. On the other hand, it is difficult to find information about the destination. I would like to know background information on the destinations before we visit, but that kind of information is not provided. I suspect that was because cruise company want to sell their excursion packages. But if we want to go to the city ourselves with public transportation, there was no information

Access to information is critical to passengers and the interviewed passengers have repeatedly stressed the importance of information. Onboard environment is relatively closed to outside world and has limited access to massive amount of information that passengers are used to in their day-to-day life. Passengers are not only in need of information about schedules and programs of activities onboard, they are also eager to know about the excursions, transportation, as well as cultural and historical information about the destination. However, interviewed passengers consider information provided by the cruise liners not adequate, nor communicated in an effective way. Other categories of information is also appreciated by the passengers, such as weather and news, so that they can arrange their program onboard better and stay tuned with the outside world.

Stress and Boredom

Mood maps show low mood points whenever stress and boresome was present. In addition, the presence of noise and smell will also cause unpleasant feelings from passengers.

For whatever reason passengers choose to go on a cruise, they all want to relax during the trip. Some passengers want to take a break from the accelerated pace of modern life while others simply want to spend some quality time with their loved ones. In either case, the passengers desire to have a relaxing environment and services to help them to rest and to escape from the stress they usually feel in their daily life. To create a stress-free environment that is interesting, but not too demanding for passengers is key for pleasant passenger experience.

Nausea, Phobia and Allergies

"I am extremely careful about what I eat every time, especially here onboard. Because if I have get into some trouble, I do not know about if the medical care onboard."

--22 year-old German passengers

During the observation trip, the journey between Tunis, Tunisia and Ibiza, Spain was really wavy because of the seasonal current that was presenting in the area.

"A lot of passengers came to ask for sea sickness pills and a lot others came to ask about the conditions of the ship. Because the ship was rocking heavily, they are either scared or concerned. The movie Titanic did not really help with the case. But this is really normally for us staff, because we go through this sea route every week. It is just takes a lot of time to explain that to all the concerned passengers. "

--Receptionist, MSC Sinfonia

Safety is not something that passengers actively think about when they are enjoying life onboard. However, feeling safe is a prerequisite for passenger to enjoy any activities onboard. Even though safety is not something that an average passenger consciously thinks about all the time, it is without a doubt important to passengers, especially when they have specific phobias or food allergies or when the whether is particularly bad.

Long Waiting Time

All the mood maps demonstrated low mood points when passengers needed to wait for a long time to enter or exit the vessel.

When embarking and debarking the cruise ships, passengers in a lot of cases need to stand in line for some time in order to enter or exit the vessels. Waiting is boring for passengers and usually comes with standing in line with a large group of people. As mood map manifested, crowd often produce negative feelings amongst passengers. Rush hours in restaurants and entertainment programs can also result in long waiting time for passengers. Despite cruise liners' effort to dilute traffic (having passenger dining in batches and multiple venues), some waiting time onboard seem to be inevitable.

Low Price/Quality Ratio for Services

"Of course we can here to relax and have a good time. We do not want to get bothered by the little things that may go wrong every now and then. "

--59 year-old Australian passenger

"Service in the other cruise liner was definitely better. Staff was warmer and more helpful. This is our first time with this cruise line and I think next time we would know which one to go for. "

A 58 year-old Chinese-American repeat cruise passenger

Elisa, one of the passengers making mood maps, marked 2/5 on "overpriced and bad food" onboard of a Nordic ferry.

With the intention to relax, passengers might be willing to overlook some mishaps in service offering. However, a repeat passenger might compare current experience with the previous and make repurchase decisions according to the comparison. In addition, Petrick (2004) proven that while quality is the predominant indicator for repeat passengers to repurchase, value perception predicts first timer's intention to purchase. Thus, increasing quality and value perception are both very important for cruise

liners.

4.1.2   Need Statement

As individual passengers have very specific needs and it is impractical to elaborate every passenger's individual needs. In this section, general need domains will be concluded from problem statement presented in previous section. However, in subchapter 4.2, as front stage service design is aiming at addressing these general needs, back stage service is designed to enable staff members to collect information from individual passengers and satisfy their specific needs.

Drawing from the problem statement, passenger need domains are concluded in Table 4.1.

Table 4.1 Passenger Need Domains

Manifested Problem	Interpreted Need
Difficult to Navigate	Navigation
Struggle to Find People	Find People
Long Waiting Time	
Trouble to communicate with People	Communicate with people
Trouble to Find Right Information	Access to information
Stress and Boredom	Relax
Nausea, Phobia and Allergies	Feel safe
Low Price/Quality Ratio for Services	Have Good Service

As passenger needs were mapped out with passenger interviews and mood map, specific services were designed to fulfill those needs. The next subchapter will

elaborate the designated services in detail.

4.2 Service Design

Service concepts were designed for both front stage and back stage. Front stage services were designed to cater to passenger needs that were presented in the last section. Back stage services were designed for staff so that cruise liners can translate information they collect from passengers via mobile application into performance. This section is organized so that the front stage service is presented first, followed by back stage services. Last but not least, interaction between the two will be articulated.

4.2.1   Front Stage Service Design

Front stage services refer to the services that interact with the passengers. Based on the needs concluded from last section, a portfolio of front stage services is designed to cater to passenger needs. The services are designed are three levels: solution, functionality and feature. The solution level service design is corresponding to domain of passenger needs. The functionality level service design is presented in relation with physical service touch point onboard. The feature level service design is conducted based on the benchmarking results in order to improve passenger experience. Figure 4.1 illustrates the three levels of service design.
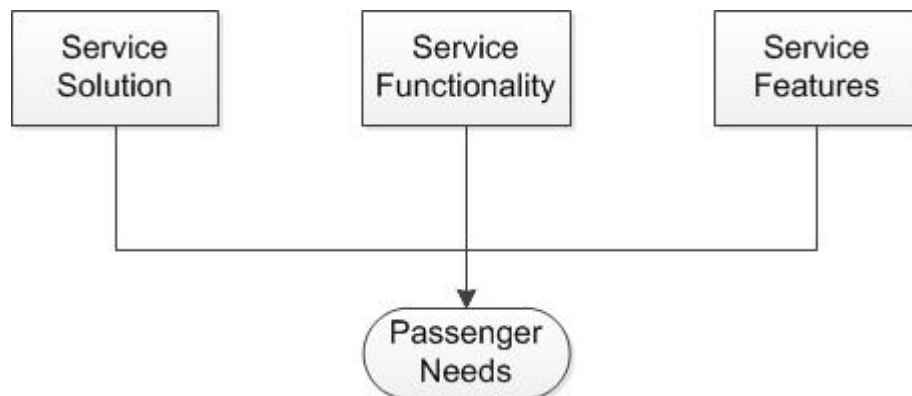
Figure 4.1 Three Levels of Service Design
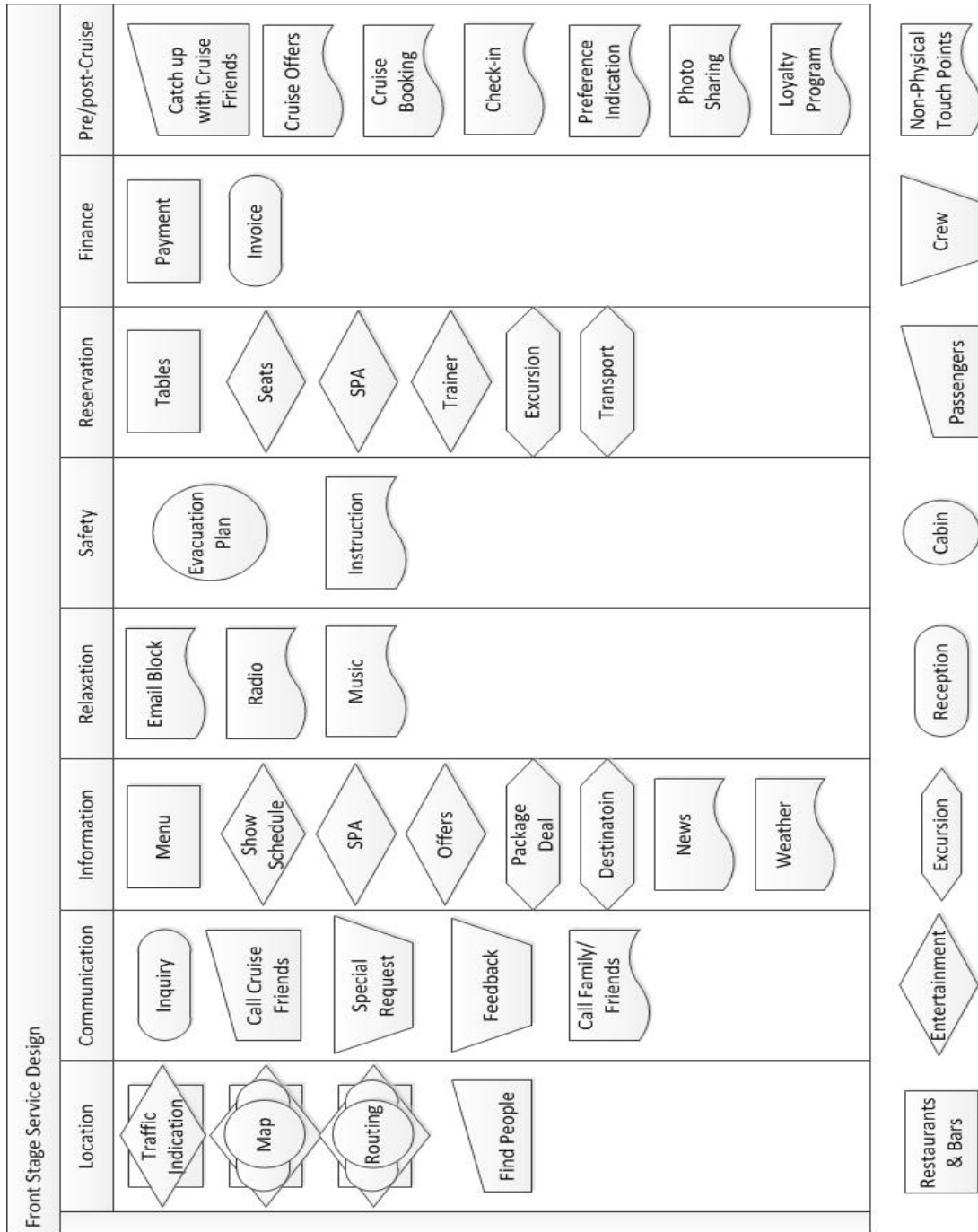
Figure 4.2 Front Stage Service Design

