TAMPERE UNIVERSITY OF TECHNOLOGY

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EXPANDING CUSTOMER BASE OF MOBILE SUSTAINABLE SERVICES

Master of Science Thesis

Prof. Miia Martinsuo has been appointed as the examiner at the Council Meeting of the Faculty of Business and Technology Management on 9th November, 2011.

ABSTRACT

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Sustainability is an emerging topic discussed and debated by host of communities like academicians, industries and business leaders, designers and policy makers. The recent dramatic changes in environment might have caused a great concern towards sustainability. There are many services offered around the sustainability domain like energy management consultation. As with other domains, it has also adopted technology as a platform to accentuate the effectiveness of its services. The high penetration of mobile technology in rural and urban areas plays a vital role in taking sustainable services to masses. However, few studies highlight that there are many challenges in deploying sustainable services using mobile technology like poor infrastructure in mobile network and electricity, low acceptance levels and service discoverability problems. These challenges inhibit the usage of the services by mass customers.

The objective of this study is to identify avenues augmenting the usage of sustainable services using mobile technology by customers. This is carried in two fold ways, by first identifying potential gaps in the sustainable services using mobile technology which could be tapped to attract customer usage. Secondly, the drivers and hindrances in using these services, as experienced by the customers are analyzed. This would pave way to effective design of these services, thereby accentuating the customer usage. The literature discussion on sustainable services using mobile technology is in its infancy; therefore, a theoretical framework is developed and used as a guiding theme for empirical data analysis.

The landscape of sustainable services using mobile technology in market reality is way ahead of the literature discussion. New services identified from empirical data indicate a need for literature discussion about those services. Customer perspectives on the theoretical driving forces framework comprising of drivers and hindrances, provided insights on how these driving forces are seen in reality. The approach used in this study, would pave way to make informed service design decisions resulting in mass customer usage of the services.

PREFACE

This study attempts to shed light on new avenues to augment customer usage of sustainable services offered using mobile technology. Developing a framework to analyze sustainable service domain was the main challenge in this study, as the literature discussion about this domain is emerging. The framework is developed by correlating the elements of mobile commerce and the domain of sustainable development.

During this research process I had several hours spent in studying sustainability as a concept and service, designing data gathering methods to collect information about different mobile services offered towards sustainability issues. I would like to place my sincere gratitude to Professor Miia Martinsuo for her guidance during the progress of this work. I take this moment to thank Riitta Jantunen from Nokia, for her guidance in providing the interview contacts and study materials. I would also like to extend my thanks to all those interviewees who participated in this study and reviewers; my manger in Nokia Katja Nisumma-Saarela and my husband Sriram Gurumoorthy for providing editorial comments. Finally, I take pleasure in submitting the completion of this thesis with the moral support of my son and my family.

Tampere, 07.01.2013

Vidhya Govindan

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ABBREVIATIONS AND NOTATION

CDMA	Code Division Multiple Access
GSM	Global System for Mobile communications
IT	Information Technology
MSS	Mobile Sustainable Services
NGO	Non-Governmental Organizations
OS	Operating System
PDA	Personal Digital Assistant
SMS	Short Messaging Service
UI	User Interface
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WCED	World Commission on Environment and Development
WWF	World Wildlife Fund

1. INTRODUCTION

1.1. Background

Human life and existence in Earth highly depends on the natural environment, which is degrading rapidly. While some people are still suspicious if the statement is true, many indicators indeed prove that the natural environment has already degraded and natural resources exploited far from what it was centuries back (Seager, 2008). The term sustainability not only refers to environmental sustainability but also addresses various other entities like social and economic issues. In a holistic perspective sustainability corresponds to enable humans lead a life without compromising the needs of future generations. There is a strong notion that governments and policy makers' holds the responsibility in taking measures towards sustainability issues. However sustainability being a trans-disciplinary concept calls for action from industry, citizens, and non-government organizations (NGOs) and other environmental stakeholders (Hartman et al., 1999). Also, business enterprises being a dominant form in the society contribute to the worsening and enhancement of the natural environment (Melville, 2010). Business enterprises which drive the society through their products and services play an important role in enabling people to support sustainability. Therefore the discussion of sustainability as a concept is moved to the next stage by offering services surrounding sustainability issues.

There are many technology enterprises which see a good market potential in providing solutions through their products and services addressing sustainability issues (Ozaki, 2011). For example, Motiva [1] in Finland specializes in energy and material efficiency and carries out projects in that domain. However not many of them are successful. There are many reasons attributed for the failure of sustainability products & services like not addressing the needs of consumers, strong social norms and very minimal study about sustainable services market dynamics (Ozaki, 2011). This raises an important point about lack of understanding in categorizing sustainable services and studying sustainable service characteristics which would enable better service delivery.

While the discussion about sustainable services is gaining momentum, influence of technology advancement on this services sector has also increased phenomenally. Mobile technology is the current buzz in the technology business reaching out to a massive 80% of world population [2]. The real key in the success of the mobile technology is in terms of services which enable and encourage new consumer behavior. With its massive customer base, mobile platform could play an important role in taking sustainability solutions and services to a larger group of people. It is considered as the

better solution to deploy sustainable services in comparison to other options like low cost laptops [2]. United Nations Development Programme (UNDP report, 2010) report elucidates that mobile technologies could be a potential tool to enhance sustainable development, however, the report underlined that the potential is only starting to be tapped and there are a number of challenges to overcome. For example, in the case of mobile health applications, a research2guidance report (Research2guidance, 2012) pointed out that, while mobile health applications market increased sevenfold in total revenues in 2011 to a total of $718 million, it still tiny compared to $7 trillion global health industry. The number of Google searches for "mobile health" from Google Trends shown in Figure 1, also confirms the interest shown in the past few years.

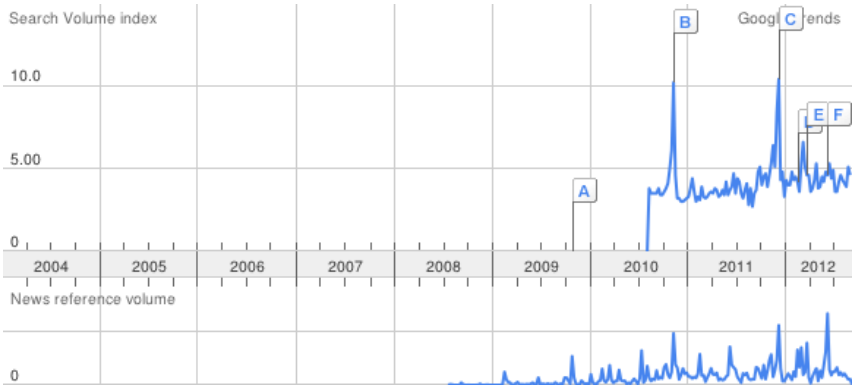


Figure 1. Google searches for "mobile health"- Google Trends, August 2012.

While this is true in case of mobile health applications, other sustainable development areas like recycling, environment preservation and eco-friendly transport are yet to attract interest from mobile based services and customers. Therefore, while the large customer base of mobile technology looks impressive, it is important to note that characteristics of sustainability services are different from other mobile services. This demands for a profound analysis of the sustainable service characteristics offered through mobile phones. The literature review of the sustainable services offered through mobile technology did not show up any terminology to refer this service domain. Therefore to facilitate readability, this study refers sustainable services offered through mobile technology as mobile sustainable services or MSS interchangeably. An example mobile service which could be grouped under MSS is "Outbreaks near me" mobile application by Healthmap.org website, which gives real-time information about disease outbreak near the mobile customer's neighborhood. The structured analysis based on sustainable service categories would pave way for better understanding of the mobile sustainable services market and to identify ways augmenting increased customer usage.

1.2. Objective

Sustainability being a trans-disciplinary concept involves multi-layered analysis of different domains and also can be interpreted differently by different groups like

governments, policy makers, NGOs and business enterprises. Hence Seager (2008) mentioned that conceptual definition of sustainability can be based on the scenario, plan, engineering product or service. Therefore to understand mobile sustainable services market, it is important to take into account how sustainable services fit in within the mobile services territory. Once the framework of sustainable services offered using mobile technology is established, it could pave way for further categorization of mobile sustainable services market and identify what aspects draw more customers to these services. Therefore, the objective of the paper is…

> *… to develop a framework to analyze mobile sustainable services and identify avenues augmenting customer usage of those services.*

The paper focuses mainly on sustainable services that are offered to customers through mobile phone technology which influences the sustainable development positively in its ecological, social and economic dimensions. Currently, the mobile sustainable services market is nascent but growing fast. Customer usage of mobile sustainable services could be augmented by identifying possible new services which are not yet tapped and by identifying the motivators and hindrances of customers in using these services.

Specifically, this study aims to figure out answers for the following research questions:

1. Are there any benefits in categorizing and analyzing MSS as a domain?
2. How could the academic discussion about MSS and market reality compliment and benefit each other.
3. Are MSS familiar or known to potential customers? How are the MSS perceived in customer's world?
4. How could adoption of MSS be augmented?

The scope and limitations of this study is discussed below:

1. The study discusses only about sustainable services which use mobile technology or mobile devices for its offerings, either primarily or as a complimentary feature. Sustainability is also discussed in the domain of mobile phone manufacturing and operations, like the materials used during the process, which is not under the scope of this study. Also some sustainable services like energy management industries have proprietary portable devices to manage energy consumption which are also not included in this study.
2. The potential customer groups of MSS are huge and collecting inputs from a broader group would demand huge time and effort. This study being carried out primarily as qualitative therefore does not focus on collecting data from all of the customer groups.
3. The results from the study cannot be directly taken as an indication, as the empirical data collected is from a small sample set. However, the study and the

results could be used as a guiding theme to understand and analyze MSS from a customer's perspective.

4. The study is directed from a customer oriented approach with an aim to increase customer usage of the service. Therefore it does not discuss any monetary or financial benefits in deploying MSS.

1.3. Research structure

This study discusses sustainability as a broader concept while at the same time analyzes the role of mobile technology in sustainable services and ways to augment the customers' usage of sustainable services through mobile technology. In order to facilitate easy understanding and logical flow of information, this research study is presented in the form of six chapters. The contents and objectives of each of these chapters are as follows:

1. Chapter 1 introduces the concept of sustainability and services associated with it in broader sense. It also elucidates about mobile sustainable services which is the core topic of this study. The research objectives of this study are presented and the research questions are formulated.

2. Chapter 2 aims to explain sustainable services in detail and presents a framework to understand mobile sustainable services based on theoretical literature. The conceptual framework that forms the basis for empirical data analysis is presented in this Chapter.

3. Chapter 3 focuses on the research methods and research process followed in this study. This research study employs qualitative research through analysis of hundred mobile sustainable services in market and qualitative interviews from different actors in mobile sustainable services value chain. A theoretical framework is built based on the academic literature. The theoretical framework is then applied to analyze empirical data.

4. Chapter 4 discusses the theoretical framework in the light of market reality. The theoretical framework is used as a guiding theme to analyze the empirical data. New findings from empirical data are added to theoretical framework and thus resulted in a comprehensive framework built from academic and market perspectives.

5. Chapter 5 employs the comprehensive framework to identify the avenues to increase customer base of MSS.

6. Chapter 6 provides conclusions from the study and possible further research work on this topic.

2. LANDSCAPE OF MOBILE SUSTAINABLE SERVICES

2.1. Sustainability and services

The Chapter 2 aims to provide landscape analysis of mobile sustainable services and hence it becomes imperative to get a clear understanding of what the term mobile sustainable service is about, in the first place. Thus the birth of MSS concept is introduced systematically by defining the concept of sustainability, sustainable services, elements and features of mobile service and how the mobile features provide added value to sustainable services. Sustainability concept has gained global recognition today. It is a broad and evolving concept that defies universally agreed definition. In this section, a brief overview of sustainability as a concept and services that are offered around sustainability domain is discussed.

2.1.1. Definition of sustainability

The word ‘sustain’ comes from the Latin word ‘sustenare’ which means ‘to hold up’. Though sustainability has been on talks for some decades, the first definition that invoked public interest was put forth in World Commission on Environment and Development (WCED) publication in Brundtland on 1987 (WCED, 1987) and states that “Sustainability is meeting the needs of the present without compromising the ability of future generations to meet their own needs”. An emerging consensus on sustainability is that there are three pillars constituting sustainability namely economic, environmental and social (Haugh and Talwar, 2010; Linnenluecke et al., 2009; Ahmed and Hardaker, 1999) and is explained briefly below.

1. Economic sustainability corresponds to the financial success of an organization with profits exceeding the expenditure and affirms that organizations operate in interest of their shareholders through maximizing their wealth (Haugh and Talwar, 2010). However several studies confirm that economic sustainability alone is not sufficient for a company to be successful in longer run (Sharma and Vredenburg, 1998).
2. Environmental sustainability which takes into account the impact of business operations on the natural resources, environment and ecology are of high importance in the present world. Organizations are obliged to comply with legal policies on waste management, emissions management, etc (Townsend, 2008). Some organizations even consider environmental sustainability as its

competitive advantage which helps to provide distinct value to their customers (Hart and Ahuja, 1996).

3. Social sustainability on the other hand corresponds to the humanitarian context of business and focus on issues like occupation safety, labor conditions, within organizations and other global issues like poverty, and education (Linnenluecke et al., 2009). Organizations consider its support towards global social sustainability issues as an extension of its brand image.

These three pillars are closely related and their impacts are deeply interconnected which calls for a holistic sustainability involving the understanding of interactions and impacts of the three pillars of sustainability (Townsend, 2008). Another interesting definition of sustainability comes from the basic building blocks which drives the sustainable development. They are sustainable planning, sustainable design and sustainable policy making (Shrivastava 2010; Dobers and Strannegard, 2005). Policies related to sustainability are dispersed by government agencies and environmental stakeholders in an attempt to make businesses and people to oblige thereby supporting sustainable growth (Seager, 2008). This study would take into account the concept of holistic sustainability encompassing the interaction of three pillars of sustainability.

2.1.2. Sustainable services

Services are generally considered as an activity offered by one party to another and are essentially intangible and does not provide an ownership (Kotler and Armstrong, 2010). Sustainable services can be perceived as a subset of services which provide offerings satisfying customer needs while at the same time improve the social and environmental performance along the whole life cycle in comparison to conventional offerings (Belz and Peattie, 2009). Eco-efficient services are sometime referred to as sustainable services and are defined as services which facilitate eco-efficiency of activities by influencing the consumer behavior in combination with eco-efficiency of the technology applied and materials used (Zaring et al., 2001). Halme et al. (2006) argues that most of the sustainable services terminology refers to the eco-efficient services and neglects the social aspect of sustainability. They gave a pragmatic definition to sustainable services as services which contribute to positive impact on at least two of the three dimensions of sustainability. The current period faces a boom in technological advances and calls for ethical concerns in achieving sustainable development, which is promoted through sustainable services.

As sustainable services span a variety of domains like educational and environmental, a pragmatic understanding of sustainable services would require knowledge on sustainable services per se and the targeted customers.

The pragmatic understanding is facilitated through explanation of a simple service oriented framework (Arsanjani, 2004) as shown in Figure 2 below.

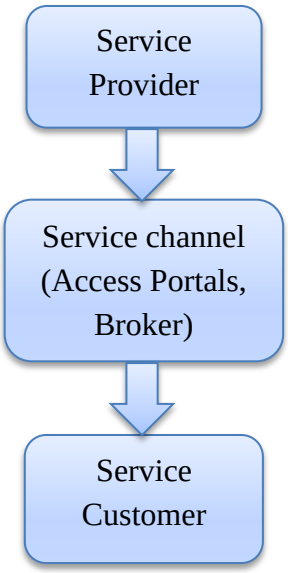


Figure 2. Conceptual model of a service oriented architecture (Arsanjani, 2004).

According to Arsanjani (2004), the service oriented framework shown in Figure 2 is based on interaction of three primary parties namely service provider who implements the service and publishes the service, service channel refers to the medium like web portals through which the service is identified and availed and finally the service customer who uses the service by finding the service through the service channel. Sustainable services could also be explained in a similar way based on Figure 2. As the array of sustainable services is vast, Figure 2 is extrapolated based on the discussions of Harmon and Demirkan (2011) and resulted in the framework shown in Figure 3.

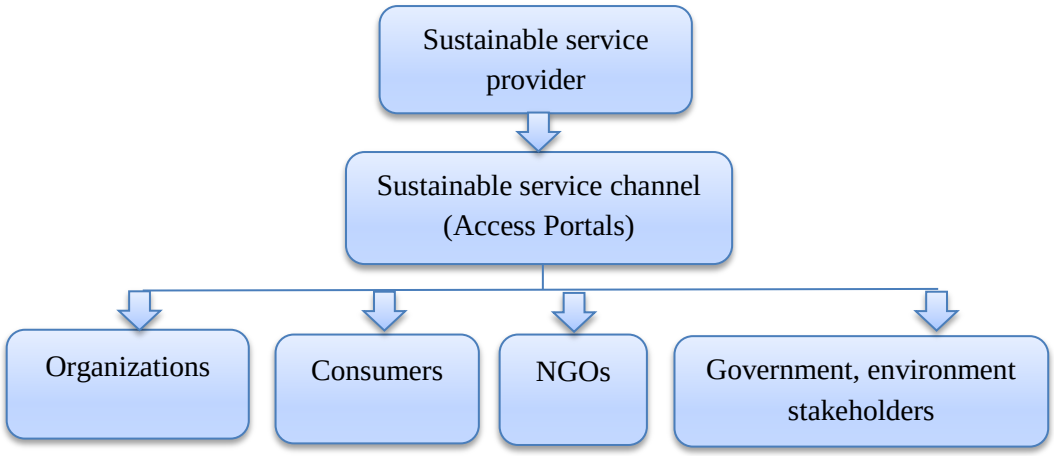


Figure 3. Sustainable services offered to different customer segments (Adapted from Harmon and Demirkan, 2011).