Figure 4.2 demonstrates the service solutions and functionalities in relation with physical service touch point. Different textbox shapes represent different physical/non-physical touch points onboard. Combining the swim lanes and textbox shapes, readers can have an understanding of designed mobile application services' interaction with the physical environment and traditional service offering onboard.

Table 4.2 Location Service Design

Service Functionality	Traffic Indication	Routing, Map	Find Friends
Addressed Needs	Find People	Navigation	Find People
Service Touch Point	Restaurants & Bars And Entertainment	Cabin, Reception, Restaurants & Bars And Entertainment	Passengers
Service Features	Share My Location, Traffic Status, Traffic Prediction	Where I Am, Search Location, Show Me Route, Map of The Ship	Share Location to Friends, Find Friends
Collected Information	Passenger Location	Passenger Location	Passenger Location
Managerial Benefits	Possibility to Dilute Traffic	Possibility to Dilute Traffic	Possibility to Dilute Traffic
Applied Technology	NFC or RFID Tags	NFC or RFID Tags	NFC or RFID Tags
Limitation	Privacy Concerns	Privacy Concerns	Only Works When "Share Location" is On
Offline Usage	No	Only Map	No

Traffic Indication is for passengers to share their location by choice to specific groups, e.g. the cruise liner, the passengers they are travelling with and/or the other passengers. The flip side of the functionality is for passengers to view the current traffic status and traffic prediction for upcoming hours in order to make decision about joining or avoiding the crowd. Passengers shall have the option whether or not to share their location with the cruise liners and other passengers. Thus, the traffic information provided to passengers is not 100% accurate, but only an indication.

Routing and maps are to facilitate passengers to navigate around the ship, not only to find out where they are, but also how to get to where they want to go. Passengers will have to share their location with the cruise liner to find out where they are and get the updated route towards where they are going. However, they shall have the option to turn off the location share if they want to.

Find friends, as a functionality, is useful when passengers want to find the people that they are travelling with, especially when the people they are trying to reach are occupied and cannot pick up their calls. With this functionality passengers can simply locate the people they are trying to find. Functionality only works when the people passengers are trying to find choose to share their location with them.

Table 4.3 Front Stage Communication Service Design

Service Functionality	Inquiry	Call Cruise Friends/Family	Special Request	Find Friends
Addressed Needs	Communication	Communication	Communication, Have Good Service	Communication, Have Good Service
Service Touch Point	Reception	Passengers	Crew	Crew
Service Features	Ask Questions, Wake-Up Call Request, Language Aid	Contact List, Add Contact, Call History, Contact Group, Call Onboard, Call "Home"	Room Service, Personal Assistant, Language Aid	(Anonymous) Feedback to Staff/Manager, Feedback Lottery, Satisfaction Survey
Collected Information	FAQ	N/A	Passenger Request	Passenger Feedback
Managerial Benefits	Time Saving and Convenience	No Need to Install Cabin Phones	Timely Service And Possibility to Optimize Staff Allocation and Inventory	Performance Tracking and Improvement
Applied Technology	Wi-Fi	Wi-Fi	Wi-Fi	Wi-Fi
Limitation	Need Sufficient Reception Staff	Only Works With Wi-Fi	Only Works With Wi-Fi	Need Incentives for Feedback
Offline Usage	No	No	No	No

Inquiry is to facilitate the communication between reception desk and the passengers. This is not to replace the function of reception, but to act as a medium so that the communication between the two is improved. Not only passengers do not have to walk all the way to reception to conduct their inquiries, they can also have the inquiry in the language they are most comfortable with.

Calling cruise friends and outside world, as functionalities, are designated to cater to passenger needs to stay connected with one another, both passengers they are

travelling with and the people back home. They should be able to add contacts by their names if they meet some interesting passengers onboard and want to communicate with them during the voyage.

Special request is customized to cater to passengers' individual needs. Most frequent made requests shall be made into pre-determined choices for passengers to choose from. A voice/written note function shall also be available in case passengers want to make requests that are not included in the pre-made list. Passengers shall be able to not only make or choose the content of the request, but also request the time that certain service is delivered. Information collected about passenger request's content and delivery time can help the cruise liners to optimize staff allocation and inventory control.

Feedback functionality in mobile application is to replace and improve the traditional feedback system which collects satisfaction survey and comment forms from passengers at the end of voyage and have data analyzed by the company online and sent back to the ship after certain period of time. This functionality will provide a possibility to give real-time feedbacks so that passengers can have an impact on the service quality they are experiencing for the remaining of the journey. Anonymous feature shall be an option for passengers in case they do not want to reveal their identity. A lottery amongst feedback respondents can be offered as an incentive for participation. This functionality offers real-time monitor and possibility to improve the individual staff performance. The opportunity to improve the service quality during passenger journey can possibly improve the rating that passengers give at the end of journey. In addition, the digitalization of the process can also help the cruise liners with documenting the feedback and monitoring ratings on real-time basis. Real-time feedback might pressure for staff. However, a healthy amount of pressure might just be what staff members needed to maintain high level of service quality.

Table 4.4 Front Stage Information Service Design

Service Functionality	Menu	Show Schedule	SPA, Offers	Package, Destination	News, Weather
Addressed Needs	Access to Information				
Service Touch Point	Restaurants & Bars	Entertainment	Entertainment	Excursion	Non-Physical
Service Features	Menu, Ingredients, Pictures, Reviews	Sneak Peeps, Recommendation	Availability, Happy Hours	Package, Recommendation, History and Culture, Language Aid, Transportation	News in Different Languages, Hourly Weather Forecast
Collected Information	N/A	N/A	N/A	N/A	N/A
Managerial Benefits	Possibility To Improve Inventory	Save On Staff Provision For Inquiry	Push Notification To Drive Revenue	Save Staff For Inquiry, Drive Revenue	N/A
Applied Technology	Wi-Fi	Wi-Fi	Wi-Fi	Wi-Fi	Wi-Fi
Limitation	N/A	N/A	Partially Works With Wi-Fi	N/A	Only Works With Wi-Fi
Offline Usage	Yes	Yes	Only Offers	Yes	No

Menu function is to facilitate to help passengers to decide where to dine onboard. Pictures and reviews will help passengers to have more information to make their decisions. Cruise liners will provide passengers with information in advance so that they will make reservation in advance and cruise liners can base their inventory management based on information collected.

Show schedule is a functionality that cruise liners can recommend different shows to passengers based on information collected from them. Passengers can also view short clips of the shows to help make the decisions.

With the functionality SPA and offers, cruise liners can provide real-time information on availability of SPA and other treatment and pre-determined information on shopping/SPA/bar offers throughout the week. With the possibility to have push notification, passengers are more aware of the offers and availability of certain programs onboard and potentially cruise liners can benefits from increased sales from these items or programs.

With the functionality of package deals and destinations, characteristics and price of different package deals of the excursions shall be provided and recommendations shall be made based on the profile of the passengers. Background information about the destination shall also be provided for passengers to understand the history and cultural aspects of the destination. A list of short phrases in local language can help passengers to survive some basic circumstances. Transportation information can help passengers to travel between the harbor and the city center of destination.

Functionality of news provides passengers the option to stay connected with the world outside the ship and hourly weather forecast facilitates passengers with scheduling their activities. With the provision of news and weather forecast in the mobile application service offered by cruise liners, passengers do not need to resort to other source of information aside from the cruise mobile application.

Table 4.5 Front Stage Relaxation Service Design

Service Functionality	Email Block	Radio, Music
Addressed Needs	Relax	Relax
Service Touch Point	Non-Physical	Non-Physical
Service Features	Email Notification Block, Exception Group	Local Radio, Onboard Radio, Radio By Language, Radio By Category, Music By Language, Music By Category
Collected Information	N/A	Passenger Preferences
Managerial Benefits	Reduce Passenger Stress	Reduce Passenger Stress
Applied Technology	N/A	Wi-Fi
Limitation	N/A	N/A
Offline Usage	Yes	No

Email block provides passengers the possibility to escape from the constant responsibility and stress created by certain amount of email inflow of their usual life. An exception group of contacts can be created in case passengers want to only review emails from contacts they consider important. It can reduce level of stress that passengers feel and help them relaxing and enjoying the voyage in serenity.

Radio and music is provided to help passengers to relax through enjoying radio and music. Radio and music should be available in different languages and categories for cater to passengers with various backgrounds.

Table 4.6 Front Stage Safety Service Design

Service Functionality	Evacuation Plans	Safety Instructions
Addressed Needs	Feel Safe	Feel Safe
Service Touch Point	Cabin	Non-Physical
Service Features	Map to Emergency Exits, Location to Exit, Route	Instructions in Different Situations, Location and Route to Medical Department, Announcement of Safety Drill, Announcement of Wavy Sea Route, Ask Safety Officer
Collected Information	Location of Passengers In Emergency Cases	FAQ
Managerial Benefits	Facilitation in Emergency Cases	Increase Passenger Sense Of Security
Applied Technology	NFC And RFID Tags	Wi-Fi
Limitation	N/A	N/A
Offline Usage	No	Partially

Evacuation plan in the mobile application is designed to improve the communication about evacuation plan by the cruise liners. Instead of the physical map hung on the inside of every cabin door, passengers will have the map of all emergency exits on their app. In addition, they can use the location and route features to find out where they are and how to get out. Cruise liners will not only have informed the passengers better about how to exit in emergency cases, they will also be aware of passengers' location in case of emergency.

Safety instruction is designed to give passengers proper safety instruction in best fitting time to maintain and improve the safe feeling of passengers. Instructions to tackle different accidents that could happen onboard should be given in details to passengers via mobile phone, including and not limited to first aid, fire and food allergies. Location and route information about the medical department onboard

should be provided alongside. Announcement of safety drill can be sent to passengers of different arrival dates. In case of wavy sea route, announcement can be sent out to all passengers to ease the sense of worry. A comment and ask feature can help the communication between concerned passengers and safety officers. Cruise liners will understand their passengers better in terms of what they are concerned about over safety issues. In return, they can give tailored information to passengers to increase the sense of security.

Table 4.7 Front Stage Reservation Service Design

Service Functionality	**Tables, Seats, Spa, Trainer, Excursion, Transportation**
Addressed Needs	Communication
Service Touch Point	Restaurants & Bars, Entertainment, Excursion
Service Features	Availability, Booking, Seat/Staff Selection
Collected Information	Reservation Information
Managerial Benefits	Optimize Inventory and Staff Allocation
Applied Technology	Wi-Fi
Limitation	Disparity Between Reservation and Turnout
Offline Usage	No

Reservation is provided hand in hand with the information provision function. After passengers check the real-time availability of SPA/trainer/excursion, they can continue to reserve their spot in certain services. Based on the reservation information collected from the passengers, cruise liners can optimize the inventory level, manipulate onboard traffic and allocate the staff accordingly.

Table 4.8 Front Stage Finance Service Design

Service Functionality	Payment	Invoice
Addressed Needs	Have Good Service	Have Good Service
Service Touch Point	Restaurants & Bars	Reception
Service Features	Payment, Cabin Door Key, Digital Signature	Expenses, Currency Conversion, Daily Expense Summary
Collected Information	Passenger Expenses	N/A
Managerial Benefits	Convenience and All-In-One Solution	Environmental Friendliness
Applied Technology	NFC Chips	Wi-Fi
Limitation	Security Concerns	N/A
Offline Usage	No	No

Payment functionality is a way to provide passengers a way for identification in order to minimize the number of items that passengers need to carry onboard. With NFC technology, mobile phones can act as credit cards and room keys, which means the current in-use key cards can be replaced by mobile phones. Digital signature or other authentication methods should be in place for security reasons. Cruise liners would achieve compatibility and unification of all payment services onboard. In addition, with digital means to authenticate, the mobile phone payment is arguable safer than key card. Passengers might still have reservation about the security issues over payment service despite the provision of authentication.

Invoice as a functionality in mobile application will replace the paper version of expenditure summary at the reception. Passengers can view their daily and total expenditure on the mobile application. Passengers shall be able to view the expenditure in their own currency and language. Cruise liners can with this functionality reduce paper consumption and improve environmental awareness.

Table 4.9 Front Stage Pre-Cruise Service Design

Service Functionality	Cruise Offers	Booking Cruise	Check-In	Preference Indication
Addressed Needs	Access To Information	Have Good Service	Have Good Service	Have Good Service
Service Touch Point	Non-Physical	Non-Physical	Non-Physical	Non-Physical
Service Features	Special Offers, Recommended Trips, What Others Are Purchasing	Availability, Reservation, Payment	Frequent Cruiser No., ID, Barcode for Check-In, Harbor Traffic, Check-In Reminder	Allergies, Dislikes, Religious Diet, Vegetarian, Cabin Preference
Collected Information	N/A	Reservation	Passenger Id	Passenger Preference
Managerial Benefits	Drive Revenue	Inventory Optimization	Staff Reduction And Efficiency	Tailored Service
Applied Technology	Wi-Fi	Wi-Fi	Barcode or QR	Wi-Fi
Limitation	No	No	No	No
Offline Usage	No	No	No	No

Cruise offers can be divided into three categories. First are the standard special offers that cruise liners have. Second are the recommended trips for passengers based on their profiles. Last but not least, passengers can view what trips have other passengers purchased recently and get inspired. Via target advertising, cruise liners have possibility to achieve higher level of reservations.

Instead of booking their voyage via traditional travel agencies, passengers will have the possibility to book and pay for the cruise they want to go on via mobile application. By getting reservation and passenger information beforehand, cruise liners can tailor their service offerings and optimize inventory level and staff allocation.

Check-in is to simplify check-in procedure. Instead of filling in all the information on the computer, print and bring the documents to the harbor, passengers can fill necessary information on mobile and have the machine at the harbor read the barcode or QR code on the screen of their mobile phone to complete the check in process. In addition, passengers will have the option to monitor the real-time traffic status at the harbor and decide when is the best time for them to go to the harbor so that they do not have to wait for long. Cruise liners can reduce the staff required at the harbor and drastically improve the efficiency of check-in procedures at the harbors.

Passenger would have the option to send in their preferences beforehand so that cruise liners can prepare for tailored service offerings accordingly. Having the knowledge of passenger preference beforehand, cruise liners can be proactive and make operational decisions according to the data collected.

Table 4.10 Front Stage Post-Cruise Service Design

Service Functionality	Catch Up With Cruise Friends	Photo Sharing	Loyalty Program
Addressed Needs	Communication	Communication	Have Good Service
Service Touch Point	Passengers	Non-Physical	Non-Physical
Service Features	Voice Note, Picture, Text, Chat	View Photo From Cruise, Order Photo to Address	Loyal Member Offers, Frequent Cruiser Miles, Different Tracks Of Royalty Program
Collected Information	N/A	Photo Order	N/A
Managerial Benefits	Drive Revenue	Additional Revenue	Customer Loyalty
Applied Technology	Wi-Fi	Wi-Fi	Wi-Fi
Limitation	No	No	No
Offline Usage	No	No	No

Catching up with cruise friends is designed so that passengers can keep in touch with the other passengers that they made friends with after the cruise. This functionality can be integrated with predominant social media platforms. By offering passengers the opportunity to reminisce about their experience onboard, cruise liners can benefit form potential increase revenue when they return for more cruise trips.

Photo sharing provides passengers the opportunity to view and share photos from their experience onboard even after the cruise has ended. Passengers can order additional photos to specific addresses of their friends and relatives. Cruise liners will benefit from additional revenue generated by photo sharing.

Mobile application loyalty program works as a replacement of usual loyalty programs. Instead of getting periodical emails about the offer, passengers will have the possibility to check their membership status on real-time basis. Cruise liners can create and offer better service to a loyal group of repeat cruise passengers.

With a range of mobile application services covering solutions such as location, communication, information, relaxation, safety, reservation, finance and pre-/post cruise services, cruise liners can offer passengers a overall well-rounded experience in the digital environment. At the same time, based on information collected from passengers, cruise liners can improve their service offerings in the traditional physical environment.

As the above-mentioned services constitute the front stage service, a portfolio of back stage services is designed for cruise liner staff members to use the information collected from the passengers to improve their own performance.

4.2.2   Back Stage Service Design

Back stage services, much like the front stage services, can be divided into three levels: solutions, functionalities and features. Every solution is either corresponding to operational areas that either facilitate front stage services or translate information collected into performance. Table 4.2 shows the back stage service solutions and functionalities.