Figure 3 points out four sustainable service customer segments namely organizations, consumers, NGOs, government and environment stakeholders. The classification in Figure 3 is based on the recipient of the sustainable services or in other words customers of sustainable services.

There are other categorizations like sustainable product-service systems which are based on the design of the product or service that are sustainable in terms of environment factors and resource use (Roy, 2000). According to Roy (2000), the categorizations based on sustainable design are result services, shared utilization services, product-life extension services and demand side management. A brief explanation about sustainable design categories is explained below:

1. Result services which are focused in selling a result instead of a product like for example providing laundry services instead of washing machines.
2. Shared utilization services are based on providing opportunities to increase product utilization by product sharing. For example offering an affordable community washing room where residents can share washing machines is a better way to promote shared utilization services.
3. Product-life extension services which focuses on increasing the life of product usage by offering maintenance services. An example is a clothes retailer who takes back its clothes used by the customers and distributes it to charity organizations.
4. Demand side management focuses mainly on energy management services which aim to reduce energy consumption, like services which would help build low cost heating systems.

This study aims to understand mobile sustainable services market and identify ways to boost customer adoption of these services. The former classification of sustainable services based on the recipient of the service as shown in Figure 3, would give room to analyze the characteristics of individual customer segment and also identify the factors which drive these customers to use the services. On the other hand, design based classification lays emphasis on the service concepting and design, rather than the customer orientation. Therefore, the classification based on recipient of the sustainable services as shown in Figure 3 is chosen to be used in this study, as it suits better for the purpose in hand.

In order to understand the sustainable service classification in Figure 3 better, each of the four segments is discussed in detail to give a good understanding about the sustainable service ecosystem. Examples for each of the four segments are presented which would facilitate better understanding of this ecosystem.

Firstly, sustainable service provider could be various companies and organizations who offer such services. Some examples of the providers along with the sustainable service they provide are given below in Figure 4.

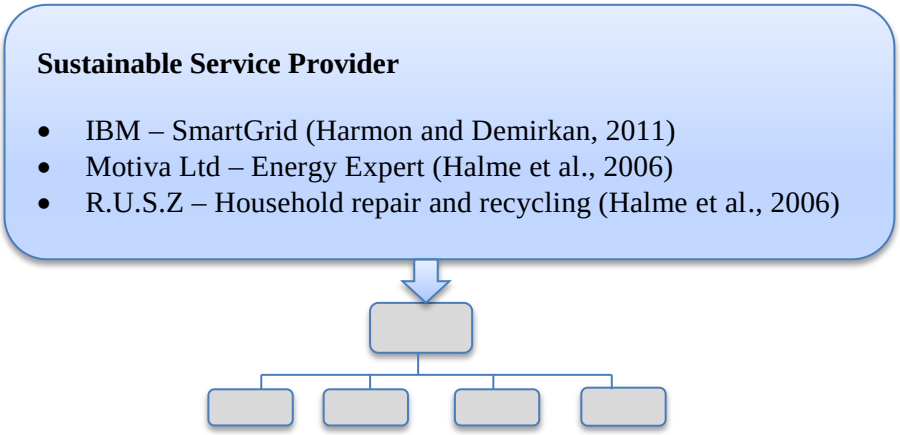


Figure 4. Examples of sustainable service providers and corresponding services.

The sustainable service provider examples given in Figure 4 are just a few and there are many more of these discussed in literature. Though there are many of these services, Halme et al. (2006) clearly pointed that the discoverability of these services has been problematic in most of the cases. This emphasizes the significance of the second party, sustainable service channel in the framework shown in Figure 2. Service channel serves for two different purposes namely discoverability of services and accessibility of services. Few examples of service channels are listed in Figure 5 below.

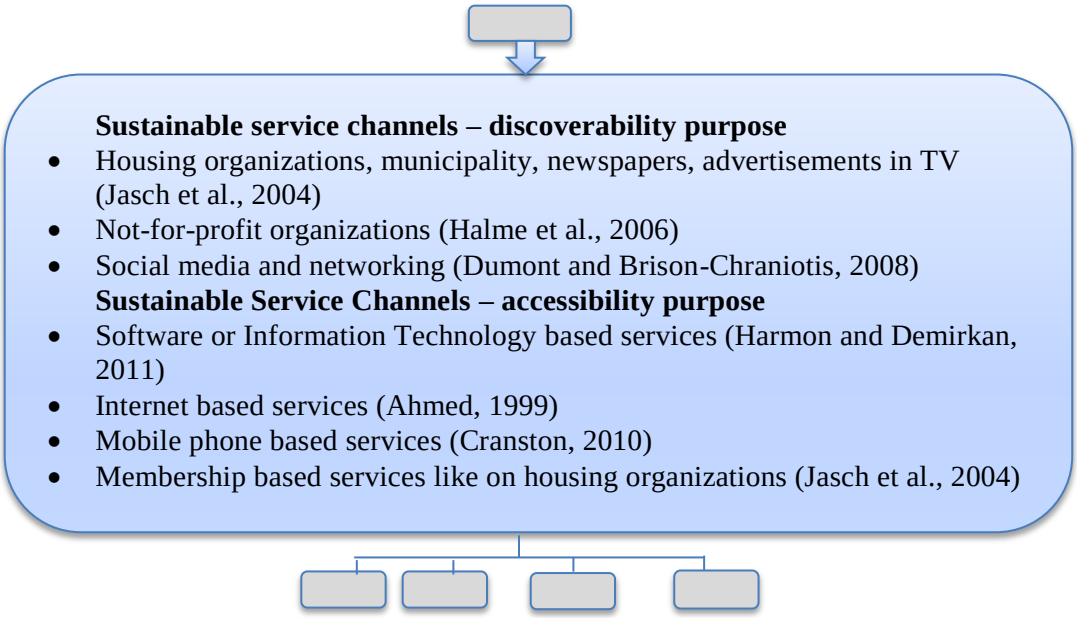


Figure 5. Examples of sustainable service channels.

It has to be noted that, sustainable service channels in Figure 5, can serve either discoverability or accessibility purpose and also in some cases both purposes. The sustainable services and associated service channels largely depend on the sustainable

service customer segment it is served to. There are various sustainable services offered in each of the four segments mentioned in Figure 3. It would be overwhelming to list and analyze all of those services. However, as many sustainable services are similar and targets a particular domain, related services could be grouped and classified under a service category. For example, sustainable services like energy management systems, smart grid which are offered by Information Technology (IT) companies can be grouped under IT-for-green service category. Therefore, for example, IT services which enable sustainability in the business process of a company could also be categorized under IT-for-green (Harmon and Demirkan, 2011). A list of such service categories for each sustainable service customer segment is compiled from different literatures and is discussed below.

The first customer segment, organizations see growing trend of availing sustainable services, and showcase interest towards sustainability issues for various reasons like better brand image and legal obligation. This has spurred in the need for sustainable services that cater to the needs of organizations. As many organizations' core competencies are not related to sustainability, they look for 3rd party service providers offering sustainability services. The compiled lists of sustainable services offered to organizations are shown in Figure 6.

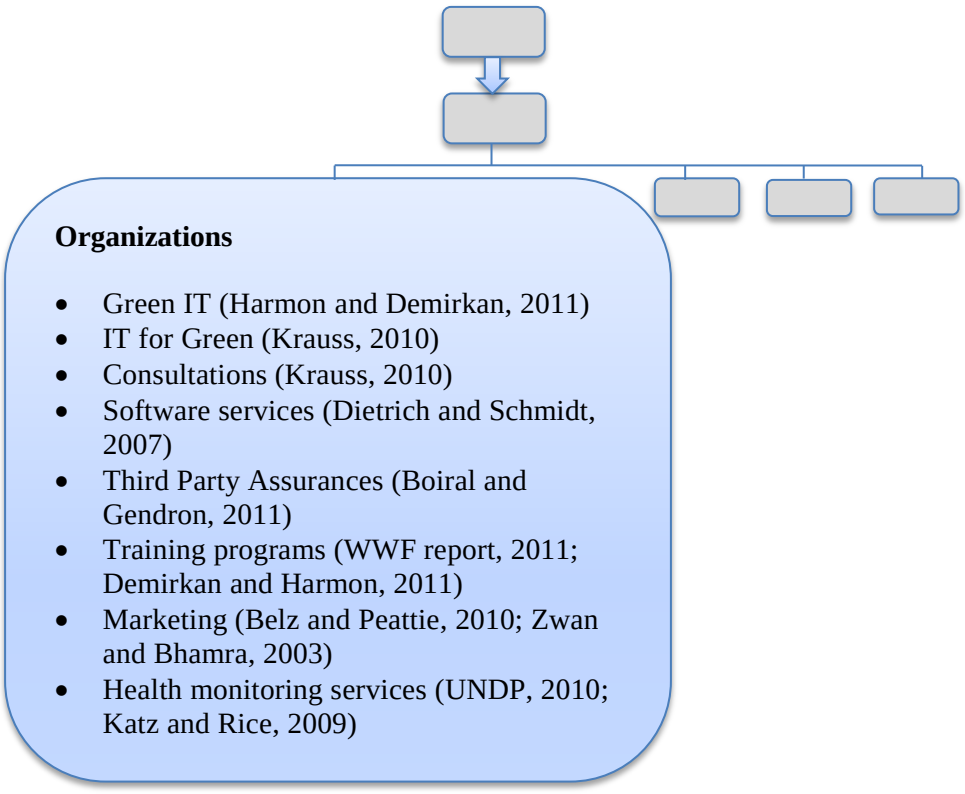


Figure 6. List of sustainable service categories offered to organizations.

In the second customer segment namely consumers, sustainability and sustainable lifestyle has become a buzz word these days and there are plenty of services offered to

customers to choose an eco-friendly and sustainable lifestyle. While this is true in developed countries, developing nations have a different picture towards sustainable lifestyle. As social and basic health issues are more prevalent in developing nations, various sustainable services are offered to solve them. Figure 7 highlights sustainable services offered to consumers.

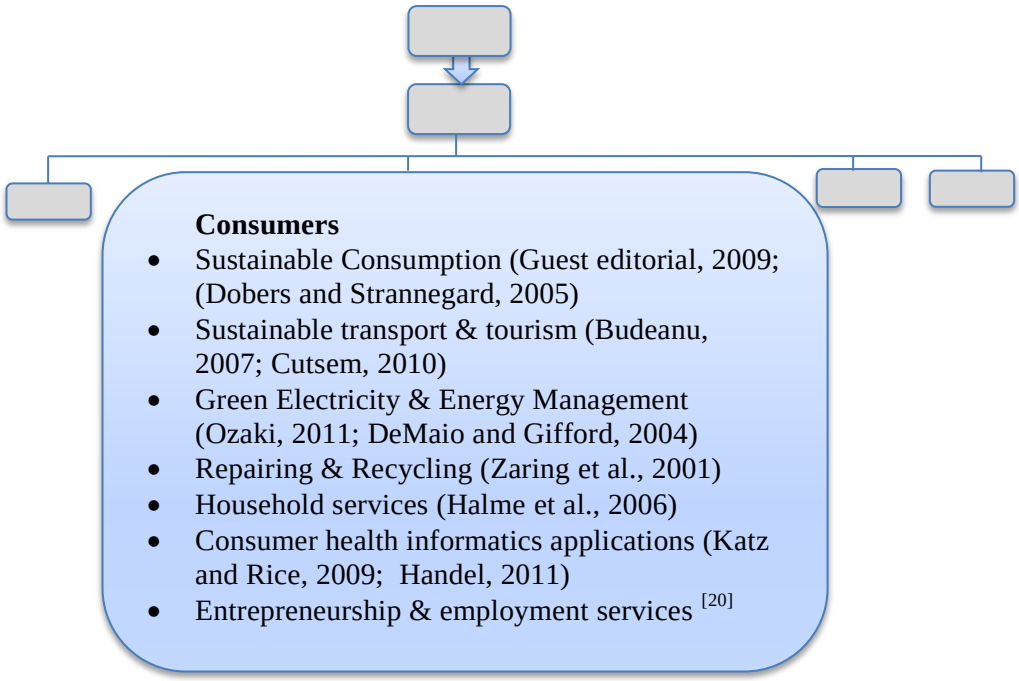


Figure 7. List of sustainable service categories offered to consumers.

The third segment Non-Governmental Organizations (NGOs), involves the active work for the cause of social, environmental and economic sustainability issues across the globe. Many services are being offered to facilitate their operations and enable them to make bigger impact. Figure 8 provides a list of sustainable services offered to NGOs.

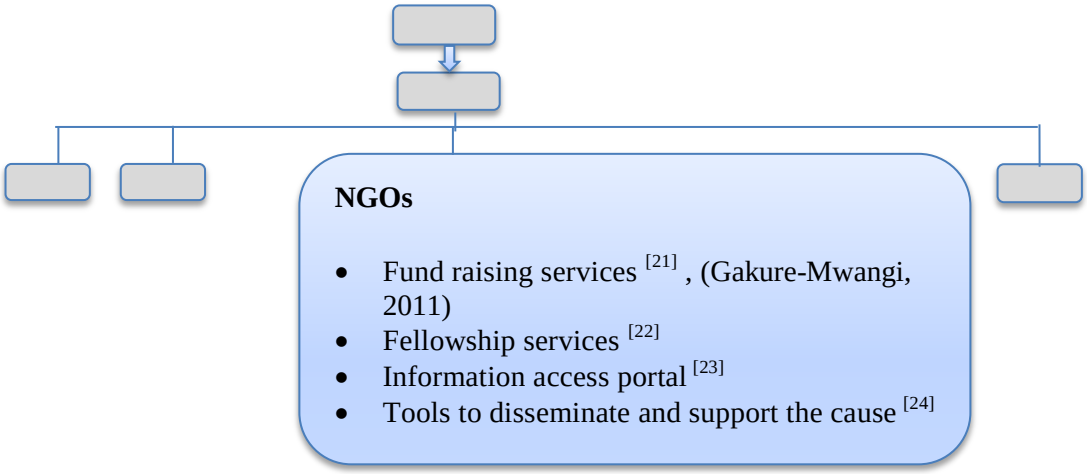


Figure 8. List of sustainable service categories offered to NGOs.

In the final segment namely government and other stakeholders, there is more focus from governments across the globe to deploy policies and programs addressing social problems and environmental and economic sustainability issues. Since government organizations' core competence is not inclined towards developing tools & services, they rely on other NGOs or service providers for those. Figure 9 provides a compiled list of services taken from literature which are offered to governments and other stakeholders.

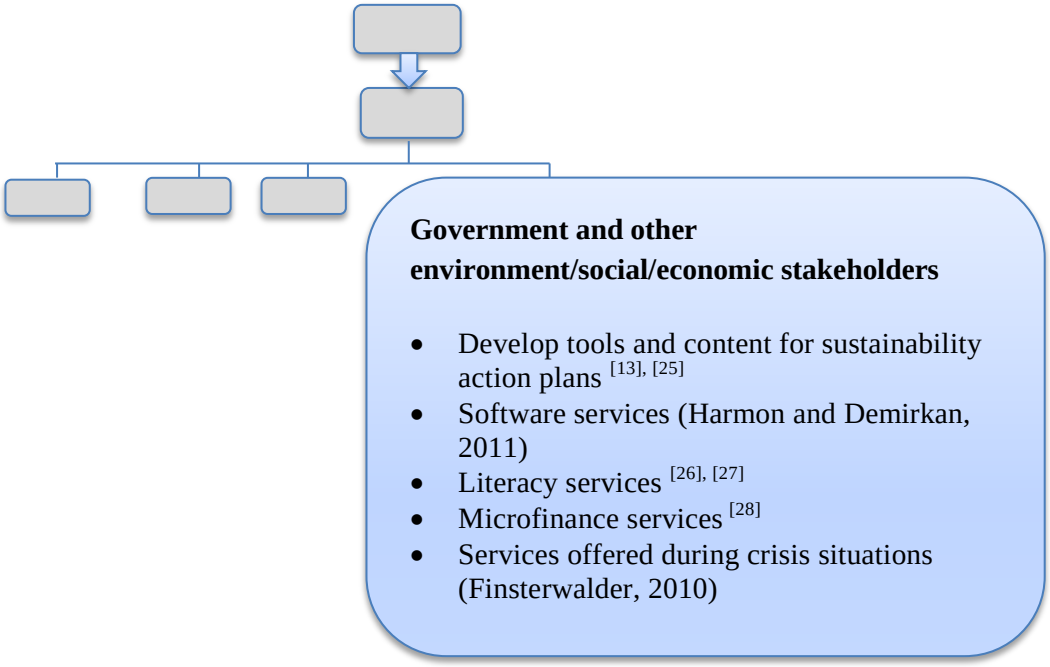


Figure 9. List of sustainable service categories offered to Government and other stakeholders.

Many of the sustainable service categories for different segments mentioned in Figures 6,7,8 and 9, utilize latest technology like internet for service channels and extend their services through mobile devices. Sustainable services offered through mobile devices are catching up at a faster pace. The term mobile device itself is wide and includes many types of handheld devices like feature phones, personal digital assistants (PDAs), smart phones, tablets and e-readers (Georgiev et al., 2004). The next chapter aims to establish the context of mobile device used in this study and discusses the elements and salient features of mobile services thereby building a stage to introduce the concept of mobile sustainable services in Section 2.4.

2.2. A look into mobile services

As mentioned in the earlier section, mobile devices include various kinds of devices. Based on the characteristics of some sustainable services provided to the four segments as explained in Section 2.1.2, it could be seen that cellular connectivity forms a basic requirement for the service to be effective. Therefore it is decided that this study will be

restricted to those mobile devices which have cellular connectivity. Thus, the study includes feature phones, smart phones, PDAs and excludes e-readers, tablet PCs, notebooks and other mobile devices which do not have cellular connectivity. Here by in this study, the words ‘mobile phones’ and ‘mobile devices’ are used interchangeably and would include feature phones, smart phones and PDAs.

Mobile phones belong to the product-service system where in a tangible mobile phone product comes with a set of services designed for it, which jointly are capable of fulfilling specific customer needs (Tukker, 2004). Mobile phone with its high penetration rate has many salient features that enable sustainable services to be offered to a bigger audience. As the focus of this study is related to sustainable services offered through mobile devices, it is important to gain insight on elements constituting mobile services and significant features of the mobile services. This understanding of mobile services would pave way for analyzing the effectiveness of sustainable services offered through mobile devices.

2.2.1. Elements of mobile services

According to Vesa (2005) mobile services can be defined as a set of services offered through mobile phones to the customers to communicate with others, access information and provide entertainment. Mobile services can be categorized in various ways and the one mentioned by Vesa (2005) as shown in Figure 10, suits the purpose of this study.

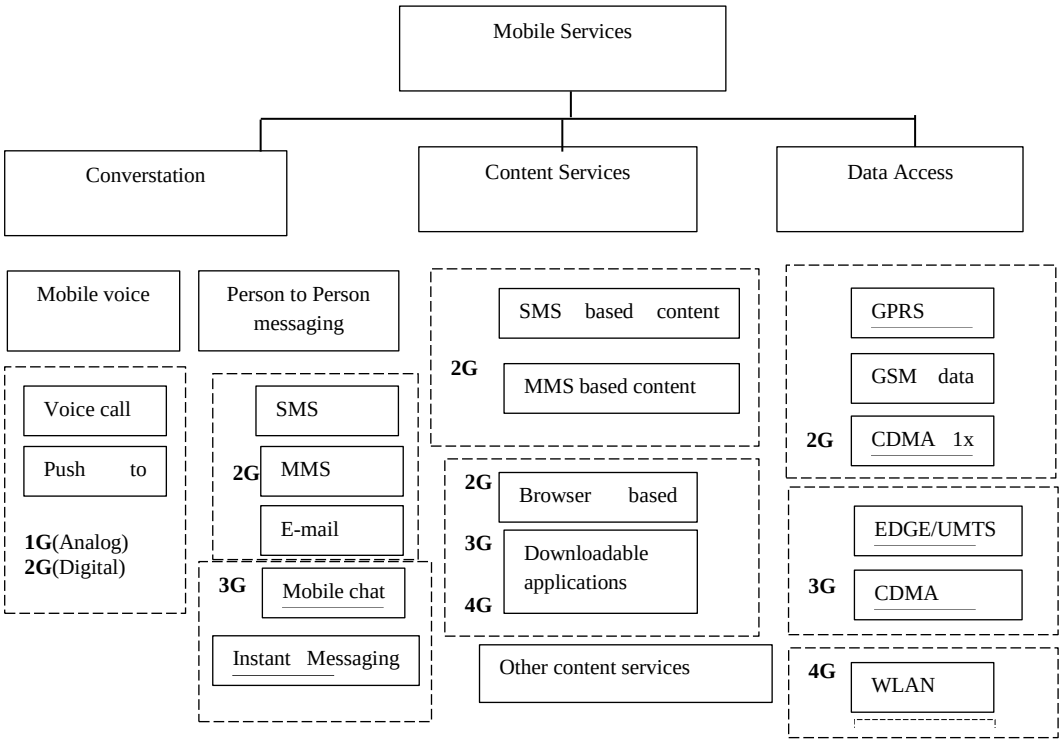


Figure 10. Classification of Mobile Services based on technology used.

Figure 10 also highlights mobile services in association with the evolution of generations (1G, 2G, 3G and 4G) in mobile technology. Steinbock (2007) depicts the evolution from analog to digital to multimedia to broadband cellular as the 1G, 2G, 3G and 4G respectively. Each generation is characterized by various standards, technology used and the data speed achieved (Steinbock, 2007). These technology generations are important to know as the design of mobile services has to take into account which mobile technology it is going to utilize.

Many literature studies assert that operators played the key driving factor in mobile services during the early years around 1990s (Vesa, 2005; Steinbock, 2007). However the current mobile ecosystem has many players involved in providing mobile services for the customers. Vesa (2005) with his analysis on mobile services on various demographic markets like Japan, Europe and UK explains that mobile services ecosystem is influenced and driven by different players across different geographies. The three different mobile services ecosystem model according to Vesa (2005) is shown in Figure 11.

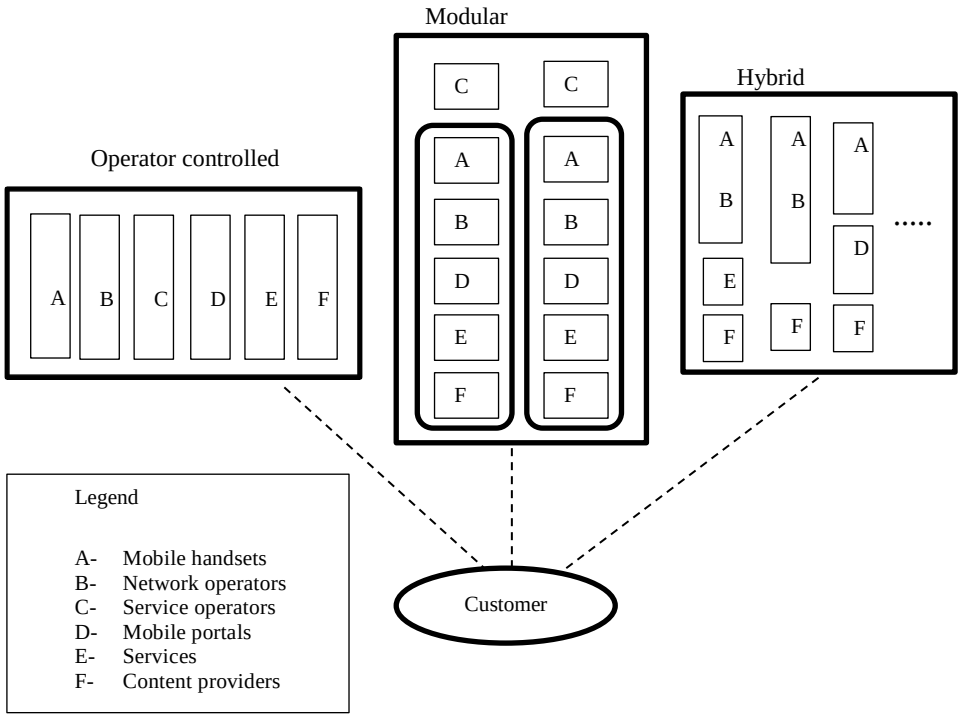


Figure 11. Three different mobile services ecosystem (Vesa, 2005).

As could be seen in Figure 11, the three different ecosystems are,

1. Operator controlled vertical mobile services ecosystem
2. Modular ecosystem with competition within the same industries
3. Hybrid ecosystem with different players partnering in providing a service.

The current trend demands hybrid innovation involving combination of mobile phone producers, process and service innovations, as a success factor for any mobile service.

2.2.2. Features of mobile services

Nowadays, mobile phones could be termed as extremely personal device and is a storehouse of more personal information. The sheer facility that people could be contacted anytime using a mobile device, gives it a privilege to be on people's hands or bags most of the time. According to Rice and Katz (2003), two dominant special things that stand out in using mobile phones based on people's perception are emergency use and livelihood purposes. There are many more significant features a mobile device brings in and a study of those would shed light on value-add provided by mobile phones to sustainable services. A list of significant features of mobile devices based on literature review is given in Table 1 below.

Table 1. List of significant features of mobile devices.

S.no	Literature review	Can be termed as feature
1	Provides opportunity for instant communication (Sarker and Wells, 2003; Mimbi et al., 2011)	Communication
2	Always accessible with/without connectivity resulting in alteration of behavior (Rice and Katz, 2003)	Accessibility
3	Real time information enabling speedy & informed decisions (Rice and Katz, 2003)	Real-time information
4	Easy use, portable, easy to carry (Mimbi et al., 2011)	Easy use
5	Payment & transactions anytime (Sarker and Wells, 2003)	Mobile payment
6	Personal Safety and emergency contact purposes (Katz and Aakhus, 2001)	Personal Safety
7	Collaborate seamlessly (Sarker and Wells, 2003)	Collaboration
8	Packed with tools like camera, sensors, audio/video recording (Berg et al., 2003)	Added tools

The list of salient features of mobile services shown in Table 1 provides a good base to identify and analyze those sustainable services which could be offered through mobile

technology. The next section utilizes this table of features and builds a framework to understand the concept of mobile sustainable services.

2.3. Framework to understand mobile sustainable services

The academic literature has references to many sustainable services which are offered through mobile devices like World Health Organization's HealthMap (Cranston, 2010). As mentioned in Section 1.1, the sustainable services offered using mobile technology is termed as mobile sustainable services in this study. It is worthwhile here to provide clarity that, mobile technology could be either primary or secondary or complimentary service channel for sustainable services, and all of these variants are considered as mobile sustainable services in this study. This chapter aims to build a framework highlighting the possible sustainable services that could be offered using mobile technology, by first discussing if the mobile technology brings in any value-add to sustainable services.

2.3.1. Mobile technology – a value-add to sustainable services?

Mobile phones though have many significant features, it is necessary to evaluate if it creates any additional value for sustainable services. According to Collins (1986) value added service is, "an economist's term meaning that the service offered will have additional value to the user compared with more basic telecommunications (or other) services."

The value-add need not necessarily be directly related to economic benefits, but for example can also enhance the characteristics of the sustainable services currently offered. Therefore a sustainable service provider has to investigate on how to effectively tap the features of mobile phones and leverage it to create value for the services offered. Anckar and D'Incau (2002) proposed an analytical framework for evaluating value-added services in mobile commerce which is used here to understand the value-add of mobile technology to sustainable services. The adapted and modified analytical framework of Anckar and D'Incau (2002) for sustainable services is shown in Figure 12 below. The total value-add of using mobile phones for sustainable services could be perceived as a sum of value-add from the features of mobile device per se and the benefits of connectivity available in mobile devices. The mobile connectivity encompasses cellular, GPRS, 3G, Wi-Fi, Bluetooth and other connectivity options available in mobile.

The list of mobile features identified in Section 2.2.2 is mapped to mobile device value-add and mobile connectivity value-add as shown in Figure 12 below.

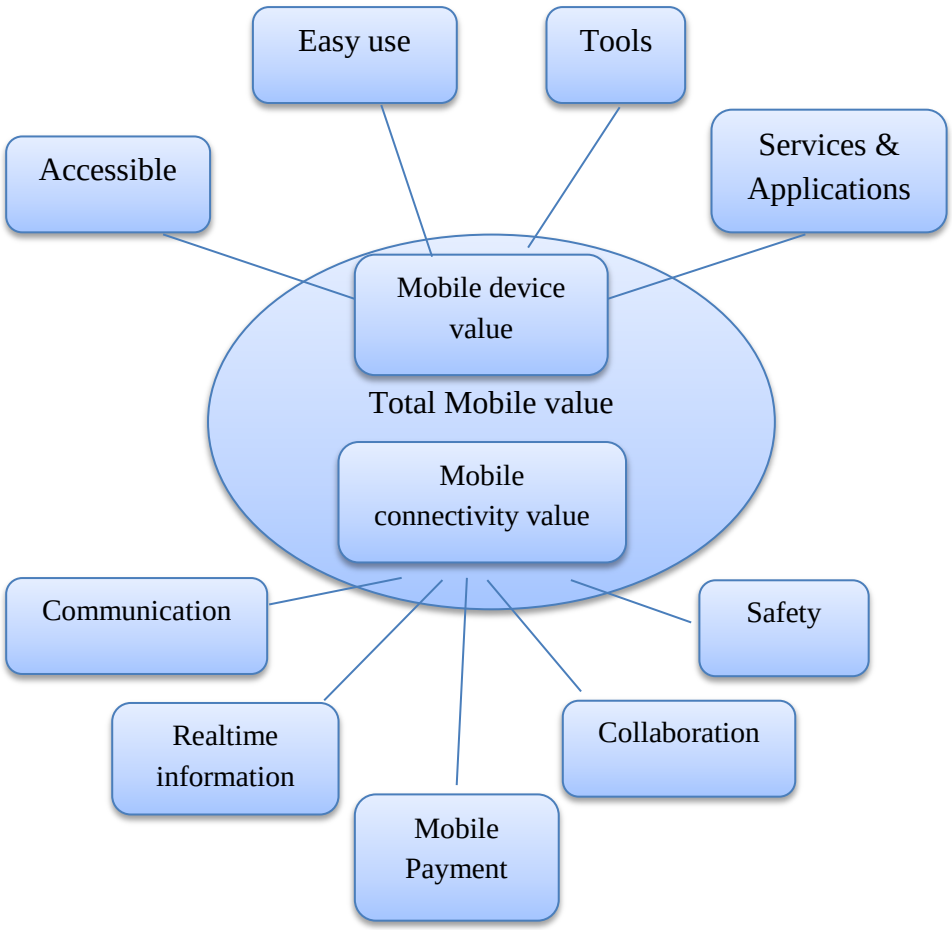


Figure 12. Framework to understand value-add of mobile technology (Adapted from Anckar and D'Incau, 2002).

The mobile device value seen in Figure 12 corresponds to the capability of the mobile device in terms of functionality and the significance of mobility as a new interaction medium. The mobile features like accessible, easy use, tools, services and applications are grouped under mobile device value. Mobile connectivity value in Figure 12 corresponds to the aspect of different communication possibilities using mobile devices. Features like real-time information, mobile payment, collaboration, safety and communication which are based on connectivity are grouped under mobile connectivity value. While it is true that these two value-add namely mobile device value and mobile connectivity value overlap with each other, it is important to group features to either one of these, and thereby help in understanding which one is significant. In order to evaluate if deploying sustainable services using mobile technology brings in any value-add, it is imperative to understand value-add provided by these mobile features.

The framework in Figure 12 could be analyzed to identify the value-add provided by these features and is summed up in Table 2 below.

Table 2. List of features and their possible value-add with respect to sustainable services.

S.no	Feature	Value-add
Mobile device based value		
1	Accessible	Reach remote customers (Rice and Katz, 2003)
2	Easy use	Reach rural and less educated customers (UNDP, 2010)
3	Tools	Augmenting services (The World Bank, 2012)
Mobile connectivity based value		
1	Communication	Provide automated customer care services like mobile banking (Mimbi et al., 2011)
2	Real time information	Location based updates, weather forecast, market based price updates (The World Bank, 2012)
3	Mobile Payment	Hassle free transactions for busy customers (Zhang et al., 2003)
4	Collaboration	Increasing co-ordination among different working groups (UNDP, 2010)
5	Personal Safety	Tailored services for aged, disabled (Jasch et al., 2004)

The value-add listed for each feature in Table 2, is not comprehensive. It is provided here as a reference and this could be used as a guiding theme for respective sustainable service.

2.3.2. Developing framework of mobile sustainable services

The salient mobile features mentioned in Section 2.2.2 and value-add provided by those features in Section 2.3.1, sets the stage to understand what kind of sustainable services could be augmented when they are integrated with mobile technology. In order to identify sustainable service categories that would need mobile technology as a vehicle for further growth and development, a table is constructed in Appendix 1 to evaluate the mobile features that would add value to the respective sustainable service

category. Table 3 explains the evaluation of mobile features that adds value to sustainable service category with an example.

Table 3. Evaluation of mobile features adding value to sustainable service category.

Mobile Features	**Communication**	**Accessibility**	**Realtime information**	**Easy Use**	**Mobile Payment**	**Personal Safety**	**Collaborate seamlessly**	**Added Tools**
Consumers								
Repairing & Recycling		✓	✓	✓	✓			
…	…	…	…	…	…	…	…	…

As shown in Table 3, the 'Repairing & Recycling' service category for consumer segment would be benefitted by value-add provided by certain mobile features and the reasoning is mentioned below.

- Communication – The service mostly is one-way communication from the service provider and does not need strong communication tools
- Accessibility - gain traction if consumers could access it wherever they are
- Real-time information – can better use the service based on current location
- Easy use – Decrease the inhibition to use and accelerate the usage behavior
- Mobile payment – Hassle free transactions
- Personal Safety – Not much relevant to the service
- Collaborate seamlessly – No need to collaborate among different groups
- Added tools – No accessories are needed to use the service

Thus, based on the reasoning discussed above, Table 3 is filled appropriately for the 'Repairing & Recycling' service category. The table in Appendix 1 is constructed by applying similar reasoning as this example, to all sustainable service categories for four customer segments as identified in Section 2.1.2. It could be seen from Appendix 1, that some sustainable service categories like third party assurances are not benefitted by any of the mobile features while some others like sustainable transport gets a complete face-lift when integrated with mobile features. Based on this evaluation of mobile features' value-add to sustainable service categories, it could be concluded that only some of the sustainable service categories are benefitted when offered using mobile devices. Therefore a criterion is chosen where in, those sustainable service categories which would need more than 50%, corresponding to five out of nine mobile features are considered as possible mobile sustainable services.

This criterion when applied to the table in Appendix 1, resulted in a list of mobile sustainable service categories shown highlighted in Figure 13.