Table 4.11 Back Stage Service Design

Information Update	Traffic Control	Inventory Control	Communication	Performance KPI
Menus of the Day	Traffic Map	Reservation Level	Cabin Cleaning	Individual Performance
Offers of the Day	Dilute Traffic	Inventory Level	Language aid	Venue Performance
About Next Destination	Allocate Staff	Anticipated Traffic	Reception	Statistics
Bad Weather/Wave Alert		Inventory Adjustment	Feedback	Improvement
Dress code for the day				
Target Announcement				

Information update as a service solution is designed to keep information passengers received through mobile application updated and relevant to what cruise liners have in store for the passengers. Traffic control and communication are the service solutions where cruise liners can improve overall passenger experience through interaction with the passengers themselves. Inventory control and performance KPI are the service solutions where cruise liners can improve their performance through the information collected from passengers.

Table 4.12 Back Stage Information Service Design

Service Functionality	**Menus of the Day, Offers of the Day, About Next Destination, Bad Weather/Wave Alert, Dress Code for the Day, Target Announcement**
Front Stage Service Connection	Information -> Menu, Offers, Destination info, Weather
Service Features	Food/Restaurant Recommendation by Profile, Offers by Profile, Offers by Time, Transportation Information about Next Destination, Background Information and Site Seeing Recommendations for Next Destination, Weather Forecast, Back Weather Alert, Safe Drill Announcement by Arriving Dates
Base Information	N/A
Service Impact	Facilitating Passengers with Decision-Making

With information update, cruise liner staff members have the responsibility to keep the information the passengers receive up to date, ranging from onboard activities to destination information. Majority of the information can be prerecorded according to the cruise schedule. Staff can send updates to passengers in case the information that needs to be updated is not prerecorded. Having updated information, passengers will be informed properly in a timely manner without having to go through the trouble of asking staff or going to reception. Having the information at hand, the passengers can make decision about their schedules with ease.

Table 4.13 Back Stage Traffic Service Design

Service Functionality	Traffic Map	Dilute Traffic	Allocate Staff
Front Stage Service Connection	Location -> Traffic Indication	Information -> Offers, Location -> Traffic Indication	Location -> Traffic Indication, Communication -> Special Request
Service Features	Traffic Map by Passenger Profile, Traffic vs. Venue Capacity	Dilute Traffic by Offers, Dilute Traffic by Notifications	Transfer Staff Based on Current Traffic, Allocate Staff Based on Special Request
Base Information	Passenger Location	Passenger Location	Passenger Location
Service Impact	Overall Knowledge of Onboard Traffic and Base for Preparation	Improved Onboard Ambient	Appropriate Passenger-Staff Ratio

Traffic map is configured when passengers agree to share their onboard location to the cruise liners. Cruise liners will have aggregated information of all onboard passengers that give their consensus. Staff can view the traffic by passenger profile or compare the traffic status with the venue capacity. Based on the traffic by passenger profile and traffic comparison with venue capacity, staff members can dilute the traffic or make staff arrangement based on the traffic status.

Based on the traffic map made from the location information collected, cruise liner staff can make operational decisions on whether or not to dilute traffic on crowded venues onboard. They also have the possibility to dilute the traffic either by sending passengers with specific profiles with special offers or sending push notifications to passengers and alert them about busy venues onboard. Through diluting traffic onboard, cruise liners can create a more comfortable environment onboard where passengers do not have to wait for their meals or other services as waiting has been identified as one of the most important factors that are affect passenger experience in a negative way.

Every venue has certain amount of staff during specific hours onboard. When certain venues are short of staff due to heavy traffic, this back stage service allows staff members to be transferred from free venues to busy venues. Staff can also be relocated based on the special request of passengers in circumstances like room service, language aid. With the possibility of allocating staff, cruise liners can make sure that each passengers are properly served with sufficient amount of staff and best service quality possible.

Table 4.14 Back Stage Inventory Service Design

Service Functionality	Reservation Level, Inventory Level, Anticipated Traffic, Inventory Adjustment
Front Stage Service Connection	Reservation -> Tables, Excursion, Transportation
Service Features	Reservation vs. Inventory, Calculate Anticipated Traffic Based on Reservation Level, Adjust Inventory
Base Information	Passenger Location and Reservations
Service Impact	Optimized Inventory Level and Minimized Inventory Cost

With the reservation level of the restaurants, incorporated with the reservation level of excursion and transportation to destination which will dilute traffic at the onboard restaurants, cruise liner can adjust the inventory level accordingly. With the possibility to adjust inventory level based on reservation information, cruise liners will be able to save expenses because minimum amount of resources will be wasted.

Table 4.15 Back Stage Communication Service Design

Service Functionality	Cabin Cleaning	Language aid	Reception	Feedback
Front Stage Service Connection	Location -> Traffic Indication, Communication -> Special Request	Communication -> Inquiry, Special Request	Communication -> Inquiry	Communication -> Feedback
Service Features	Cabin Cleaning By Request, Routine Cleaning While Passengers Are Absent	Matching Staff Language Skills With Passenger Nationalities, One Click with Language Aid	One Click to Reception	Passenger Feedback, Feedback Resolution Checklist
Base Information	Passenger Location	Passenger ID	N/A	Passenger Feedback
Service Impact	Minimum Interruption	Improved Onboard Ambient	Convenience	Improved Service Quality

With the location service available, hotel department staff can arrange the schedule of routing cleaning while the passengers are not in the cabin. In addition, the cabin can be cleaned upon request. This service functionality will allow cruise liner to be able to clean cabins without interrupting passengers' routine.

Language aid is utterly important for cruise trips because both passengers and staff members come from all over the world. Even though nowadays a lot of staff members are well equipped with language skills, it is not possible for staff members to speak all the languages that passengers speak. Thus having passenger and staff members matched based on language skills can help with communication. When passengers encounter the staff members that do not have the language skills to help them, reception staff with all language skills is prepared to help. This service functionality is to facilitate the communication between staff members and passengers. Passengers

perceive same service better if it is served with their own native languages.

One click to reception will allow passengers to communicate with reception and make inquiries without having to physically go to reception. This functionality is to improve passenger experience by saving them the unnecessary trouble and lowering the barrier to communicate.

Feedback is functionality designed to improve service quality on real-time basis based on passengers' opinion. Staff will collect feedbacks from passengers, resolve the problems immediately and check them off the checklist. Having feedbacks resolved on real-time basis will give passengers the sense that they themselves have an impact on their own journey. On the operational side, because cruise liners will improve service quality instantly, their ratings will improve accordingly.

Table 4.16 Back Stage Performance Service Design

Service Functionality	Individual Performance, Venue Performance	Statistics, Improvement
Front Stage Service Connection	Communication -> Feedback, Location -> Traffic Indication	Communication -> Feedback
Service Features	Individual Performance By Feedback, Venue Performance By Traffic	Traffic Light System, Improvement Checklist
Base Information	Passenger Feedback, Traffic	Passenger Feedback
Service Impact	Performance Tracking	Performance Enhancement

Cruise liners can track individual staff performance by passenger feedback and venue performance by both feedback and traffic status. Being able to track the performance of both individuals and venues, cruise liners can identify the peaks and pits in their service touch points and improve their service quality accordingly.

Cruise liners can use a traffic light system based on statistics of rating and feedbacks,

and track the improvement they have made along the way. Statistics give a long-term observation on the performance of individual, venue and overall performance.