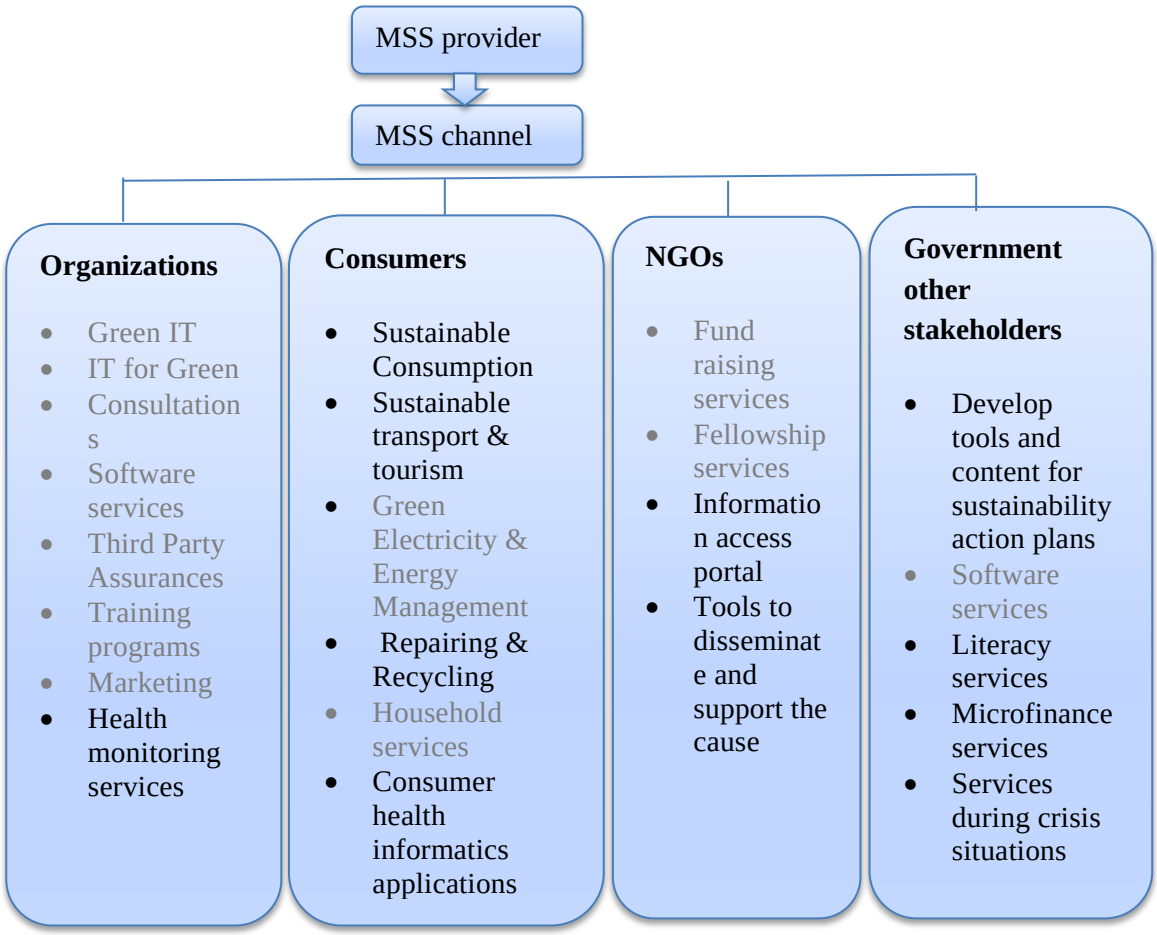


Figure 13. Sustainable service categories that could be offered through mobile.

This list of highlighted mobile sustainable service categories shown in Figure 13 is obtained based on literature review of sustainable service categories and evaluation of those services against value-add provided by mobile features. However it has to be noted that this list has some limitations like absence of literature discussion on certain sustainable service categories which results in the list being not comprehensive. Also, the list mentioned in Figure 13 could differ from the current market offering. Thus by complementing this theoretical analysis with empirical data on current market offering could reveal interesting insights on how mobile sustainable services are evolving. Section 4.2 carries out this compare and contrast study with current market offering, which could provide useful contributions to the academic literature while at the same time provide innovation opportunities in the market of mobile sustainable service. This research study aims to identify avenues to expand customer base of mobile sustainable services by identifying new MSS and augmenting the driving forces of MSS value chain. This Section 2.3 laid base to identify the possibility of new mobile sustainable service categories. The next section will provide a theoretical framework

of driving forces in MSS value chain which could be used to analyze with the empirical data.

2.4. Landscape analysis of mobile sustainable services

The aim of this study as mentioned in Section 1.2 is to identify avenues to accentuate the adoption of mobile sustainable services. This section will attempt to identify the driving forces of the value chain which would help accelerating the MSS ecosystem growth in the coming years. Mobile sustainable services though are similar to other mobile services; vary largely because of the players involved in its value chain. This could be attributed to the reason that mobile sustainable services are focused mainly on social, economic and environmental issues (UNDP, 2010). The understanding of players involved in mobile sustainable services value chain is therefore required in order to identify the driving forces in the value chain, which augments the customer base of these services. Thus this section discusses the players involved in MSS value chain briefly and identifies the driving forces influencing the value chain from the academic literature.

2.4.1. Players in mobile sustainable services value chain

The framework presented in Section 2.3 to understand mobile sustainable services noted that, there are many players involved in mobile sustainable services business. This business pitched in recently within few years and the industry dynamics change rapidly with more players coming in. The current trend highlights, that many companies started providing mobile application support for their services to enhance their brand image and accentuate their customer-service relations through cutting-edge technology (Ruquet, 2011). Hence it is important to understand the mobile sustainable services value chain and the players involved. While discussing mobile commerce value chain, Barners (2002) has proved that advanced value chain techniques aimed at online activity can unravel key players involved rather than the traditional value chain analysis. Therefore this study employs a similar technique and extrapolates the mobile commerce value chain framework by Barnes (2002) to mobile sustainable services. According to Barnes (2002) the mobile commerce value chain can be perceived from content domain and infrastructure and services domain. Six core processes are identified in these two domains namely, content creation, content packaging and market making in content domain and mobile transport, mobile services and delivery support, mobile interface and applications in infrastructure and services domain. After establishing these processes in the value chain, Barnes (2002) details the players involved in mobile commerce value chain.

For this study, the mobile sustainable services value chain framework is built based on discussion of the mobile commerce value chain by Barnes (2002) and is shown in Figure 14.

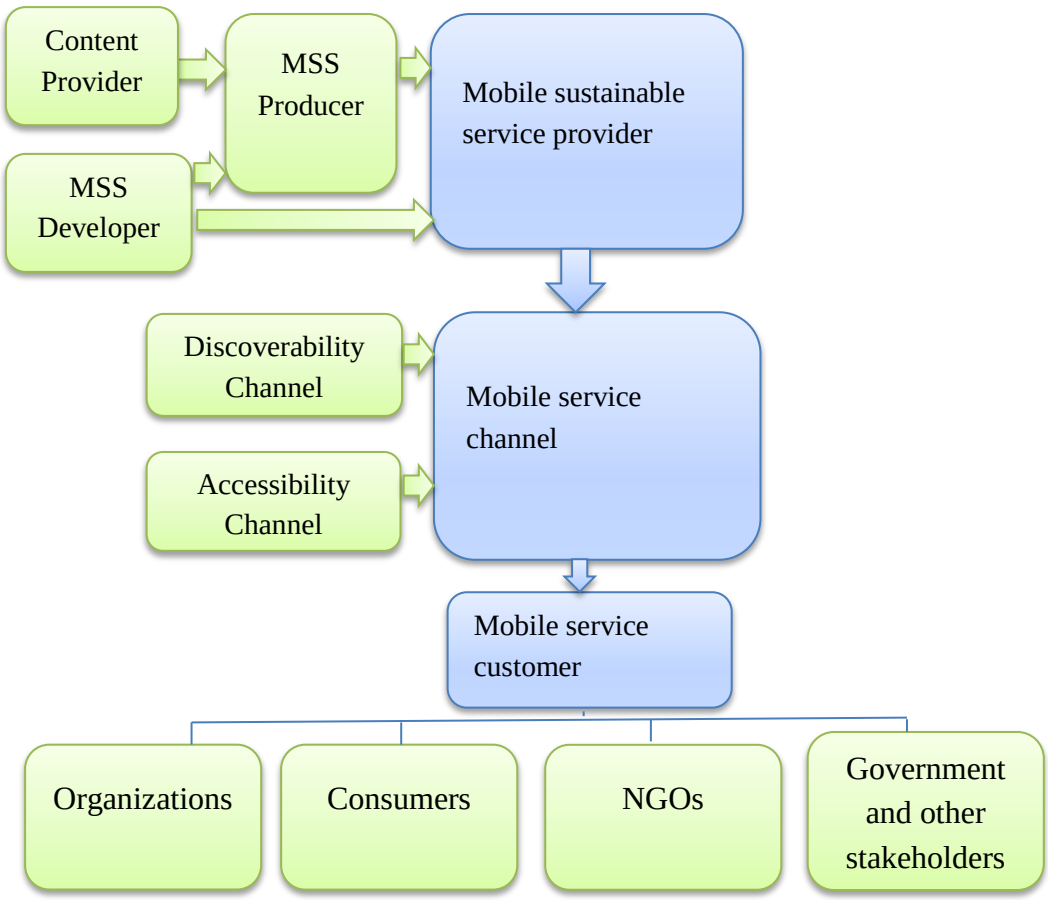


Figure 14. Mobile sustainable services value chain (Adapted from Barnes 2002).

As shown in Figure 14, the mobile sustainable services value chain encompasses service provider, service channel and customers. The players involved in mobile sustainable services value chain shown in Figure 14 are discussed elaborately below.

1. Sustainable service provider:
   a. MSS Producers - Those who publish the sustainable services through mobile technology and therefore create applications and services for mobile devices. Some players who are involved as producers are given below.
      - Mobile handset makers (The World bank, 2012)
      - 3rd party gaming and app companies (The World bank, 2012)
      - Government agencies, environment stakeholders, NGOs (Kushchu and Kuscu, 2004)
      - Service-based companies (Jasch et al., 2004)
      - Collaborations (Halme et al., 2006)

b. Content Provider - Those who deliver content which is used in the sustainable services deployed through mobile devices. For example, Nokia Life Tools mobile service worked with content providers like local state agricultural boards and meteorological departments for crop, market information and for climate, weather information respectively (Heatwole, 2010). Few examples of such content providers are given below to facilitate the understanding of players providing content.

- Reuter's market light – provides market related information like prices and market demand (Heatwole, 2010)
- Telecom operators (UNDP, 2010)
- Government and private owned medical and health centers (Plaza et al., 2011)
- NGOs specialized in issues like public health, labor conditions and women rights (UNDP, 2010)
- British council providing English language content through mobile devices (Newton, 2010)

c. MSS Developers - Those who are involved directly in coding and developing the applications and services to be deployed in mobile devices. There are different types of developers like individual developers who create and publish their mobile applications to consumers through different service channels. There are also 3rd party mobile app developing companies who specialize in creating mobile based services like TactioSoft[3] which develops applications on health and lifestyle domain. While companies like TactioSoft publishes their mobile services directly through service channels, there are also 3rd party mobile service developing companies like Accenture, CapGemini (Krauss, 2010) which provide software as a service to sustainable service producers. Some of MSS developers are listed below.

- 3rd party mobile service and applications developing companies (Krauss, 2010)
- Open source community based projects like Ushahidi (UNDP, 2010)
- Mobile vendors like Nokia who create services like Nokia Life Tools with assistance from 3rd party companies [4]
- Individual contributors (Holzer and Ondrus, 2011)

2. Sustainable service channel:
   a. Accessibility channel or access portals - Few years back when the mobile applications were not so very popular, many organizations working on sustainability services utilized SMS as the major platform to deploy their

services. In the case of SMS deployment, the accessibility channel is through the mobile network operator and the customer can subscribe to services by sending SMS to a particular number (UNDP, 2010). However, discoverability of these SMS services was difficult. In the current trend of mobile applications, the application developer publishes the mobile application on an access portal and the consumer can download onto the mobile device. Thus the access portals plays an intermediary role between developers and consumers, and also partly solves the discoverability problem faced by SMS based services (Holzer and Ondrus, 2011). There are different kinds of portals available and differs based on who has the control over the portal. A brief overview of different kinds of portals based on the discussions of Holzer and Ondrus (2011) is given below and is not discussed much, as it is out of scope for this study.

- Decentralized Portals – Developers can upload and distribute their applications on any third party portals like GetJar [5]. However, the consumers cannot get a comprehensive overview of all available applications for a particular mobile device. Centralized portals addresses to this problem.
- Centralized Portals – In this model, one single portal hosts all mobile applications and gives total control and competitive advantage to the portal provider. This method eases the job of developers, as it serves as a single point for publishing and sales. Also the consumers get an opportunity to access complete list of mobile applications. Apple's AppStore is an example of centralized portal.

Though centralized portals serves as a single point of publishing, the discoverability of mobile applications is distributed. Discoverability here refers to how a consumer gets the awareness or existence of a mobile application or service. Discoverability of a mobile service is very important to engage more consumers towards the service and is discussed next.

b. Discoverability channel - As with other internet or mobile based services, discoverability plays a vital role in exposing a mobile sustainable service to consumers. In the case of SMS and voice based services, the organizations deploying them adopt traditional advertising techniques like television advertisements and billboard banners to advertise their SMS and voice services (UNDP, 2010). However, most of the SMS and voice based services suffer from issues with discoverability like need to remember the subscription service number and keywords, no inter-operability between mobile operators and lack of repository database of available SMS services (Boyera, 2006). These

problems are far less in the case of mobile applications and there are many channels of discoverability as listed below.

- Mobile application portal search (Boyera, 2006). Many access portals like Nokia's Ovi store have dedicated channels like Green Channel [6] featuring mobile sustainable applications.
- Internet and mobile search engine (Boyera, 2006).
- Portals like AppAware which highlights the mobile app usage – downloaded and installed, by other people (Girardello and Michahelles, 2010). Also Facebook's AppCenter [7] is a recent example for mobile app usage based on one's activity and interests. This technique is in line towards the current trend of community update sharing.
- Distribution platforms which highlight mobile services and applications based on certain themes [8]. Industry-specific portals like mobileactive.org focusing on sustainable services could be called as distribution platforms.
- Developer marketing tools which equips the developers with paid tools like social media marketing tools to market their mobile applications and create a good exposure [8].
- Community centers like municipality health center, municipal educational boards.

Holzer and Ondrus (2009) explain that the players of the mobile services value chain are evolving and new entrants like Google and Android are disrupting the market structure. They pointed out that these new entrants have created new revenue streams for some players like access portal providers, while some players like content providers are integrated in early stages of the value chain.

With hundreds of mobile applications being added to the portals every week, the problem of mobile application and service discovery keeps increasing in the near future. Though the number of mobile sustainable applications and services added every week are not very high, it still faces the discoverability problem. However, as discussed by Abecassis (2012), the discovery problem could be partly attributed to the process of mobile application and service creation, which focuses on "build first, market later" attitude. Abecassis (2012) suggests that co-creation involving consumers to be part of mobile application design and creation could help developers gain mind share from consumers at an early stage. Some MSS like Nokia Life Tools [4] have already implemented co-creation partly and the success of the service underlines the significance of co-creation.

This understanding of players involved in mobile sustainable services value chain could be leveraged to analyze the driving forces of the value chain in the next section.

2.4.2. Driving forces influencing the value chain

Understanding driving forces is important for any activity that involves foreseeing the future like scenario building. As the purpose of this study is to identify avenues to increase adoption of MSS, driving force analysis of mobile sustainable services ecosystem would help identify the accelerators. According to Fleisher and Bensoussan (2007) driving forces are forces which cause things to remain as they are or to change. They add further that those forces which pushes toward change are drivers and those which restrain change are hindrances. In particular they define drivers as, "cluster of trends that create influences on changes to an industry's structure and a rival's competitive conduct". Therefore they claim that constructive transformation happens only when the drivers are more powerful and the hindrances are reduced. This concept could be pictorially illustrated as in Figure 15.

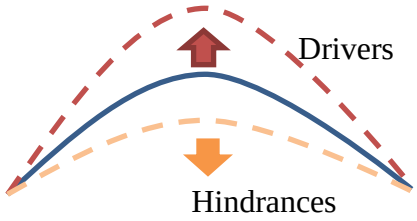


Figure 15. Illustration of drivers and hindrances.

Thus, it could be understood, in order to achieve increase in usage of mobile sustainable services, it is important to know the drivers and hindrances in its adoption. This knowledge would pave way to develop strategies to enhance the drivers and reduce the hindrances, thereby enabling to achieve the goal. In order to identify the driving forces in adoption of mobile sustainable services, it is important also to know if there is a definition of driving forces in the context of sustainable development. OECD's (1996) definition of driving forces in its Driving Force State Response (DSR) model, suits the study on hand. According to OECD (1996) driving forces are "human activities, processes and patterns that impact on sustainable development". This brief understanding of driving force analysis would thus set a stage to build a framework to identify the driving forces, along with the drivers and hindrances of mobile sustainable service adoption.

Mobile commerce or m-commerce is a mobile based service which is gaining traction now. Zhang et al. (2003) has discussed the driving forces of m-commerce success which would enable to create valuable m-commerce applications. Mobile sustainable service, though not known by this term or marketed as heavily as mobile commerce, the driving forces framework of m-commerce by Zhang et al. (2003) could be used for this study based on two reasons mentioned below.

1. Mobile sustainable service as with mobile commerce relies on mobile technology as the service channel

2. Mobile commerce is predicted to reach only 7 percent of electronic commerce in 2016 [9] and is in growth stage. In the same line, none of the mobile sustainable service categories mentioned in Section 2.3.2 found a place in the statistics about consumer behavior in mobile usage [10]. This clearly indicates that there is a greater room for growth in mobile sustainable services and its adoption.

Driving forces of m-commerce as expounded by Zhang et al. (2003) is applied to mobile sustainable service value chain and is illustrated pictorially in Figure 16 below.

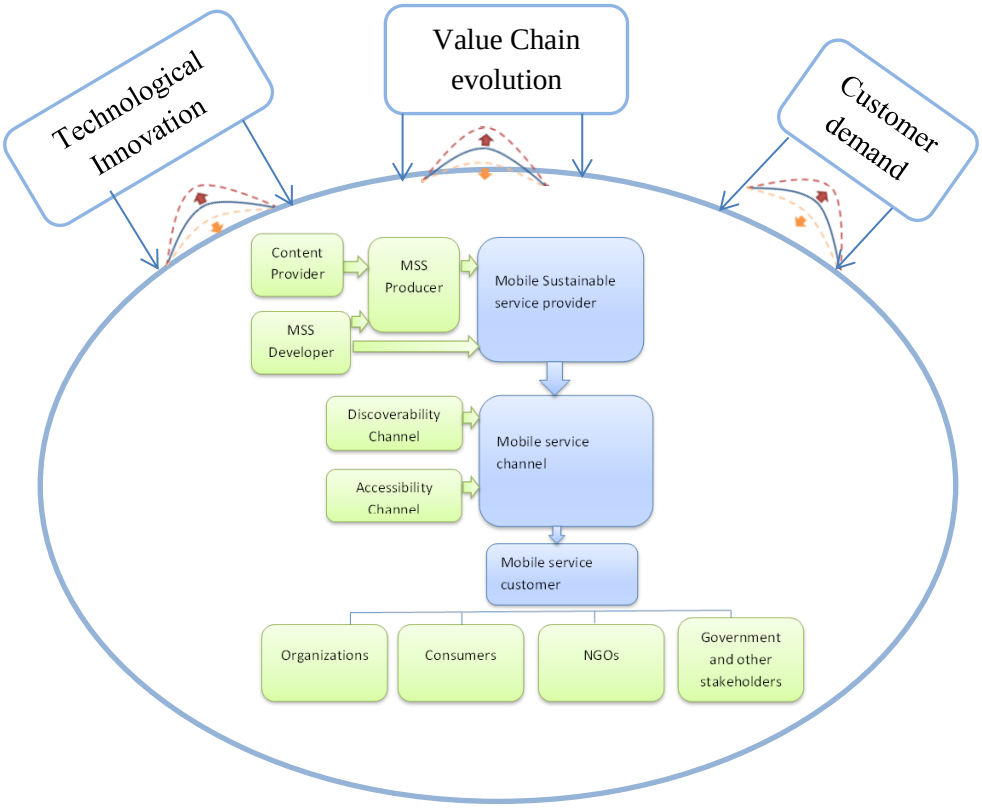


Figure 16. Driving forces of mobile sustainable services (Adapted from Zhang et al., 2003).

As shown in Figure 16, technological innovation, value chain evolution and customer demand are identified as three driving forces and how these driving forces are relevant from the context of mobile sustainable services is discussed below.

1. Technological innovation - Technological progress is likely to bring about some novel applications for mobile sustainable service. Several major technologies and improvements which are expected to have a significant influence on mobile sustainable services are identified through this driving force. Some of the subjects of analysis are with the capabilities of mobile devices, benefits and limitations of mobile networks, the accuracy of geographic location information, and security solutions.

2. Value chain evolution – In a value chain, each party plays its specific role and gets its own benefits. Customer service charges depend on how much value the user receives, so there will be different pricing and business models for individual services (Secker, 2001). According to Zhang et al. (2003), in the early days of mobile services, mobile operators owned major share of the mobile services value chain. However mobile handset makers like Apple have disrupted the mobile application store market and have captured a good share from the operators. It is also true in the case of mobile sustainable services that majority of the services were voice or SMS centric and thus reaped benefit to mobile operators. The mobile sustainable services have now leveraged the benefits of technology and are evolved as a competitive mobile service offering. However, the wireless network coverage is poor in many rural areas because of the poor infrastructure by the operators, as the profit margins on those places are very low. Despite this lack of infrastructure, services like Ushahidi [11] aims to provide complimentary web based services. The setback with these services however are that they are available and relevant only for particular demographics. Thus there is a greater room for value chain evolution in terms of mobile operator infrastructure support and discoverability of mobile sustainable services to take it to a global reach.

3. Customer demand – Zhang et al. (2003) raised the point of availability compelling content to generate active customer usage of mobile applications. While this could be true for mobile sustainable services, the UNDP (2010) report on mobile technologies and empowerment elucidate the major problem of customer adoption of these services as, "Many people simply do not know what is available, how to access and use what is there, what rights and risks are involved and what can be achieved with mobile applications and other digital technologies."

   There is a need to raise awareness and to educate people on the many possibilities generated by new mobile technologies, such as in m-governance and service delivery (Zefferer, 2011). Instead of waiting for killer applications to stimulate passive consumers, as Zhang et al. (2003) proposes for m-commerce, fundamental consumer demand is the active force that can improve the chance of increased adoption of mobile sustainable services. This could be achieved by making them realize the additional value these services provide to their lives, while at the same time provide means to spread this positive message to their social circle. Realization of additional value could be deployed by leveraging mobile technology as a complimentary offering to meet larger citizen development projects (UNDP, 2010). The UNDP report underlines that instead of promoting mobile based services as technologically

efficient and brings in productivity, it will reach masses only when it is viewed as a platform of robust human development initiatives.

It could be seen that these three driving forces place more emphasis on adoption of mobile technology based services and did not take into account the sustainability aspect in it. Therefore in order to arrive at a comprehensive framework, it becomes imperative to identify driving forces from the context of sustainable development and compliment it to the framework shown in Figure 6. Bleischwitz et al. (2007) has analyzed the driving forces from sustainable development perspective, in their report to European Commission's project on "The links between the environment and competitiveness". The study by Bleischwitz et al. (2007) is extrapolated to mobile based sustainable services and a summary of driving forces is discussed below.

1. Technological progress - The technological progress in mobile domain augments the adoption of sustainable development in various ways like empowering groups working on sustainable issues like education, rural entrepreneurship and health to make their services effective (UNDP, 2010). The UNDP (2010) report suggests that, technological progress helps to take mobile sustainable services to a larger audience when the services are designed duly taking into account various factors like gender, literacy, income level and family size etc.
2. Structural change in demands –Bleischwitz et al. (2007) has indicated a change in the structure of demand in the coming years towards service sectors and new sustainable oriented products, change in consumer preferences towards less material needs like car-sharing, more inclination towards eco-friendly goods. Mobile services could influence and enable the shift of consumers towards more eco-friendly lifestyle In addition, Bleischwitz et al. (2007) noted that, "institutional factors like the level of environmental legislation, the influence of the ecologically oriented part of population and the importance of environmental issues in the social discourse also have an impact on the consumption of raw materials".

3. Legislation and policies – According to Environmental Kuznets Curves (EKC) hypothesis, the level of environmental pollution will increase in the coming years and with rising per capita income, the demand for better environmental conditions will also increase (Mazzanti et al., 2007). Bleischwitz et al. (2007) expounded that the EKC hypothesis would create a political pressure for the introduction of environmental regulations and minimum standards. This would create demand for mobile based services to showcase company's compliance to the standards, assist customers to make the choice or come up with new solutions based on mobile devices.

Among these three driving forces, technological progress could be mapped to technological innovation illustrated in Figure 16. Addition of other two forces to the illustration in Figure 16 would lead to a comprehensive list of driving forces of mobile sustainable services from a technology and sustainable development perspective and is shown in Figure 17.

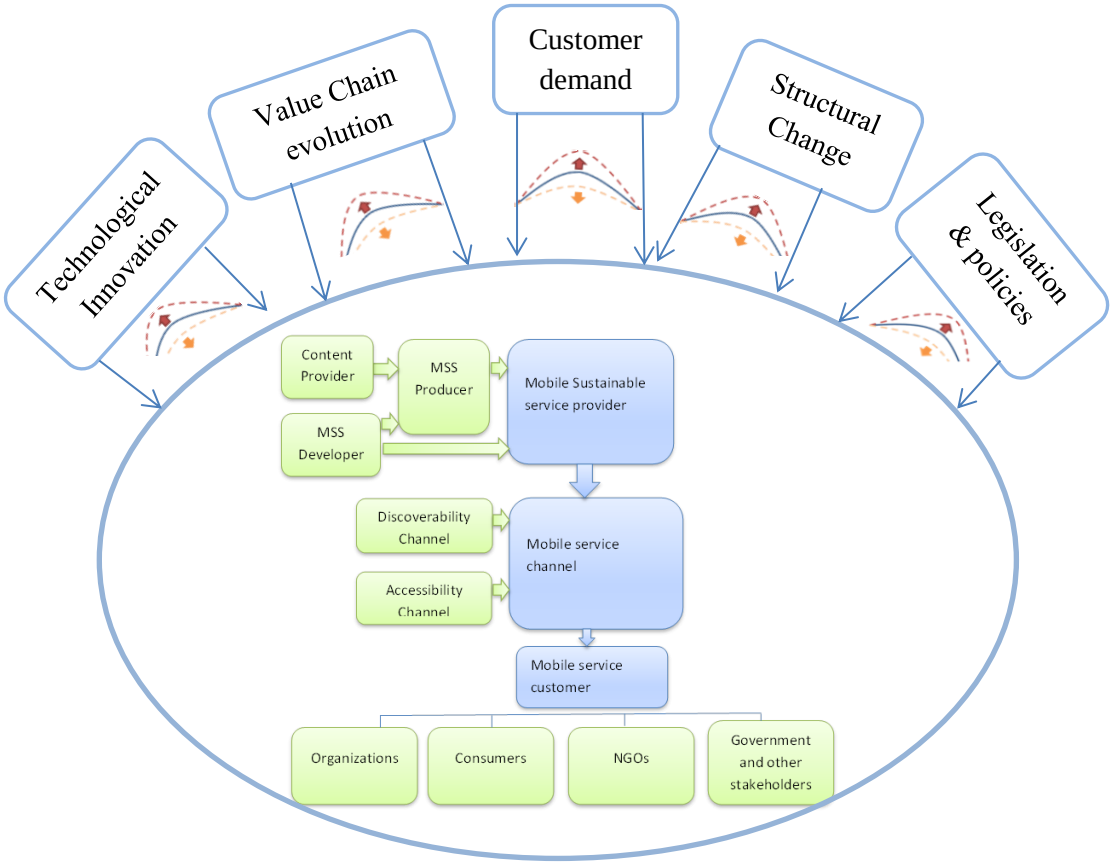


Figure 17. Comprehensive list of driving forces of mobile sustainable services.

As could be seen in Figure 17, the driving forces influence the entire MSS value chain and a profound study of the influence from a particular player's perspective would help to identify strategies augmenting that player's interest. As this study focusses on identifying avenues to augment customer usage of mobile sustainable services, it is important to understand the influence of driving forces from a MSS customer perspective which is discussed in next Section.

2.4.3. Driving forces from customer perspective

As discussed in Section 2.1.2, the customers of mobile sustainable services are namely, organizations, consumers, NGOs, government and environmental stakeholders. The adoption of MSS by these customer segments depends highly on the drivers which motivates them to use. The discussion of driving force analysis in the previous section laid emphasis also on the hindrances, which would restrain customers from using the services. Therefore to identify the possible ways to accentuate customer usage of MSS,

it is important to understand the drivers and hindrances, for each of the five driving forces identified in the previous section. This is discussed in detail in this section. The drivers and hindrances of customer's adoption, when latest technological innovations are used in mobile sustainable services are shown in Table 4.

Table 4. Drivers and hindrances of technological innovation.

Technological Innovation	
Drivers 	• Proliferation of internet infrastructure and availability (UNDP, 2010) • Increased integration of different accessories like sensors, robotics with mobile technology (The World Bank, 2012) • New modes of user interaction like gesture recognition could bring in innovative applications and increased participation (Berg et al., 2003) • Increase patient involvement in treatment and equip them with self-management programs (Handel, 2011)
Hindrances 	• Intermittent mobile network and internet availability (Kim et al., 2002) • Low technology self-efficacy which refers to the degree of confidence in using high-tech devices (Sarker and Wells, 2003). The reason for it could be many things like illiteracy, age and the interest in the high technology oriented applications • User Interface for mobile services getting complicated (Sarker and Wells, 2003) • Problems with mobile services discoverability (Girardello and Michahelles, 2010)

Value chain evolution as a driving force; foresee how the ecosystem could evolve in the near future. Therefore, the drivers are identified based on the latest trends in mobile services and sustainability domain and shown in Table 5. The literature review does not hint any new hindrances that would restrain customers from using the services.

Table 5. Drivers and hindrances of value chain evolution.

Value chain evolution	
Drivers 	• Social and community networking is seen as the big leap influencing group behavior change. Therefore technologically mediated social communication can create positive environmental attitudes (Dumont and Brison-Chraniotis, 2008). This could create new opportunities for mobile based services.

	• Mobile application and mobile web app support would soon be perceived as adding value to a brand (Ruquet, 2011) • There is a shift in the focus of market orientation from end-customer towards encompassing whole stakeholders in the value chain (Crittenden et al., 2011). This would create new demands in service dynamics which in turn would need sophisticated solutions using mobile technology. • Sustainability marketing concept is on the discussion in many literatures and mobile technology could be a better platform to augment the concept of sustainability marketing. According to Belz and Peattie (2010) sustainability marketing places emphasis on long-term orientation of relationship marketing with a holistic approach to consumer behavior.
Hindrances 	None identified

The literature review indicated that there would be an increase in demand for the mobile sustainable services and many drivers influencing the customer adoption is shown in Table 6.

Table 6. Drivers and hindrances of customer demand.

Customer demand	
Drivers 	• Community following of a particular service creates ripple effect and hence more participation (Sarker and Wells, 2003) • Increase in crimes has created increased interest towards personal privacy and security applications (UNDP, 2010) • New ways to engage employees and community groups to embrace sustainability in their day to day life and actions (Haugh and Talwar, 2010) • Motivated highly by social identity gained through participation and contribution in leading eco-friendly lifestyles (Ozaki, 2009). • According to Dobers and Strannegard (2005), sustainability is more perceived as a utopian concept and therefore could be abandoned. Thus they propose the concept of aesthetic consumption centered on sustainable design of products and services.
Hindrances 	• Lack of clarity in the information passed about eco-friendly lifestyles (Ozaki, 2009). This reflects in customer's buying behavior with respect to products and services like green electricity.

Mobile phones phenomenal reach even in rural and remote areas enables more structural changes that could happen in mobile sustainable service ecosystem. The drivers identified showed the possible emergence of new communities, information systems that would augment the customer usage of MSS. The drivers and hindrances in customer adoption because of structural change as a driving force are shown in Table 7.

Table 7. Drivers and hindrances of structural change.

Structural change	
Drivers 	• Increased availability of mobile services and its adoption could reduce the pricing of network charges (Sarker and Wells, 2003) • Emergence of new communities of interest, communities of transaction, communities of relationship around sustainable development (Ahmed and Hardaker, 1999) which could be enhanced by mobile services • Need of new information systems to promote environmental sustainability which influences Belief-Action-Outcome framework (Melville, 2010). The Belief-Action-Outcome framework focusses on stimulating beliefs about environment sustainability to people and transforming it to actions and produce tangible outcome. • Collaborative leadership among different stakeholders (government, business and NGOs) of sustainable development creates new roles and structures. For example, Greenpeace partnered with a German appliance manufacturer to produce 'Greenfreeze', an ozone sensitive refrigerant technology and catalyze industry-wide adoption of technology (Hartman et al., 1999). • Attractive services replacing product usage and owning a product (Tukker, 2004)
Hindrances 	• Collaborative leadership from different stakeholders often involves more bureaucratic work which is time consuming (The World Bank, 2012)

Legislation and policies is an important driving force which has the power to increase the adoption of mobile sustainable services by organizations and other stakeholders. While this true, it is also important to note that it might take long time to get them implemented. Several projects like SPREAD 2050 commissioned by European Union strives to develop policies promoting sustainable lifestyles which would be relevant from the customer perspective.

The drivers and hindrances of customer usage because of legislation and policies are shown in Table 8.

Table 8. Drivers and hindrances of legislation and policies.

Legislation & policies	
Drivers 	• Increasing interest towards online reporting for communicating sustainability issues (Isenmann et al., 2007). This would enable transparency in company's sustainability oriented activities and also a possibility to have dialogue with all stakeholders. • Environmental policies created to ensure that companies reduce their environmental impacts (Groezinger and Tuncer, 2010).
Hindrances 	• The approach towards sustainability by treating it as a triple bottom-line comprising of economic, social and environmental aspects itself would be problematic with ideologies of capitalist market-economy (Scerri and James, 2010). Therefore it gives a strong message that it is important to communicate the value proposition of mobile sustainable services with utmost tactic.

It has to be noted that the drivers and hindrances identified here are few and there could be many more from the literature. The list provided here could be a reference for further elaborated research on this subject.

3. RESEARCH METHOD AND MATERIAL

3.1. Data gathering methods employed

The focus of this study is to understand landscape of MSS ecosystem and identify ways to augment customer usage of those services. In order to achieve this research objective, the study employs qualitative research with a combination of multiple data gathering methods. Chapter 2 has laid theoretical basis about MSS ecosystem and a driving forces framework from customer perspective. The empirical data is collected with an aim to apply it to the theoretical framework developed in Chapter 2, and thereby shed light on how the framework is seen in market reality. This kind of process could belong to deductive approach as opposed to inductive approach used in qualitative research. This deductive approach adds value to the study in hand, as the focus of the study is to understand landscape of MSS ecosystem and to augment the customer usage. Table 9a describes the list of aspects which are analyzed and the respective data gathering methods employed.

Table 9a. Data gathering methods employed.

S.no	**Analysis Perspective**	**Data gathering methods employed**
1	Landscape analysis of MSS	A set of hundred MSS from mobile services market is collected based on snow ball sampling.
2	Inputs from organizations segment	Web based sustainable surveys from twenty targeted organizations.
3	Inputs from consumers segment	Twitter based focus group discussions, thematic interviews.
4	Inputs from NGOs segment	Thematic qualitative interviews.
5	Inputs from government and other stakeholders segment	Thematic qualitative interviews.
6	Inputs from sustainable service providers	Thematic qualitative interviews.