4.2.3   Integrated Service System

The service designed for the mobile application should be an integrated system, incorporating both front stage and back stage services. Figure 4.3 illustrates the information flow between front stage and back stage services and the information flow within front or back stage service portfolios.
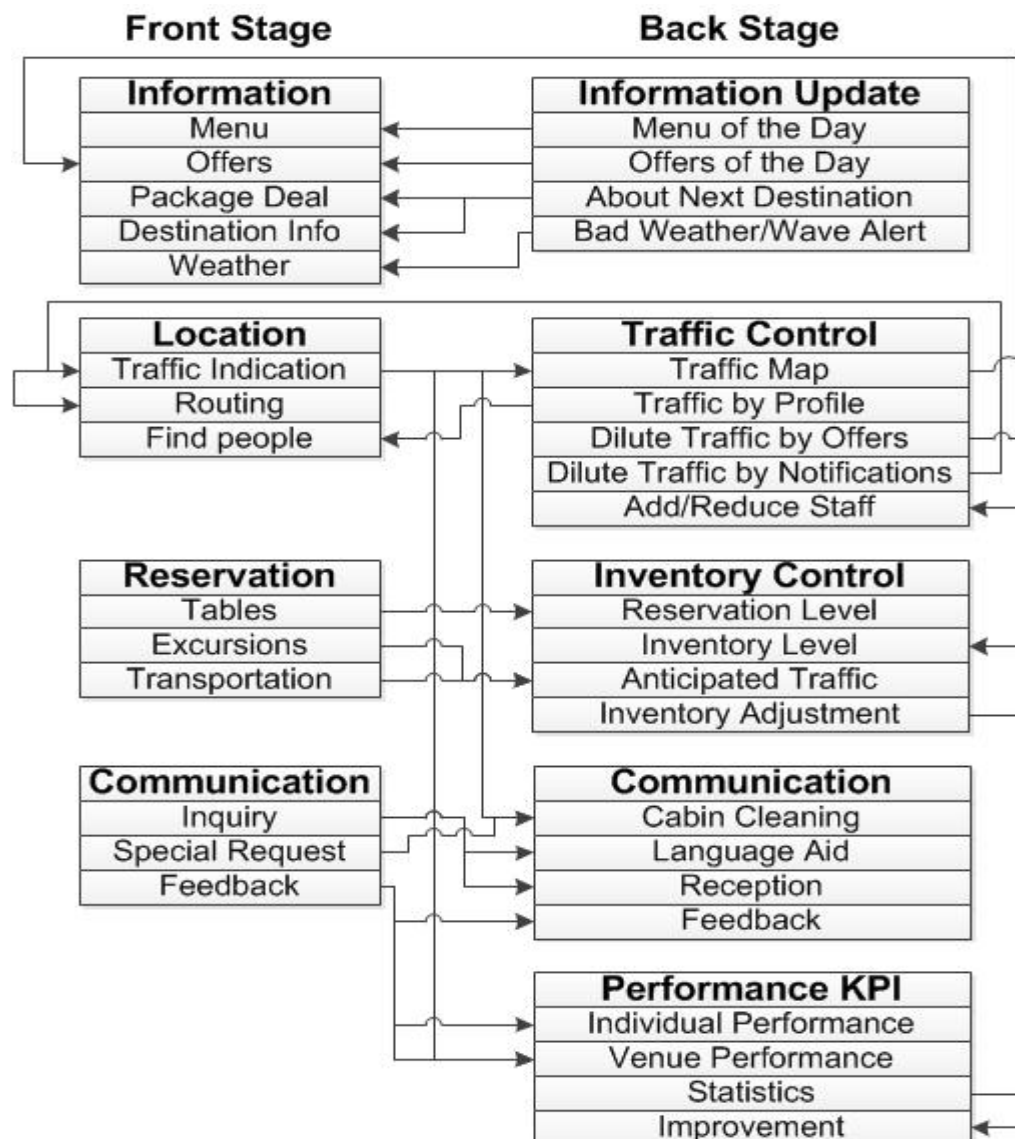
Figure 4.3 Information Flow between Front Stage and Back Stage Services

As shown in Figure 4.3, information flows both between corresponding service solutions (location and traffic control) and beyond the boundary of solutions (communication and performance KPI). It is the essence of the service system that information flows both ways. Passenger side front stage service relies the information update supported by back stage service. In return, cruise liner side back stage service makes operational decisions based on information collected from front stage service.

4.3 Validation of Results

A validation workshop was organized in Turku University of Applied Science. There were 89 participants of the workshop, each was handed a clicker to show their opinion on the usefulness of the services and concerns for security. The workshop used actors performing 10 different scenarios (see Appendix E) incorporating service design results while the screen shows pictures indicating cruise environment of different scenarios. Only 10 scenarios were planned for the session due to time constraint. 10 services were integrated into the scenarios. The participants use the clicker to indicate their agreement on the scale of 1 to 7 to the statement projected on the screen. The statements were:

- I think this service will improve my experience onboard.
- I think this service is useful.
- I have concerns about the security issues of this service.
- I will use this service.

These statements were used to indicate the ability to improve current service offerings, the usefulness, the security concerns and the popularity of the services. The aggregated results were instantly shown on the screen after the answers were collected (The Appendix F). At the end of 10 scenarios, an open discussion was carried out based on the results. After the workshop, the results were statistically processed and figure 4.4 shows the outcome.
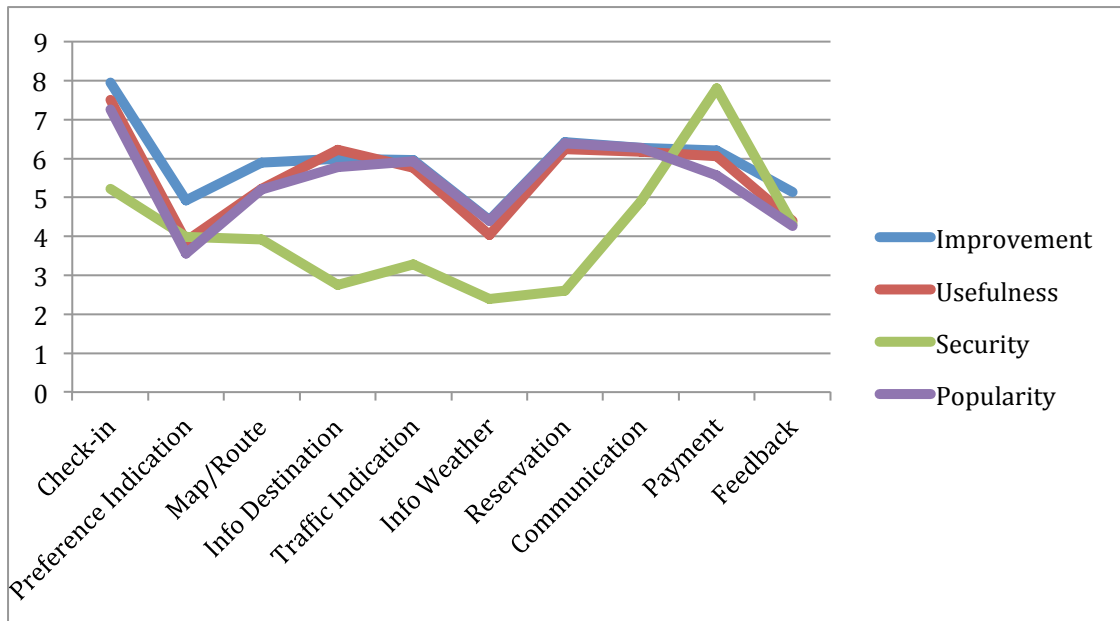
Figure 4.4 Service Design Validation Result

The data was processed so that the agreement of the improvement, usability, security concern and popularity are presented on the scale of 1-10 in figure 4.4. In order to achieve such result, the statistical data was aggregated and normalized. As improvement, usefulness and popularity are positive attributes for a service and concern for security is negative attribute, the high the score is for improvement, usefulness and popularity the better and the situation is reverse for security concern. As shown in figure 4.4, improvement, usefulness and popularity are to a great extent correlated in all the services. Validation workshop participants rated check-in service particularly high in all three aspects. The reason is possibily that they are the generation growing up with digital devices and they appreciate convenience of checking in with mobile phone. On the other hand, they did not rate preference request and weather forecast high, because they presumed the passengers would have to repeat their preference to the staff on spot thus there is no need to indicate before hand and weather can be easily observable. In the discussion part of the workshop, the offering of mobile application and Wi-Fi and their delicate competitive relationship was also brought to light. Participants assumed that with the availability of Internet,

such service like weather forecast could be possibly achieved without the mobile application. However, they also agreed that if all the necessary information and services they needed onboard was provided through the mobile application, they did not need to look for separate source of information elsewhere.

Regarding security, the participants did not have privacy concerns over the location service, which was opposite to current assumption that cruise liners hold. In accordance with the interview conducted with cruise industry representatives, they assume that passengers do not like to disclose their locations to cruise liners or other passengers. On the contrary, the participants of validation workshop did not seem to mind about disclosing their location onboard if that would enable them to take advantage of the convenience that location service offers. However, as anticipated, workshop participants showed great concerns over the security issue related to using mobile as payment tool. In the discussion part of the workshop, the participants agreed that adding additional digital signature would mitigate such concerns. The participants also agreed that they will be willing to carry the phone with them at all times, if it enables them to access to all the services.

5 DISCUSSION

This chapter is addressing the benefits and challenges of mobile application services in cruise industries, as well as its managerial implications. Benefits for both passengers and cruise liners are concluded from interviews and literatures. Challenges of the mobile applications are drawn from the current status of the technology, expert interviews and industrial future trends. Managerial implications are included in this chapter to provide cruise liners ideas on what to take into consideration when implementing the solution.

5.1 Benefits of Mobile Application Services

Providing services in form of mobile applications can provide both passengers and cruise liners advantages that traditional service offerings are not able to achieve. The addition of a virtual environment in which passengers can access to onboard services and cruise liners can collect information on real-time basis is create a win-win situation for both parties.

5.1.1 Benefits for Passengers

Benefits for passengers are self-evident in this study as the service design is conducted to address passenger needs. Here some additional benefits aside from satisfied needs and improved experience are elaborated.

Timely Convenience

Because the cruise liners are able to collect the information about their needs and from passengers on real-time basis, passengers will have timely services without having to actively go out their daily routine to ask for them, e.g. going to reception or seek out staff.

All-in-One Solution

With the provision of mobile application services, passengers have an all-in-one solution in their pockets. Instead of having to go to different sources on and off board to seek information and services, passengers can have access to a full range of service and information provision just by consulting their mobile phones.

Possibility to Socialize

Traditionally, passengers go on cruises with their families and friends and stay within

their circle while onboard. The mobile application provides additional channel to communicate and possibility to seek out and socialize with other passengers.