As seen in Table 9a, this study employs multiple data gathering methods because of various reasons like,

- The target group for empirical data belongs to different societies like rural and urban mobile consumers.
- This study is not confined to analysis of MSS in a particular region, rather discusses it from a general overview. Therefore aims to seek inputs from different sources across globe, which demands to employ different data gathering methods like telephonic interviews and web based surveys.
- Limited accessibility to government based organizations.

The reasoning for choosing the particular data gathering method shown in Table 9a is discussed in detail below for each of these aspects.

The landscape analysis of MSS demands knowledge of current offerings in market. Despite this market came into existence only few years before, the services currently offered are aplenty. There are various sustainable services groups in social media namely LinkedIn and Twitter which had mentions of several sustainable services offered using mobile technology. Also, forums like mobileactive.org provided a repository of mobile tools related to social sustainability. Thus a thorough study is carried out on these sustainable services offered using mobile technology in the market currently. In order to facilitate analysis of these services using theoretical framework, a list of hundred services spanning different sustainable development areas is chosen, based on snow ball sampling. The satisfactory criteria used for selecting the hundred services are,

- Services which offers solution to a sustainability issue
- Mobile applications and services with good reviews quoted in social media
- Using mobile technology as the prime or complimentary channel for service offering
- Currently active and have user base

As the study focuses on augmenting customer usage of MSS, it becomes imperative to collect opinions from different customers of mobile sustainable services in some form. Organizations working on sustainability domain are spread world-wide and are difficult to reach. Therefore, a web based multiple choices sustainable survey was sent to 20 organizations and received 19 responses. The survey method was chosen as it would take less time for these organizations to respond. Apart from the answer options in the survey, a free form column is provided for the participants to share their views about the survey question. These twenty organizations are identified from Twitter groups which are working on sustainability oriented activities. The organizations are chosen based on their active user base and correlation of their activity with mobile technology. The list of

organizations to whom the survey is sent and the survey questions are presented in Appendix 2.

The perceptions of mobile customers from urban, was collected by conducting a focus group discussion using Twitter. This method is chosen in order to receive inputs from different parts of the world and engage it in the form of discussion. Twitter provided a generic platform for interested individuals to share their opinions, without the need to register or join some virtual conferences. The discussion is centered on sustainable lifestyle and behavior, and the figure illustrated in Appendix 3 is used as a guiding theme. The participant invitation is sent to some university student forums, workplace forums and twitter groups, and the list of participants is attached in Appendix 4. The discussion saw participation of 8 people from 3 countries in student and working background. In the case of rural mobile customers, a thematic qualitative interview is conducted with an agricultural entrepreneur based in a rural village in India. The interview is based on open ended questions on the driving forces identified in theoretical framework. Information about the interviewee is presented in Appendix 5.

The response from NGOs on the driving forces identified in theoretical framework was obtained through thematic qualitative interviews. Two NGOs involved in sustainability oriented activities, operating in Tampere region consented to provide their inputs. To understand the global picture two international NGOs namely World Wildlife Fund (WWF) and United Nations Educational, Scientific and Cultural Organization (UNESCO) were approached and got response from one of them. As the activity of these NGOs differed from each other, it was decided to conduct thematic interviews based on their activity. The interviews are open ended questions related to the driving forces framework. Information on personnel participated in the interview is presented in Appendix 5.

Inputs from Government and other stakeholders related to MSS were obtained through thematic qualitative interviews. As the awareness about MSS among the personnel in this segment is low, there was a need to present an overview about MSS to them. Therefore, open ended thematic qualitative interview in line with their area of activity was chosen to receive their inputs. Tampere government based project assisting energy objectives of Tampere city consented to provide their inputs. In order to get perspective from an international context, a Euro-planning adviser from European Union who has initiated a LinkedIn group on sustainable services was contacted. An open ended list of question based interview was used to obtain inputs from the adviser, as he is based in Italy. Information about the participant is presented in Appendix 5.

In addition to the afore-mentioned customers' inputs, it is also important to understand the sustainable service provider perspective which would add value to the driving forces framework. In particular, the challenges faced by the provider in deploying the services could be used to correlate with customer experience. Therefore, thematic qualitative

interviews were obtained from two sustainable service providers namely Motiva and Nokia with respect to mobile technology. As these two companies have broad service portfolio, thematic qualitative interview method is chosen to facilitate open discussion about the sustainable services and their activities in that domain.

3.2. Research process

Sustainability as a concept and services around sustainable development is discussed in literature, by corporates and other stakeholders. However, as mentioned in Section 1.1, sustainable services offered using mobile technology are not conferred a terminology and would be addressed in this study as mobile sustainable services. Therefore, in Chapter 2, considerable amount of time is spent in establishing what a mobile sustainable service is about. Later, a comprehensive framework comprising of MSS value chain, its service categories and driving forces is presented in Chapter 2.

As mentioned in Section 3.1, this study employs different data gathering methods for different customers. Therefore it becomes imperative to understand how different empirical data is used in this study. Information about how these empirical data is used and analyzed in this study is shown by extrapolating a column in Table 9a and is presented in Table 9b.

Table 9b. Utilization of collected empirical data

S.no	**Analysis Perspective**	**Data gathering methods employed**	**Utilization of empirical data**
1	Landscape analysis of MSS	A set of hundred MSS from mobile services market is collected based on snow ball sampling.	The list of 100 MSS is analyzed and categorized based on theoretical framework in Section 2.3.2. Performed a compare and contrast study of theoretical framework and market offering.
2	Inputs from organization segment	Web based sustainable surveys from twenty targeted organizations.	The analytics from the survey results is properly grouped under appropriate drivers and hindrances of the driving forces.
3	Inputs from consumers segment	Twitter based focus group discussions, thematic interviews.	In the case of twitter discussion, each conversation from the participants is assimilated and validated against the drivers and hindrances identified. The conversation is then highlighted under appropriate driver or hindrance. In the case of interviews, which were

			conducted with the driving forces as a guiding theme, the inputs are highlighted under appropriate sections.
4	Inputs from NGOs segment	Thematic qualitative interviews.	The inputs from the interviews are directly correlated under respective drivers and hindrances and highlighted under those sections.
5	Inputs from government and other stakeholders segment	Thematic qualitative interviews.	The interview inputs are digested and presented under appropriate drivers and hindrances section.
6	Inputs from sustainable service providers	Thematic qualitative interviews.	The responses of the interview participants are grouped under appropriate drivers and hindrances section.

As seen in Table 9b, all the interview inputs are assimilated and analyzed to group under relevant drivers and hindrances section for each driving force. The interview responses highlighted are verbatim and quoted with the respective participant identity. This ensures the validity of the highlighted interview statements. In addition, each of the driving force analysis is complimented with key take away point inferred from the highlighted empirical data, which is then reflected and criticized.

The collection of empirical data responses, key take away point and its reflections are then analyzed for various driving forces. This response analysis provides insights about how the drivers and hindrances are weighed from customer's perspective. Indeed, the analysis also includes some references about customer experience from the service provider's point of view.

The landscape analysis based on the compare and contrast study of 100 MSS along with the response analysis is summed up and added to the theoretical framework. The resulting integrated framework highlights the ways to boost customer usage of MSS through new untapped opportunities and also essential service design and concepts which are essential from customer perspective.

Figure 18 below shows pictorially the process undertaken to achieve the objective set in this paper.

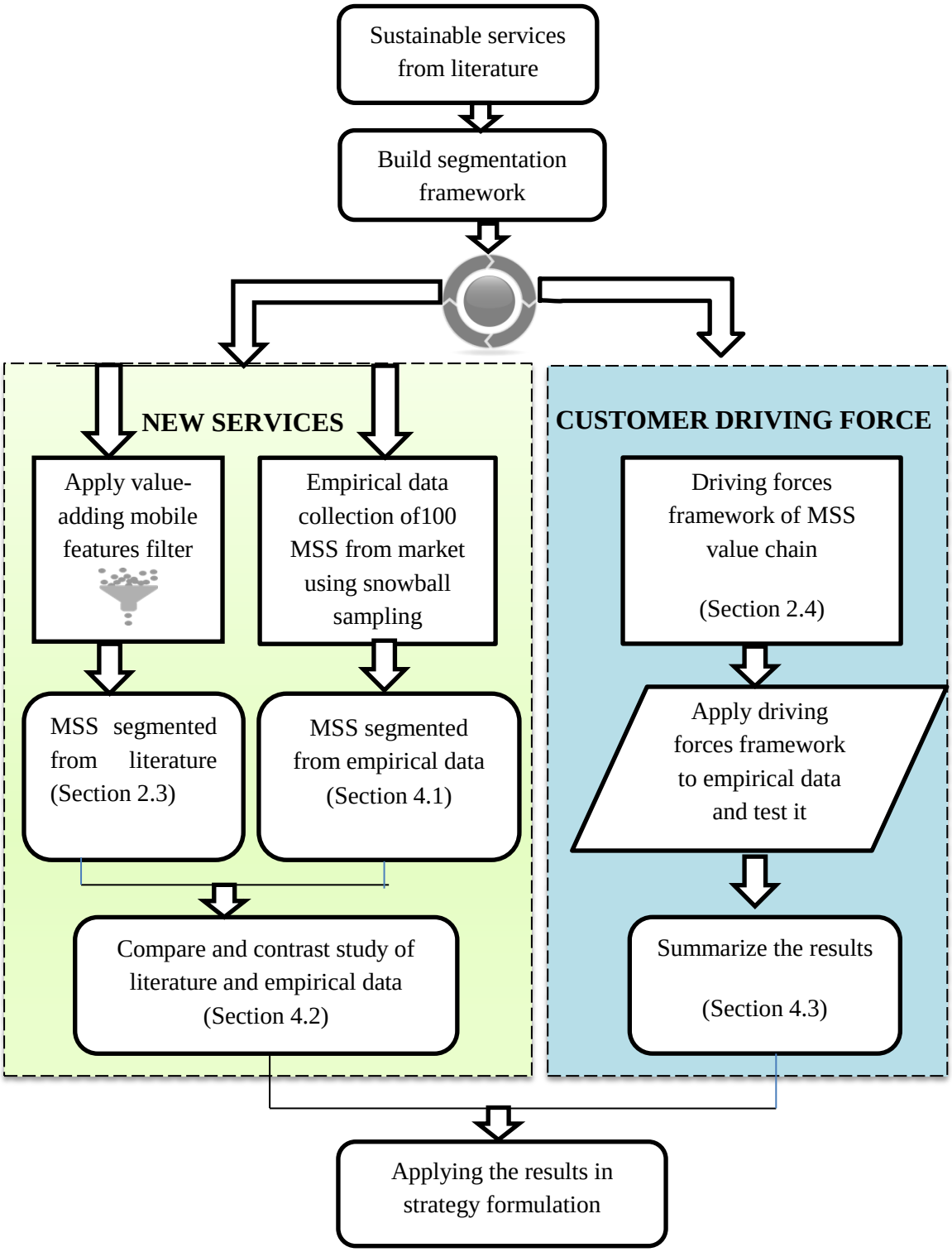


Figure 18. Research process carried out.

Figure 18 illustrates the process carried out in achieving the objective to figure out the coherence between theoretical discussion and market scenario. This chapter described the research process employed in this study.

4. MOBILE SUSTAINABLE SERVICES – AS PERCEIVED FROM THE MARKET

4.1. Mobile sustainable services on the market

There are a plethora of mobile applications and services offered currently in the market. In order to understand current market environment of MSS, a list of 100 MSS offered in various mobile devices is collected. The criteria used for selection of 100 MSS are elucidated under research process in Section 3.2. In order to understand the service characteristics and the target customers of mobile sustainable services better, it is important to gain knowledge about MSS ecosystem. The theoretical framework of service oriented architecture described in Section 2.1.2 is used for this purpose of understanding MSS ecosystem. Thus the groups characterizing the MSS ecosystem namely MSS provider, MSS channel and MSS customer are also included for each of the 100 MSS identified. An example is shown in Table 10 elucidating how the 100 MSS is analyzed along with the groups characterizing the ecosystem.

Table 10.An example for analysis of MSS.

Mobile Sustainable Service & Application	**MSS Provider** 	**MSS Channel** 	**MSS Customer** 
Farmer's friend (www.google.co.ug/mobile/sms)	Google	sms based, mobile web	Farmers
Climate Mission	Nokia	Ovi Store	Consumers interested in playing games and ecofriendly lifestyle

The two mobile sustainable services mentioned in Table 10 are explained elaborately below.

- Farmer's friend is a SMS based mobile service which provides agricultural market information to farmers. The service is spearheaded by Google and developed in association with MTN Uganda and a local NGO BROSDI. Uganda farmers could start using the service by sending a SMS.
- Climate Mission is an ecologically themed game helping the user to learn more about climate change. It was developed by Nokia and is available to customers of Nokia mobile phone through their web-portal Ovi store.

This ecosystem group analysis of 100 MSS shed light on different mobile sustainable services from various MSS producers. A brief discussion on different players involved in producing these services is given below.

1. **Mobile Vendors/Mobile Operating System:** Around 7% of MSS applications are created by Mobile vendors for a particular mobile operating system (OS). They are developed by the owners of the mobile OS or by 3rd party app companies and have the possibility of getting pre-installed in mobile phones, for example 'Nokia Life Tools'. These applications are usually available through mobile vendor native app store or in some cases mobile OS app store like Android Market. From the analysis it is found that most of these applications targets consumers and only very few are available for NGOs like 'Nokia Data Gathering', 'Open data Kit'.
2. **3rd party gaming and app companies:** Approximately 60% of MSS applications are created by parties other than the owner of the mobile OS. They include individuals, gaming and application developing companies and open source communities. Most of these MSS applications are published in the mobile vendor/mobile OS hosted app store. Some 3rd party companies publish these apps in their own websites, for example Herocraft [12]. In addition to that, there is ample number of 3rd party app stores available which could be used for publishing these apps (see Appendix 2). While most of these MSS applications target consumers, there is an increase in number of applications developed by third party companies for mobile health. For example 'Rx Vigilance' application by Tactio enables drug and disease references for health care professionals.
3. **Government agencies:** City councils in many countries have started involving in promoting sustainable design and lifestyles. For example Albury city council in Australia has been very active in promoting sustainability among its residents [21]. Many city councils like 'City of Boston' have taken a step ahead and promote sustainable lifestyle through mobile phone applications like Citizen Connect. This shows a favorable trend towards mobile sustainable services. While these applications are available only through the Mobile vendor/OS hosted app store, the visibility for such apps are created by providing a link to them in the city council website [13].
4. **Environmental stake holders:** Eco-friendly companies like Electronic Recyclers International [14], Treehugger.com [15] sees offering their sustainable services through mobile phones as an opportunity to reach more customers. These applications are usually created by 3rd party companies and in some cases for example 'LeafSnap' application, are created by collaboration with universities. However as mentioned earlier, though these mobile sustainable services are available at mobile vendor/OS hosted app store, they are often entered through the provider company websites.

5. **Service based companies:** There are several service based companies like green tourism, green transport, organic dining which can be considered as eco-friendly companies. These companies find it extremely important to provide their services through mobile. For example DogFriendly.com provides app named 'Organic Travel Mobile'. Most of these applications are 3rd party developed and also hosted on third party app stores.
6. **Collaborations:** The increasing reach of mobile phones and its impact on people's lives has triggered collaborations of universities, local NGOs, open source communities and companies to develop mobile sustainable services. Open Data Kit is a good example for this collaborated effort resulting in an open-source suite of tools for mobile data collection. It is a joint effort by researchers of University of Washington, NGO Change and Google [16]. University of Washington and NGO Change actively participates in this collaborated effort and has created many MSS applications [17]. Group Complete is a famous data collaboration tool used by NGOs and is created based on Open Data Kit by Radical Dynamic, a socially responsible company. Some companies like Rock Health forerun the digital health ecosystem and support open source community development of mobile health related application [18]. Around 12% of the identified 100 MSS is a result of collaborated effort.

The distribution of 100 MSS by different producers is shown pictorially using the pie chart below.

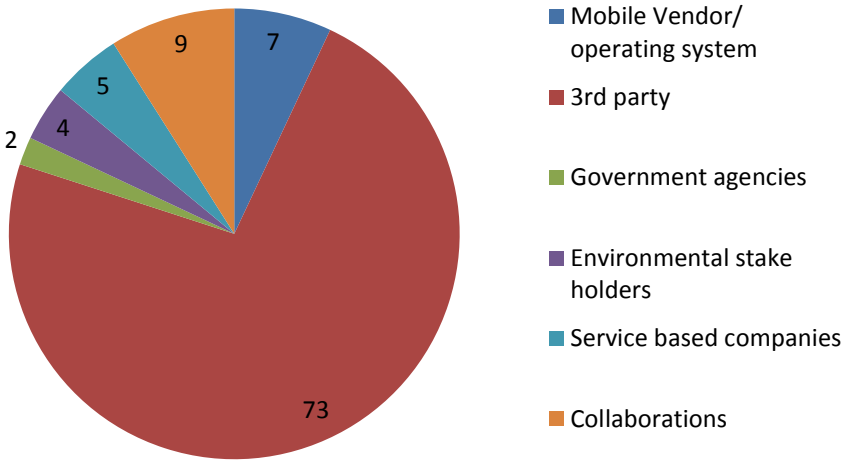


Figure 19. Distribution of 100 MSS by different MSS producers.

As it could be seen from Figure 19, a whopping 73% of MSS is produced by 3rd party companies. The mobile sustainable services quoted above are just a few and there are hundreds of such applications and SMS-based services available currently. The ecosystem group analysis done in this chapter gave a good overview of the MSS on

the market and different producers involved. One of the objectives of this study is to identify new service possibilities in mobile sustainable service domain. This could be achieved by categorizing these 100 services under appropriate customer segments and group the related services under service categories and is carried out in next Chapter.

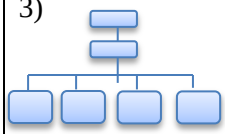
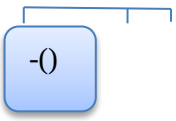
4.2. Segment and service category of mobile sustainable services

4.2.1. Segment and service categories

The four segments of sustainable services and different service categories identified for each segment, through literature review in Section 2.1.2 are used as a base to categorize the list of 100 MSS. Based on what the mobile sustainable service is about and its user, the service is classified to appropriate segment identified in Section 2.1.2. The service is then analyzed against the service categories identified by literature review to see if it matches with any of them. Those services which fit in the service category identified by literature are classified under same name as found in the literature. Those services which do not fall under any of the service categories identified by the literature are categorized under names that suit the service better.

The list of 100 MSS is therefore classified into respective segment and service category based on reasoning mentioned above. An example of how the classification made is shown in Table 11 below.

Table 11. Sample list of MSS and its segment and service category.

S.no	**MSS & Application**	**About**	**Segment Category** (Fig 3) 	**Service Category** (Figs 6-9) 
1	Farmer's friend	Provides agriculture market information to farmers	Consumer	Livelihood
2	Cohort mobile lite	Project Management for relief providing organizations	NGOs, sustainable stakeholders	Project Management

Farmer's friend service mentioned in Table 11 is used by farmers and thus belongs to the consumer segment. As the service enables livelihood opportunities for farmers by

providing real time market information, it matches the livelihood service category of consumer segment as identified by the literature review. The second service 'Cohort mobile lite' in Table 11 provides project management service to organizations working on relief during crisis situations. This is particularly used by NGOs working on these relief works and thus categorized under NGO segment. The prime focus of the service is on Project Management and could not be matched against any of the service categories identified by the literature review. Thus it is named under a new service category called 'Project Management and work plan' in accordance with the focus of that service.

Similar reasoning is applied to rest of the MSS. Those services which could not be grouped under the service categories identified by the literature review are categorized as new service categories. Section 4.3 discusses the list of new service categories and an analysis on those with respect to the literature review.

4.2.2. Analysis of new service categories from empirical data

The segment and service category analysis carried out in Section 4.2 identified the need of new service categories which was not discussed in the literature. The list of mobile sustainable services which could fall under new service categories sums to a total of twenty four, which is around quarter of the total hundred MSS. This would indicate that the current trend in sustainable services offering using mobile technology is heading to a new direction. The list of new service categories identified is shown in Figure 20.

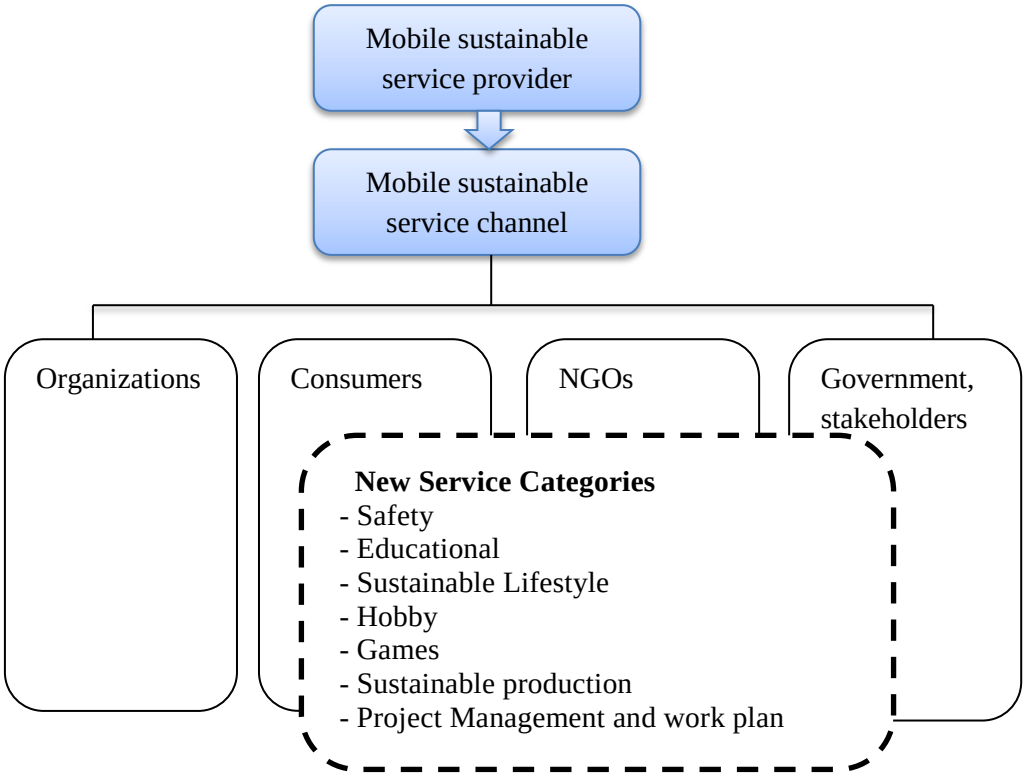


Figure 20: List of new service categories identified from market offering.

From Figure 20 it could be seen that new service categories adds up to the already identified service categories under consumers, NGOs and government segments. As some of the new service categories are identified on more than one segment, the list of new service categories is shown spanning across all the three segments. This list of new service categories has to be analyzed thoroughly before grouping it under a particular segment. It can also be understood from Figure 20, that there are no new service categories identified under organization segment.
The service category split up of those identified from the literature and new service categories from the empirical analysis is shown pictorially in Figure 21.

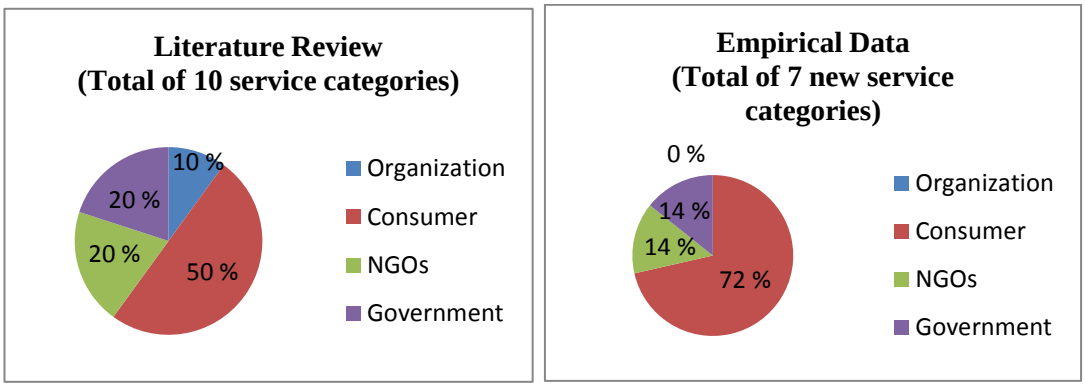


Figure 21. Split up of service categories identified from literature and empirical data.

It is also important to highlight the presence of some service categories in the list of 100 MSS which falls under service categories identified by literature review in Section 2.1.2 but do not fulfill the evaluation of mobile features criteria as discussed in Section 2.2.2. An example for this could be a mobile sustainable service named ecoLamp which is used to calculate energy and environmental benefits of replacing light bulbs. This mobile application is categorized under consumer segment in energy management service category as discussed in Table 3 in Section 2.3.2. This service category though identified by the literature review is not chosen as possible sustainable service that could be offered using mobile technology, based on the evaluation in Section 2.3.2. This would indicate a lack in mobile features identified by Section 2.2.2. However it could be understood that this process of comparing the segment and service categories identified by literature review with segmentation of those services available in the market provides informative insights that enriches both academic literature and the mobile sustainable services market.

4.3. Market dynamics of mobile sustainable services ecosystem

4.3.1. Driving force analysis from the customers

The driving forces analysis elaborated in Section 2.4.2 and Section 2.4.3 gave a good overview on the significance of the analysis. Understanding driving forces is important

for scenario building and it is important to analyze how they are perceived in reality. Therefore, the framework of drivers and hindrances identified for five driving forces is used as a guiding theme for empirical data collection. The drivers and hindrances are translated to appropriate questions that are relevant to each of the four customer segments and the responses are collected. When the responses were analyzed, it was observed that, while there are many affirmations to these drivers and hindrances, there were also few denials. Therefore, this section summarizes each of the drivers and hindrances, along with affirmative and denial responses. This summary would therefore highlight how the theoretical framework is perceived in reality.

The responses relevant to a driver or hindrance are grouped and listed under respective drivers and hindrances. These responses are accompanied by the empirical data source and the participant involved, where needed. The list of data sources along with how they are referenced in this results section is shown in Table 12.

Table 12. Empirical data source and reference methods.

S.No	**Empirical data source**	**Referred as**	**Participants referred as**
1.	Survey from sustainability oriented organizations	Sustainability survey	Does not apply, as the participant identity is not known
2.	Twitter based focus group discussion	Twitter discussion	Participants are referred by the serial number in Appendix 4
3.	Thematic interviews	Interview	Participants are referred by the serial number in Appendix 5

As could be seen in Table 12, participant identity of sustainability survey data source is not available and therefore cannot be stated. However, answers provided in free form column are addressed by the question number of the survey. As mentioned in Table 12, the participants of Twitter discussion and thematic interviews are referred by the serial number in respective Appendices. For example, “Twitter discussion, participant 1” refers to participant in serial number 1 in Appendix 4. The affirmative response for each driver and hindrance is highlighted in green color and denial response is highlighted in red color. The essential crux from the responses is presented below each driver and hindrance under the title “Key take-away points and critique”.

In order to facilitate better readability, each of these driver and hindrance is referred by a short name as shown in Table 13.

Table 13. List of reference names for drivers and hindrances.

S.No	**Driver or hindrance identified**	**Referred as**
Technological innovation - driver		
1.	Proliferation of internet infrastructure and availability	Mobile internet
2.	Increased integration of different accessories like sensors, robotics with mobile technology	Mobile accessories
3.	New modes of user interaction like gesture recognition could bring in innovative applications and increased participation	Advanced UI (user interface)
4.	Increased patient involvement in treatment and equip them with self-management programs	Mobile health
Technological innovation – hindrance		
5.	Intermittent mobile network and internet availability	Network issues
6.	Low technology self-efficacy which refers to the degree of confidence in using high-tech devices	Technology self-efficacy
7.	User interface for mobile services getting complicated	Complicated UI
8.	Problems with mobile services discoverability	Discoverability problems
Value chain evolution – driver		
9.	Technologically mediated social communication can create positive environmental attitudes	Social media
10.	Mobile application and mobile web app support perceived as adding value to a brand	Brand value
11.	Shift in focus of market orientation from end customer towards encompassing all stakeholders in the value chain	Stakeholder orientation
12.	Mobile technology boosting sustainability marketing	Sustainability marketing

Customer demand – driver		
13.	Community following of a particular service creates ripple effect and hence more participation	Ripple effect
14.	Increase in crimes has created increased interest towards personal privacy and security applications	Personal security
15.	New ways to engage employees and community groups to embrace sustainability in their day to day life and actions	New engaging ways
16.	Motivated highly by social identity gained through participation and contribution in leading eco-friendly lifestyles	Social identity
17.	Trend towards aesthetic consumption centered on sustainable design	Aesthetic consumption
Customer demand - hindrance		
18.	Lack of clear and reliable information about eco-friendly lifestyles	Unreliable information
19.	Awareness on sustainability issues and possible solutions is low	Low awareness
Structural change – driver		
20.	Increasing adoption of mobile web services could reduce the price of network charges	Increased mobile web-services
21.	Emergence of new communities of interest, transaction and relationship around sustainable development	Community emergence
22.	Need of new information systems to promote environmental sustainability	Information system need
23.	Collaborative leadership among different stakeholders of sustainable development creates new roles and structures	New roles
24.	Attractive services replacing product ownership and usage	Attractive services
Structural change – hindrance		
25.	Collaborative leadership brings in time consuming bureaucracy	Bureaucracy issues

Legislation and policies – driver		
26.	Increasing interest towards online reporting for communicating sustainability issues	Online reporting
27.	Environmental policies created to ensure that companies reduce their environmental impacts	Environmental policies
Legislation and policies - hindrance		
28.	Approach towards sustainability as a triple bottom-line faces challenges in a capitalist market economy	Challenging economy

The short names mentioned in Table 13 will be used to refer the respective driver and hindrance. The empirical data responses corresponding to each of the driver and hindrance are discussed in detail in the coming sections.

4.3.1.1 Technological Innovation

Driver 1 – Mobile internet: Proliferation of mobile internet infrastructure and applications.

Affirmative Responses:

"*User-friendly mobile internet based services could influence the user participation in a greater extent. It would eliminate the need for paper or internet based surveys" –* **Interview, participant 4.**

"Mobile internet would pave way for many sophisticated value-added services. However, these could be deployed only in smartphones and not feature phones. Soon, the capabilities of feature phones could match smartphones though"- ***Interview, participant 1.***

"Mobile phone based applications boost the reachability to people than internet based applications" – **Interview, participant 5.**

"Increased use of internet could create demand for more sophisticated mobile services. The challenge lies in creating services especially for rural people which adds value to their livelihood" – **Interview, participant 1.**

"Mobile apps using internet could help exchange real time information and helps making fast decisions" – **Interview, participant 2.**

Denial Responses:

"Mobile operators provide poor mobile internet coverage in rural areas. Also the costs of mobile data plans too high for the farmers to afford." – **Interview, participant 6.**

Key take-away points and critique:

1. "User participation could be increased by efficient user interface design that would replace existing methods like paper or internet based surveys."
   - Nokia data gathering and other open source based mobile applications already exist, but they are not known widely. It might be because, the benefits provided by these mobile applications to projects was not spread widely. Providing a platform for successful projects to spread their stories could address this issue.

2. "Mass adoption of low cost smartphones blurs the line of feature and smartphones."
   - Therefore service design should take into account how the service behaves under various circumstances like poor mobile network coverage.

3. "Need of value propagating platform which would help customers to visualize and realize the value of a mobile sustainable service."
   - This sends a message that these MSS should convey the benefits it provides the user by some means. For example, in the case of Nokia's Ovi Life tools, pictorial or statistical representations of how this service could benefit the farmer during adverse climate conditions like heavy downpour of rain or drought. This would help farmers better relate to these services.

Driver 2 – Mobile accessories: Increased integration of different accessories like sensors, robotics with mobile technology.

Affirmative Responses:

"Environmental budgeting uses GIS tool and mobile applications to calculate pollution levels. It is true that ICT tools and mobile applications are evolving to address environmental issues. Innovative concepts like smart grid and smart cities would create more demand for these ICT and mobile tools" – **Interview, participant 7.**

"Smartphones with camera and GPS enables new mobile applications like endangered wild animals tracking" – **Interview, participant 5.**

Denial Responses:

No relevant responses.

Key take-away points and critique:

1. "Many innovative applications using mobile sensors and accessories assert that it is a strong driver."
   - Mobile software should provide capabilities to incorporate the growing demand for innovative services with mobile sensors and other accessories. It could also be foreseen that this point indicates the need of a mobile software development kit (SDK) for mobile sustainable services which would help create services easily and more importantly relevant to customer's needs.

2. "There are no denial responses for this driver."
   - This would indicate that the participants of this study may not have used services based on these accessories, however provided responses based on their knowledge. Therefore in order to understand the fallback of this driver, it is important to bring in participants who have usage experience of the accessories.

Driver 3 – Advanced UI: Enhanced user interaction using latest technologies like voice and gesture recognition.

Affirmative Responses:

"SMS based notifications on ambient light usage behavior is felt as intrusive to users. Perhaps better user notification and interaction would encourage users to adapt these services" - **Interview, participant 3.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "User interaction enhanced using voice or gesture recognition should address the pain points of mobile customers like intrusion, privacy and security."
   - This point sends a strong message that a sustainable service using mobile technology could reap the benefits of latest technologies only when it tries to eliminate some pain points of customers.

2. "No denial responses for this driver"
   - Though this study reached out to the urban mobile consumer group through twitter discussion, it could not identify any denial responses to advanced UI as a driver. Two reasons could be attributed for this no response. First being the sample size of the participants of twitter group discussion, which is relatively small.

Secondly, the advanced UI technologies is an upcoming trend and not yet commonly used even among the urban consumers.

Driver 4 – Mobile health: Increased interest in health consciousness and use of mobile based self-treatment service.

Affirmative Responses:

"Mobile health is gaining traction nowadays and there will be increase in growth in coming years. Especially rural and remote places would need more health services which would be augmented when deployed with mobile technology" - **Interview, participant 1.**

"I know many mobile apps for diabetes and other diseases, but have not used them personally. My parents might need it, but they have basic mobile phones which cannot install those mobile applications" – **Twitter discussion, participant 5.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "While there is an increase in demand for mobile based health services, it is highly important to understand how much percentage of the target market could use it."
   - Especially, things to note are features of mobile phone used by the target customers.

2. "There are no relevant responses for this driver."
   - This would indicate that the participants of this study have not used the mobile health based services. Therefore, in order to understand holistic picture of the driving force analysis it is important to invite participants who are familiar and used these mobile health services.

Hindrance 1 – Network issues: Intermittent mobile network and internet availability.

Affirmative Responses:

"Though I am interested in using mobile internet based application that support my work, our work phone does not have internet capabilities" – **Interview, participant 4.**

"When we visit farmers in rural villages, mobile phones are handy to access internet. However, the network capabilities are very poor in rural places resulting in slow internet access and are not reliable. Therefore we prefer stand-alone mobile applications instead of internet based applications" – **Interview, participant 6.**

Denial Responses:

"At least in the western countries, mobile internet is not a problem and mobile web based applications could have wider audience using different mobile device models"- **Interview, participant 5.**

Key take-away points and critique:

1. "The mobile service design has to take into account factors like network properties and cost in the target customer market."
   - This point though appear to be obvious, many mobile applications like Climate Mission 3D have not paid attention to it and gets stuck during a sudden network outage. The service design should encompass service concepting, user interface design and also responses to error prone conditions. When used under erratic network conditions there should be possibilities to close those services without causing any unresponsive user interface in mobile phones.