Journey Extended

Mobile application stretches the experience of cruising beyond the onboard life. Passengers can express their preferences for their journey beforehand, and relive the good memories onboard by reviewing and sharing their cruise pictures or catching up with their cruise friends via communication channel provided by the mobile application.

5.1.2   Benefits for Cruise Liners

In addition to providing passengers with better and timely services and thus improving their experience, being able to make operational decisions based on information collected from passengers, cruise liners can also benefit from mobile application services from performance's perspective. The benefits are mostly operational, including driving revenue, tracking performance, manipulating traffic and optimizing inventory and facilitating communication. Because passenger experience is improve while their needs are satisfied, there are also CRM benefits including building a strong base for repeat passengers and establishing continuous relationship with loyal passengers.

Drive Revenue	Track Performance	Manipulate Traffic	Optimize Inventory	Facilitate Communication
Push Notification	Instant Feedback	Cabin Cleaning	Preference Request	One-button Dial to Reception
Mobile Booking	Traffic Indication	Rush Hour Control	Mobile Reservation	Language Aid
Target Advertisement				

Figure 5.1 Benefits for Cruise Liners

Driving Revenue

With the mobile application, cruise liners can send push notifications to passengers and be proactive in reminding passengers about offers. Moreover, these push notifications can be sent out based on passenger profiles, which means cruise liners have the possibility to target their promotions on specific passengers. Additional sales channel of mobile booking can also boost the revenue stream of cruise liners.

Track Performance

Through real-time data collection, cruise liners can achieve real-time performance tracking on both individual and venue level in addition to their traditional end-of-cruise survey. Individual performance can be tracked via instant feedback function of the mobile application and venue performance can be tracked via real-time traffic monitoring.

Manipulate Traffic

With the possibility of observing traffic on real-time basis, cruise liners can organize the staff activities based on traffic situation. For instance, cabin cleaning can be conducted while the passenger is away and staff can be added and reduced at certain venues based on the traffic. Cruise liners can also dilute the traffic with special offers when there are rush hours in certain venues.

Optimize Inventory

With information collected from preference indication and reservations via mobile application, cruise liners can optimize inventory level based on anticipated traffic at the restaurants.

Facilitate Communication

With the one-button dial to reception and language aid features available, cruise liners can facilitate communication between passengers and staff. Thus, passengers can better express their needs and desires and staff can better adjusting their services to the passengers.

Essentially, cruise liners will be able to cater to passenger needs, build loyalty in repeat passengers and continue building relationship with passengers on and off board.

5.2 Challenges of Mobile Application Services

First challenge of the mobile application solution is that it will work best with network connection. When offline, mobile application can only offer basic features as was illustrated in section 4.2.1. With only basic features available, the usability of the mobile application is diminished.

The solution is designed to work on smartphone platforms at this stage. Certain sunk cost may occur for purchasing smartphones and lease those to passengers who do not have smartphones. Depending on the size of the smartphone, it might not be as convenient as key cards. If passengers are going to the pool area and their smartphones are not waterproof, it might be a problem.

The acceptance of smartphones might experience some difficulties in the beginning of introduction, because today's target segment of cruise liners is still senior demographics and they in general have lower level of technology acceptance.

5.3 Managerial Implication

Communication channel cannot replace human interaction.

Mobile application is to provide facilitation for communication between passengers and staff members. It is by no means the replacement for human interactions onboard. For instance, the one-button dial to reception function is to build a digital bridge between passengers and reception instead of replacing the physical reception.

Mobile application allows some cruise liners to skip a technology stage.

Different cruise liners are at different technology stage concerning the modern tools onboard. Mobile application will provide the possibility for some lagging cruise liners skip certain technology stage and catch up in the race of modernization of onboard tools.

Pricing strategy needs to be considered carefully.

This solution is an addition to the current services offerings in the physical environment. Price sensitivity of passengers towards this new solution is yet to be determined. Based on the benchmarking results of adjacent industries, cruise liners can consider offering the mobile application for free and lease the smartphones to passengers who do have those for a fee. The alternative pricing strategy is segmentation, that is to say, offering basic features for free and premium features for a fee.

Senior demographics are essential for acceptance.

Senior demographics usually have lower level of technology acceptance and it happens to be cruise liners' target segment. How to encourage the usage amongst this age group will be the key of successful implementation of mobile application

services.

Lessen the security concern is important for implementation.

As passengers have security concerns over payment services, cruise liners need to take measures to minimize such concern in order to secure smooth implementation of the mobile application. In order to diminish security concern, cruise liners need to strengthen authentication, especially multi-factor authentication, including something user knows, has, or is. As the smartphone is in user's procession, something that user knows, like password, or user is, like fingerprint can add layers of security measure.

Mobile applications can be adapted to new platforms.

Currently the novel platforms such as Google glass and smart watches are yet to be proven in terms of acceptance and usability. As they have certain advantage on portability over smartphone, mobile applications can be later adapted to new platforms if they have proof of concept.

6   CONCLUSION

As "Reality Mining" being identified as one of the 10 emerging technologies in near future (Pentland, 2008), many service industries are developing their own applications to add an additional channel to serve their customers and collect information from them. This study explores the possibility of using mobile applications to provide services and benefit both passengers and cruise liners. The study was successfully conducted following the guideline of design thinking, incorporating user needs, business viability and technical feasibility. The validation of service design was successful with a novel validation method incorporating acting and voting. The method used in validation workshop was elaborated in a conference paper, which the researcher co-wrote, titled "Acting out service scenarios – a method for testing new

service concepts" presented in Istanbul, Turkey in June 2013. There were also aspects that the researcher wishes that were better. For instance, only seven personal interviews were conducted with passengers onboard of MSC Sinfonia given the constraint of time and language barriers. As the majority of passengers onboard were Italian, finding passengers for conducting interview in English was particularly difficult. Furthermore, as the focus of the research was shifted during observation trip, a great deal of previous preparation was not useful in light of the new research topic. As the researcher collaborated with two other Master thesis workers in Cruise and Ferry Experience Program, the topics were not closely related. As much moral and intellectual support that triad mates were able to give one another, spill over effect of the joint effort was limited.

6.1 Significance of the Study

As mobile applications account for a new phenomenon, not many academic studies are available directly targeting at the mobile applications. While most studies regarding mobile applications, targeting at pricing (Gans, 2012) and usability characteristics regarding hardware (Parsons & Ryu, 2006; Ciurea & Pocatilu, 2008; Garofalakis et al., 2007; and Rabi'u et al., 2012), only Pentland (2008) researched the possibility of collecting data through mobile phones to predict human behavior. This research will contribute to adding academic research of mobile applications in the area of service design and translating collected information into performance. For cruise industry, this research will offer a complete spectrum of services that can be offered via mobile applications before, during and after the cruise. Cruise liners can pick and choose different elements from the spectrum based on their positions in the market, and target segment and market. In addition, the study gives cruise liners insights on how to improve passenger experience by offer services that are designated to meet passenger needs. Moreover, the study introduces the concept of data-driven decision-making, opens up the possibility of improving cruise liners' operational

performance based on information collected from passengers on real-time basis. Furthermore, as passenger needs are to a great extent similar, ferry operators can possibly utilize the result of this study too.

6.2 Limitation of the study

There are however some limitations to the study. First limitation is that some data from need finding, namely mood map, was collected onboard of Baltic ferry instead of actual cruise. The reason was constraint on time and budget and the normal duration of a cruise will make mood maps to tiresome to make and lengthy to analyze. The downfall of having part of need finding on ferry is that ferries still differ from actual cruises even though the two share some similarities. As both of them are vassals sailing on the sea and passengers are located in a closed environment, cruises have a much longer duration (four days to a few weeks) than ferries (a few hours to overnight). In addition, ferries sail in between two ports where cruises go around in many different ports. Second, the validation of the results was not conducted with actual cruise passengers, instead in a workshop using simulation. There are merits of simulation that is presenting scenarios using actors in terms of evoking enthusiasm and being relatable. However, average age of a cruise passenger is 50+ and the participants of this workshop, with the average age of 20+, do not fall in that category. They have a higher technology acceptance and can become the typical target segment for cruise liners in 10-20 years. The result of validation can be possibly skewed towards the opinion of younger males. Third limitation is that the research works with the assumption that issues like good Wi-Fi connection will be solved onboard of cruise ships in the near future, which is a common believe and trend of the industry. However, there is no confirmed timeline with its realization and the usability of mobile application services will be impaired to a great extent without Wi-Fi connection. Last but not least, while incorporating technical feasibility and user

desirability, this study does not deal with problems with technological specifications and aesthetic design of user interface.

6.3 Possible Directions for Future Research

There are a few possible directions for future research that can be inferred from this study. First is the pricing for mobile application services onboard of cruise ships. The price sensitivity of passengers regarding mobile application services is yet to be determined. In addition, this study suggests immediate adjustment in service offerings and operational decisions to improve passenger experience and firm performance based on information collected. The relationship between information collected and long-term strategy, operational adjustment is yet to be determined. For instance, with location service, cruise liners are able to draw up the travel routes of a single passenger's entire journey onboard. How to incorporate that information into ship design and optimize travel routes and "people flow" can be one of the research areas in the future.

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APPENDIX A PASSENGER INTERVIEW QUESTIONS AND INTERVIEWEE PROFILES

Interview Questions:

1. What is your name?

2. What is your nationality?

3. How old are you?

4. Who are you traveling with?

5. Is it your first time on a cruise? If no, where have you been on a cruise before? With which cruise liner?

6. Which of these service attributes do you think are more important, and why?

   -Information and communication

   -Excursion

   -Entertainment

   -Food and beverage

   -Ship itself

   -Cleanness and comfort

   -Safety and security

   -Stuff Members

   -Supporting services (reservation and check-in)

7. Are there any attributes missing that you think are important?

8. How has your onboard experience been so far regarding these attributes?

9. How does this experience compared to your previous cruise/other travel experience?

10. Have you had any inconvenience/difficulties/troubles onboard?

11. If you can change something regarding the service onboard, what would it be?

12. How would you feel if you could give real-time feedback to staff and have them prove service quality on real-time basis?

Passenger Profiles

Passenger	Passenger A	Passenger B	Passenger C	Passenger D	Passenger E	Passenger F	Passenger G
Age	22	22	54	59	48	32	58
Nationality	German	German	Australian	Australian	German	South African	USA
Gender	M	F	F	M	F	M	F
Travelling with	couple	couple	couple	couple	friends	alone	friends
First Timer or Repeat Passenger	First Timer	First Timer	Repeat Passenger	Repeat Passenger	First Timer	First Timer	Repeat Passenger

APPENDIX B MOOD MAPS

Pauli's Mood Map

Mood map boxes (left to right):
- Not sure if I'm at a truckstop or a ship terminal.
- Definitely a ship terminal and quite a busy one as well
- Standing around doing nothing at the noisy waiting area
- Finally it's boarding time. It can only get better from here.
- Onboard the ship, let's navigate through the crowd and find the cabin.
- After the initial hassle it's nice to sit down in a comfortable chair in a quiet conference room.
- Events
- Scenery of the day: water and more water. No sunshine in sight, only cloudy skies.
- Time for some food, excellent
- Although the salad buffet didn't have much variety, it was quite tasty
- The dessert was delicious!
- What do you get when you combine a zebra and a leopard? This dreadful couch
- About to set foot on Estonia, number of countries visited just increased by 33 %.
- Exiting the harbor and heading towards the museum. Although it's overcast, it's quite bright and not raining.

Graph values: 6, 4, 2, 4, 6, 8, 6, 8, 8, 10, 6, 8, 8 (x-axis 1–13)

Ingrit's Mood Map

Events

- Arriving to the terminal, lot's of people, looks like it's going take a while. feeling: neutral to bored
- 2nd floor, queue to get trough the gates to the waiting hall. Electronic check of the boarding passes. feeling: neutral to bored
- In the waiting hall, last step before getting to the ship, feeling neutral or bored.
- Meeting room on conference area of the ship, now something is starting. Feeling: better and a bit excited
- Waiting for the lunch with a drink in the conference area lobby. Feelings are quite relaxed.
- Arrival to Tallinn harbor. The weather is grey. Waiting everybody to get out. Feeling: neutral to boring.

Graph values: 3, 5, 3, 7, 8, 5 (x-axis 1–6)

Elisa's Mood Map Part 1

negative		neutral		Positive	
1	2	3	4	5	
		●			enter port
	●				browse crowd for ticket line
		●			locate and go to travel group
			●		locate and go greet friends
		●			chat and look around while waiting
	●				tired
				●	see a funny thing, take picture for sharing
			●		receive ticket to enter ship
		●			check ticket info
		●			upstairs to gate
	●				see long line
			●		find short line
			●		see a nice travel group
		●			locate friends and wait
	●				tired and hungry
●					only bad and expensive catering
	●				headache
●					crowd, noise and smells
			●		gate opens
		●			lining up, grateful for practical shoes and no bag
				●	entering a neat, high, ventilated area
			●		slowly making way upwards
			●		entering ship
			●		check map for conference and cabin
	●				try to find cabin while loosing sight of others
		●			decide what to leave or take in cabin
				●	to conference center, passing big window
			●		take glass of water
			●		finally line up with others for tea and fruit
			●		meeting begins
		●			listen in silence
	●				drinks are announced, meeting ends
	●				linger in meeting room to chat
	●				find friend
			●		forgo drink for coffee
			●		find group to sit down with
			●		discuss and chat
			●		lunch is announced
			●		skim over what's there
		●			reserve a seat
		●			locate restroom
		●			back to cantine for lunch
			●		gather lunch
			●		relax, eat and discuss
		●			check remaining time until arrival
	●				suggest a walk on deck
		●			decide on whether to get jackets
		●			locate sundeck
			●		walk outside
		●			see that the ships is almos in harbor
				●	back inside to escape wind
			●		down to cabin to fetch jacket
			●		locate friends to go ashore
			●		check meet-up time with friend
		●			line up with group to get outside
		●			wait in silence
		●			doors are opened
			●		follow line of people to port
		●			step outside
	●				locate travel group and wait next to traffic

Elisa's Mood Map Part 2

5   *light, happy, friends, company, interest, curiosity, food, water, caffeine, nice designs, fun*

4   *practicality, anticipation, fresh air*

3   *'base' feeling*

2   *ugly, noisy, smells, cold, shame, bad design*
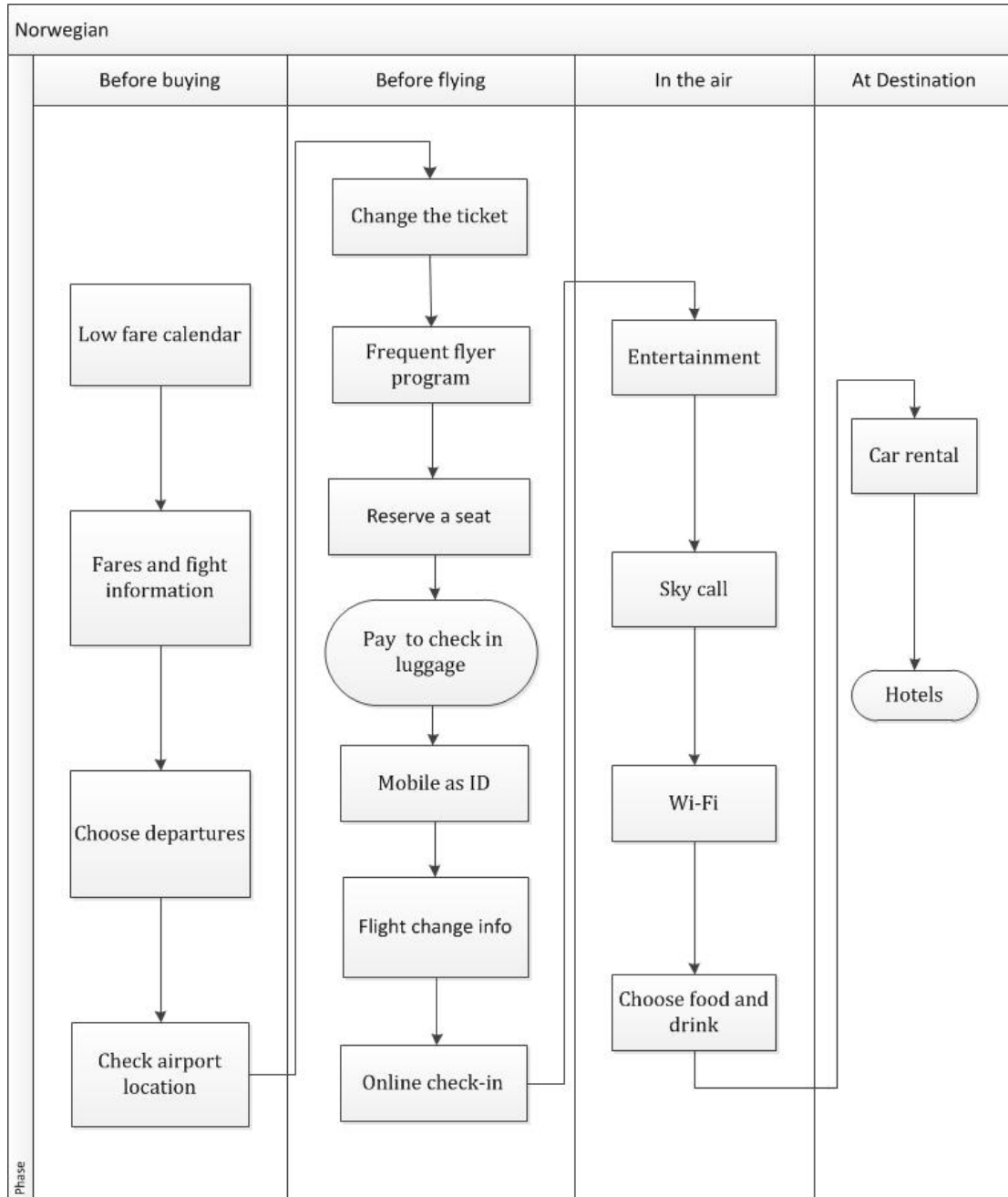
APPENDIX C EXPERT INTERVIEWS AND WORKSHOP

Expert Interviews

Interviewee	Title	Company	Interview Location	Formation
Juho Rokka	Senior Superintendent	Royal Caribbean Cruises	Turku, Finland	One-On-One Interview
Lan Le	Project Coordinator	Kaleidoskooppi	Turku, Finland	One-On-One Interview
Msc Officer	Crew Member	Msc	Onboard Of Msc Sinfonia	Group Interview

Workshop

Participant	Organization	Background	Workshop Location
Prof. Pentti Kujala	Aalto University	Academic	Espoo, Finland
Prof. Markku Tinnilä	Aalto University	Academic	
4 Industrial Experts	STX Finland, Arctec, Helsinki Shipyard	Industry	

APPENDIX D SERVICE FLOWCHART OF NORWEGIAN

Norwegian

Before buying	Before flying	In the air	At Destination

- Low fare calendar
- Fares and fight information
- Choose departures
- Check airport location

- Change the ticket
- Frequent flyer program
- Reserve a seat
- Pay to check in luggage
- Mobile as ID
- Flight change info
- Online check-in

- Entertainment
- Sky call
- Wi-Fi
- Choose food and drink

- Car rental
- Hotels

Phase

APPENDIX E 10 SERVICE SCENARIOS

1.   Check-in via mobile

Getting all the reminders for check-in and preparation procedures for cruise via email. Several emails come in for different purposes. Passenger A has to print out the documents and bring them to the port.

Mobile app solution: online check-in via mobile app. Passenger A comes to the port carrying only smart phone and luggage. Machine wipes the bar code from Smart phone, check-in done!

2.   Preferences and special request beforehand

Passenger A has food allergies and his wife passenger B want fresh flowers every morning in the cabin. A was able to get on the computer and write down all the special requests they have.

Mobile app solution: B comes with smart phone, all common food allergies are available on the drop-down menu and the special request for cabin decoration and mobility issues are also available on drop-down menu on the mobile apps. Two clicks, requests done!

3.   First day onboard, lost, location and routing service

They just got onboard and got settled in their room. It is A's first cruise and he is really excited. As soon as he settled in, A instantly suggested that they go to explore the cruise ship. But the cruise is so big that it didn't take long for them to get lost. Passenger A started to look for maps on the wall and tried to figure out how to get back to their cabin.

Mobile app solution: B took out the smart phone and put in their cabin number, a route appeared on the screen of the smart phone, and they could follow the route to go back to the cabin.

4.   Information package for destinations

Excursions were booked, Passenger A is really excited, and suggested that they go to the library or internet to find some travel guide for the destinations they are going to, so they can enjoy the visits thoroughly.

Mobile app solution: B showed A that in the mobile app, there were detailed historical and cultural description of the destinations that they are going to visit. It is like a mini travel guide, also included Dos and Don'ts and simple language instructions.

5. Traffic indication onboard

It is about time for lunch, they went to the buffet place and it was so crowded. B suggested they go to another restaurant onboard, but A insisted on the buffet because he likes the food here.

Mobile app solution: B remembered onboard traffic indication feature on the mobile app and suggested that they go for a martini in the bar and check the status of traffic in the buffet from time to time, when the people flow is less in the buffet, they can come back here.

6. Sunbathing, weather forecast, arrange schedule

Passenger A was going up to sundeck in the afternoon. But he wasn't sure if the weather is going to change soon. He is contemplating whether or not he should go up.

Mobile app solution: B take out the smart phone, on the app, there is hourly weather forecast, "It is going to start raining in 2 hours" A, "two hours is good enough for me." A continues, "If it has the weather, does it have world news? Because not keeping up with what is happening out there is making me uneasy" B, "of course it does, you can read it when you are sunbathing."

7. In mood of shopping/relaxation, find special offers onboard

While A was gone sunbathing, B got a bit bored, but she wasn't sure if she wanted to go shopping or go to the SPA. She wanted to check out the different offers, people in the selling street shoving paper posters of special offers in her hand terrifies her.

Mobile app solution: B decided to check the app, maybe there is some useful information. And she found a special offer, just for today in the SPA, she decided to go there and she was able to make the booking on the app as well for the SPA.

8. Cannot find your family member at dinner time, communicate!

Passenger A wanted to go for a smoke while B wanted to do some shopping. They decided to separate for a while and meet up for dinner at 6:00pm at the restaurant. At 6 pm, A was at the entrance of the restaurant, and B wasn't there. A tried to call the

cabin using the landline next to the elevator, but B wasn't in the cabin neither. A was frustrated.

Mobile app solution: All of a sudden, A remembered B installed mobile app for cruise for him, he thought he would check it out. Then he saw an item in the left-hand menu➔ communicate with onboard family and friends. When B installed app for him, she already logged him in using their booking number. And people who have the same booking number login will appear under the communication list for onboard family and friends automatically. He called her using the app, she was late because she was too happy shopping, forgot about the time. Not only the communicating with family and friends are available, A found in the app that you can also look for people onboard with the same interest (wall climing, ice skating, bingo) and communicate with them, arrange same times to go the activity and previous experiences.

9.   Payment with NFC

The couple ordered one bottle of wine, after dinner passenger A was able to pay with cabin key card.

Mobile app solution: B wiped the smart phone over the sensor area of the machine and the receipt came out. A was amazed, "I didn't know phone can do that." B smiled, "This is called Near Field Communication, we can also use the phone to open the cabin door" A, "Oh, then cabin key card is not necessary anymore." B, "not only that" she pulled up E-invoice in the mobile app, and everything they spent so far on the cruise was clearly listed in app. A, "it is nice, so we can keep track of what we spend all the time."

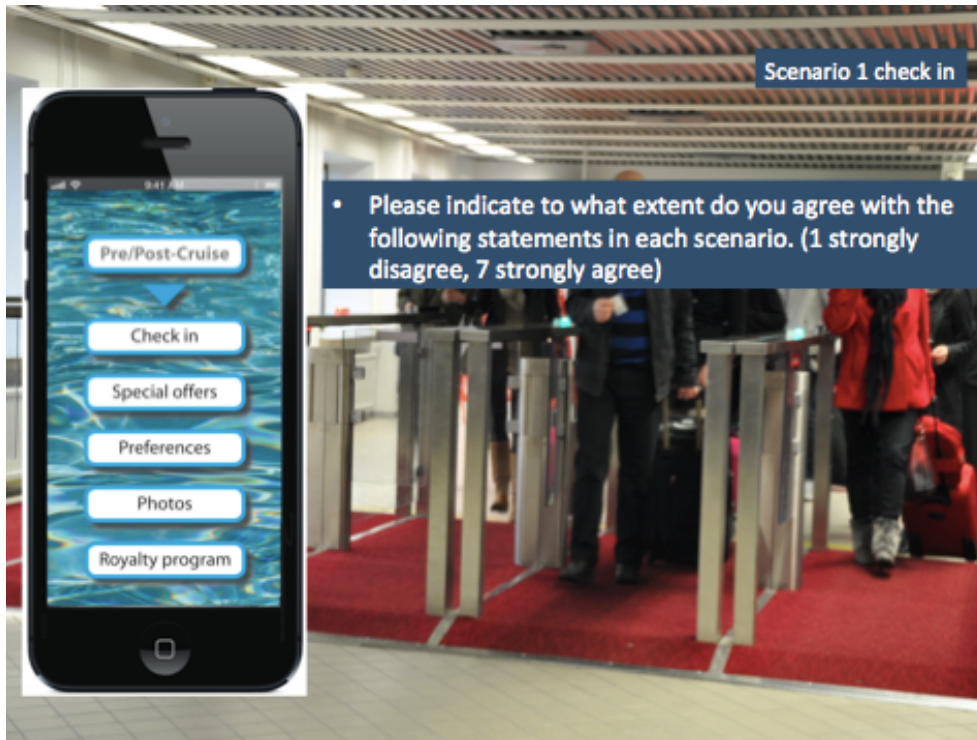10.   Bad manner of the waiter, direct feedback

At dinner, Passenger A was a little bothered by the waiter, because the waiter handed him the plate from across the table instead of coming next to him and hand him the plate. A wanted to make a formal complaint to the manager but B said: "It is not too big of a deal, let's not let this affect our holiday mood and maybe that is not that big of a mistake, if we make a complaint to the manager, the waiter might get punished by the management, and that is not nice."

Mobile app solution: A is still bothered, and he thinks if he doesn't say anything, the waiter will still do the same the next day and for the rest of the week, and then A would really be bothered. So he went through the feedback session of the app and see if there is anything he could do to improve the situation. That is a option in feedback, called direct suggestion to staff and it states that this session is for taking suggestions for crew members that serve you directly (Management wouldn't see it). A thought

this would be a way to improve his experience during this week without getting the waiter in trouble. He went a line to make the suggestion, the next day the mistake was corrected.

APPENDIX F VALIDATION WORKSHOP SCREEN

Scenario Playing

Voting