Hindrance 2 – Tech-fear: Low technology self-efficacy.

Affirmative Responses:

"I do not want to install more applications in my mobile as I am afraid that it would slow down my mobile response"- **Interview, participant 4.**

"I have been using some mobile applications, but was not aware that there are some applications related to sustainability issues and sustainable lifestyle" – **Interview, participant 2.**

Denial Responses:

"Rural people have interest and inclination towards accepting latest technology based services, though it is true that they cannot adopt them immediately. However they do not want to pay for those services unless they are convinced that the services will benefit their activities."– **Interview, participant 6.**

Key take-away points and critique:

1. "There is likelihood for the presence of unarticulated fears which prevents customers from using the MSS."
   - Therefore it is important to make customers express their hindrances while putting efforts to understand their motivations. It could be inferred from this point, that customers have realized that usage and operations with mobile phones are getting beyond their control. Thus it is important to engage in clarity communication which fosters trust in customers.

Hindrance 3 – Complicated UI: Complicated user interface for mobile services.

Affirmative Responses:

"I am skeptical in downloading applications as I cannot trust the authenticity of the applications"- **Interview, participant 4.**

"Taking mobile services with features like internet, community-oriented to rural people needs more careful design of user interface as there is a high barrier of user adoption for these services" – **Interview, participant 1.**

"More mobile applications would clutter the mobile services interface. Single point entry to appropriate applications would be very helpful" – **Twitter discussion, participant 8.**

*"Native language support is not good in many mobile phones which is a big hindrance in developing content for our services***"– Interview, participant 6.**

"I used apps on iPhone and did not like the small preview - now when using iPad Flipboard is very useful and other news apps as well." – **Sustainability survey, question 1.**

"*Biking mode of transport comes with the bike theft problem. And, there could be a mobile application to prevent it. But so many segregated applications would clutter my mobile"* – **Twitter discussion, participant 7.**

Denial Responses:

"For biking and hiking, I have used Nokia Maps and it is precise. Simple interface makes it easier instead of having many mobile applications" – **Twitter discussion, participant 1.**

"Some mobile application like EcoGuru itself is not complicated, however communicating the benefits of using it and convincing people to use it are usually the difficult part" – **Interview, participant 5.**

Key take-away points and critique:

1. "User interface is the make or break of service adoption by customers."
   - While this statement goes true for all services and applications using mobile phones, it has also been underlined for MSS. In most cases, MSS are developed for a particular target market; therefore designing the service based on customer needs should not be a problem. However making customers realize the benefit of those MSS is a big problem, especially when there are no economic benefits.

4.3.1.2 Value Chain Evolution

Driver 1 – Social media: Technologically mediated social communication can create positive environmental attitudes.

Affirmative Responses:

"Public people in general are little hesitant in adapting technological based communication. But once they find those tools user friendly and less time consuming, they are interested to participate."- **Interview, participant 4.**

"Facilitating a good bikers network using mobile phones would help the biking community to grow" – **Twitter discussion, participant 8.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "While it is true that social networking could harness benefits of group behavior change, it has to be noted that getting people participation is not an easy task."
   - Customer participation could be boosted by tapping the need to express, associate and benefit either economically or through social identity.
2. "No denial responses for this driver"
   - The study has not identified any denial responses for this driver. This could be because social media is becoming popular currently and companies use the power of social media to create an impact on their customers. This strong positive trend may have concealed the cons of using social media, which might unfold in the coming future.

Driver 2 – Brand value: Mobile application and mobile web app support perceived as brand value

Affirmative Responses:

No relevant responses

Denial Responses:

"We already use internet to spread our sustainability activities and would not need mobile internet based services like mobile apps" – **11 out of 15 respondents in Sustainability survey.**

"Certainly, mobile technology could add value to existing sustainable services. If the value add is in terms of monetary or time efficiency then companies welcome the change. If not they do not yet consider it as a brand value" **– Interview, participant 9.**

Key take-away points and critique:

1. "There is no strong need for sustainable oriented organizations to deploy their services through mobile phones complimenting to their internet services."
   - This message comes from the survey comprising of organizations working on various sustainable development organizations. There could be various reasons attributed for not needing mobile based services like,
     - Not many of their customers use mobile-based applications
     - Twitter and Facebook being used as social media tools for these companies are already available in mobile phones.
     - Organizations may not have any additional content or framework which would reap benefits of mobile features.

   However, in the coming future, if any of the mobile based service gains reputation there are more chances for these organizations to embrace mobile technology as well.

2. "No affirmative responses identified for this driver"
   - This driver is relevant from the perspective of companies. This study received inputs from sustainability oriented companies through a web survey. The possible reasons for not able to receive any affirmative responses could be because of,
     - The profile of the organization which does not pay importance to brand value
     - The organizations themselves could not relate how deploying their services using mobile technology would benefit them
     - There is no pressing need to offer using mobile technology in addition to their traditional offerings.

Driver 3 – Stakeholder orientation: Shift in focus of market orientation from end-customer towards encompassing all stakeholders in the value chain

Affirmative Responses:

"*Nokia Life Tools mobile service encompasses many stakeholders like content providers, knowledge bank owners and meteorological department. It is highly important for the success of the service to have good network of these stakeholders"* - **Interview, participant 1.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "It has been underlined that a service benefitting all stakeholders is likely to succeed and sustain for longer time."
   - While this is true, some mobile services like Whatsapp, which does not incur benefits to network carrier might face problems in deploying it.

2. "No denial responses for this driver"
   - This might be because of lack of apt interview participants in this study who could shed light on stakeholder orientation.

Driver 4 – Sustainability marketing: Mobile technology boosting sustainability marketing

Affirmative Responses:

No relevant responses

Denial Responses:

"I am not sure if we could use mobile technology for marketing our activities. I do not know how we could use it for our activities and would be interested to know if other similar groups are using them. **"- Interview, participant 4.**

"Unless people are convinced of good mobile applications which would help to adapt environment friendly lifestyle, it would be difficult to promote. Also, we see to that we do not endorse any brand or product" **- Interview, participant 2.**

Key take-away points and critique:

1. "The success stories of mobile based sustainable services are not getting rippled through the community."
   - This is an important point which lays emphasis on creating ripple effect which would result in increased adoption of these MSS. Therefore it is important to highlight success stories and more importantly how other organizations could use the services and become successful.
2. "No relevant affirmative responses for this driver"
   - Sustainability marketing is a concept gaining traction only in the recent years. While this is discussed in academia, the reflection of it in the market is yet to catch attention. This could be one of the reasons for not identifying any affirmative responses from the organizations participated in this study.

4.3.1.3 Customer demand

Driver 1 – Ripple effect: Ripple effect of community participation

Affirmative Responses:

"It is highly probable that farmers who have got benefitted of Nokia Life Tools recommend it to other farmers and we have seen the increase in service subscriptions after launching the service in a region" – **Interview, participant 1.**

"Get to know about mobile applications related to sustainability from friends or colleagues **- 10 out of 19 respondents in Sustainability survey.**

"When our team shows educational videos in mobile and send informative tips in local language to farmer's mobile, they pass the information to others which draws more attention to our services" – **Interview, participant 6.**

"I am not aware of any mobile health applications. But I would have tried using something if I come to know from my friends"- **Twitter discussion, participant 1.**

"I usually browse the mobile application store to download applications. If these eco-friendly applications are highlighted in some related Facebook page, it would create good visibility and community participation" – **Twitter discussion, participant 2.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "Community participation or friends referral play a major role in using MSS."
   - As seen from the interview responses, most of the referrals are through word of mouth. It would be a good idea to start brainstorming other modes of ripple effect like Facebook's AppCenter[7] which shares information about the mobile application recommended by other friends. This brainstorming will prepare a service provider to embrace changes in the coming future.
2. "No relevant denial response for this driver"
   - Ripple effect of community participation is a strong driver for group behavior change. Therefore it could be natural that there is no denial to this driver.

Driver 2 – Personal security: Increased interest on personal security applications

Affirmative Responses:

"Security issues are of more concern while biking. Perhaps augmented mobile applications would be useful in that case" – **Twitter discussion, participant 5.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "There is no key point emerged from the empirical data."
   - This could be because the participants of this study have not used or associated with security based applications.

Driver 3 – New engaging ways: New ways to engage employees and communities to embrace sustainability

Affirmative Responses:

"*After listening to the examples of mo-mobility for tomorrow* [29]*, it appears that mobile technology could augment the acceptance of environment friendly lifestyle" –* **Interview, participant 2.**

"Interested in receiving information and tips about eco-friendly lifestyle behavior" **- 16 out of 19 respondents in Sustainability survey.**

"Mobile devices help save energy in many ways: convergence, navigation for driving, biking and Nokia Public Transport for example" – **Twitter discussion, participant 3.**

"Crowdsourcing is an exciting way to get people engaged in these sustainable oriented applications. The application should be designed in such a way that it is non-intrusive and triggers people's motivating factors" – **Interview, participant 3.**

"Preferred mode of transport largely depends on the climate of the day. It would be good to have some intelligent ways to plan our travel based on weather" – **Twitter discussion, participant 1.**

Denial Responses:

"It would be effective to deploy our services and activities through mobile phones" **- 4 out of 19 respondents acknowledged, 5 were not sure and 6 respondents did not agree in Sustainability survey.**

"We are staying in a developing country and I believe in social change from the 'ground'. Many people do not have access to these mobile apps, so I do not see it as productive" – **Sustainability survey, question 4.**

Key take-away points and critique:

1. "New ways like crowdsourcing or multimodal journey planner which assist people in making sustainable choices are highly welcome."

- While the initial signs of adoption of these services is a good indication, the mass adoption and continued usage remains highly questionable. For example, it would be interesting to see how many mobile customers who have installed the mobile application CO2track [19] would have used it frequently to observe their daily carbon usage. Therefore if it does not bring in behavior change, it remains just as a hype and does not serve the purpose.

Driver 4 – Social identity: Social identity gained through participation as a motivation factor

Affirmative Responses:

"Not sure of correct ways of waste disposal and would find it motivating to get expert advice and also some mobile applications for that" – **14 respondents of Sustainability survey.**

"Energy consumption graphs compared to neighbors would be a great motivator to know about energy saving habits" - **Twitter discussion, participant 8.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "MSS have not yet tapped the benefits of social identity as a motivating factor of customers."
   - This is an important point which drives mass adoption of the MSS. Many of the MSS do not provide any economic benefit. Therefore it is highly important to make customers satisfied by projecting their social identity. Climate mission 3D has done a good job in this regard where it gives the player power to contribute a small amount to the organization of his choice from a list of organizations like Oxfam.

2. "No relevant denial response for this driver"
   - Social identity plays a major role in behavior change among consumers. Though it is quite natural that there is no denial response, there could also be few setbacks like lack of trust which could prevent people from embracing services which highlight social identity.

Driver 5 – Aesthetic consumption: Trend towards aesthetic consumption centered on sustainable design

Affirmative Responses:

"Mobile devices can be used to advocate sustainable consumer choices in different ways; Climate Misson, Eco-Guru, Energy Profiler"- **Twitter discussion, participant 3.**

"During our ambient light pilot testing, we observed that if house interior lighting has some sustainable design choices, people are interested in them provided the design is visually pleasing" – **Interview, participant 3.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "Aesthetic consumption is a good marketing tool for associated MSS."
   - This point indicates how value proposition is important for MSS. If the service is positioned as an aesthetic design and consumption, it is more likely to attract a cult following. Fair trade labeled products being highly priced could belong to this category.
2. "No denial response for this driver"
   - Aesthetic consumption has a niche following and does not cater to the needs of mass consumers. The lack of denial response for this driver could be because of lack of appropriate interviewees who could shed light on the challenges in popularizing aesthetic design and consumption.

Hindrance 1 – Unreliable information: Lack of clear and reliable information about eco-friendly lifestyles

Affirmative Responses:

"About eco-friendly food consumption, though there are many ways to preserve fresh foods like freezing, canning and drying, not sure which would be better" – **Twitter discussion, participant 5.**

"Public people are nowadays interested towards Green Public Procurement (GPP), however they are not sure if the eco-labels are genuine" – **Interview, participant 7.**

"Mobile applications for seasonal foods are available in iPhone. But I cannot trust the source, as there is more media hype these days" – **Twitter discussion, participant 7.**

"I am interested to know about eco-friendly food consumption habits especially during winter. But did not know how mobile applications or services could help!" – **Twitter discussion, participant 1.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "While there is a need to know eco-friendly lifestyle habits, there is a lack of trust in using mobile applications which spread that information."
   - This is an interesting point, which reflects the customer attitude towards the increasing number of health and eco-friendly based mobile services. There is a clear need to know information, yet customers are not willing to embrace the available solutions. Many government based websites like ekokumppanit.fi has lot of references to sustainable lifestyle. Yet, many residents, at least the participants of this study did not know about it. Perhaps, it is time for government to take up projects which gives these tips and information through a mobile application. This might solve the problem of authenticity.
2. "No relevant denial response for this hindrance"
   - No denial response identified for this hindrance underlines the fact that customers do not rely on the information shared about eco-friendly lifestyles. This is a major concern and has to be acted upon. New ways like accreditation from an established institution should accompany when eco-friendly lifestyle information is shared to inculcate trust in customer mind.

Hindrance 2 – Low awareness: Awareness on sustainability issues and possible solutions is low

Affirmative Responses:

"More information about government policies is passed to various stakeholders and many are aware of it. However the problem is 'information intensive', overwhelming information without proper structure results in poor implementation"- **Interview, participant 7.**

"There is more interest towards these kinds of mobile services in developing countries than developed countries. People in developed countries have less knowledge on sustainability issues and believe their government would act on them" – **Interview, participant 5.**

"I am not aware about eco-friendly lifestyles and also that mobile applications could provide tips for that" – **Twitter discussion, participant 7.**

"I am interested in knowing my carbon footprint. But did not know if there is any mobile application for that!" – **Twitter discussion, participant 6.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "Response to sustainability issues depends greatly on the environment people live."
   - This statement drives home a point that government and other organizations have the power to create more awareness on sustainability issues and provide better tools for people to embrace it.
2. "No relevant denial responses identified"
   - This might indicate that most of the participants agree that the awareness about sustainable issues is very low.

4.3.1.4 Structural Change

Driver 1 – Mobile web-services: Increasing adoption of mobile web services could reduce the price of network charges

Affirmative Responses:

"It is true that mobile network in rural and remote places is poor. However, currently mobile technology is the only plausible way to access web based services as broadband connections have not found their way in rural regions" - **Interview, participant 6.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "Mobile web based services can find its way to both urban and rural regions in the near future."
   - Mobile sustainable service providers need to equip for better service delivery during this transition time from intermittent mobile to strong network capabilities. If they have satisfied customers during this transition, there is more likelihood to capture good market share afterwards.
2. "No relevant denial response for this driver"
   - The reason for no denial responses could be because of lack of appropriate interviewee participants who have insight about the mobile operator strategies. To understand this driver, it is imperative to receive inputs from mobile operator executives who could shed light on mobile web services growth in rural regions.

Driver 2 – Community emergence: Emergence of new communities of interest, transaction and relationship around sustainable development

Affirmative Responses:

"Nokia Life Tools which empowers local farmers with market price information has created new ways of transactions which puts the farmers at a profitable role in the value chain." – **Interview, participant 1.**

"Interested in knowing sustainability practices in other companies" – **14 of 19 respondents in Sustainability survey.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "Sustainable service providers have to harness the potential of new emerging communities."
   - Mobile sustainable service providers need to watch the dynamics of the market and update the service in a way to fuel the growth of new communities. For example, if organizations are interested in knowing other organizations sustainable development activities, it would indicate the need of a portal for them to share and know from each other.
2. "No relevant denial response for this driver"
   - It is certain that there are some challenges associated with the emergence of new communities around sustainable development. The reason this study could not identify denial response might be because of the sample size and profile of the interviewee participants of this study. Another reason could be the difficulty in finding and approaching the communities working on mobile based sustainable services. It is worthwhile to mention here, that the attempts to get response from the founder of mobileactive.org regarding this driver were futile. The website mobileactive.org serves as a good resource for mobile based sustainable services and provides a platform for the organizations working on this domain to exchange ideas.

Driver 3 – Information system: Need of new information systems to promote environmental sustainability

Affirmative Responses:

"In order for the Government policies for sustainable development to be effective, they have to be equipped with better information systems which addresses the huge inflow of information and better ways to deploy and track projects working on these issues" - **Interview, participant 7.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "Potential opportunity to deploy services for Government and other organizations whose core competence is not in Information and Technology (IT) or mobile technology."
   - This kind of service is already been undertaken by companies like Tofuture.eu, and Motiva. However, it is worthwhile to note that there would be an increase in need of these services in the near future.
2. "No denial response identified for this driver."
   - The reason for not identifying any denial response could be because of the limited sample size of participants in this study with expertise in both information technology and sustainable development.

Driver 4 – New roles: Collaborative leadership among different stakeholders of sustainable development creates new roles and structures

Affirmative Responses:

"Certainly non-traditional partnerships and collaborated activities would create more interest in sustainable development. Some examples of non-traditional partnerships could be banks, local municipalities and rural entrepreneur bootstrap groups." – **Interview, participant 8.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "Collaborative activities are gaining traction."
   - However, it is too early to say, if those collaborative services would use mobile technology for deploying it. M-PESA a mobile payment service supporting

microfinance service is a service pioneered by a mobile operator Safaricom in collaboration with a local micro-finance institution Faulu (Hughes and Lonie, 2007). However, mobile operator faced many problems in partnering with Faulu like paper based management that Faulu used. Therefore while collaborative activities increase the possibilities to reach greater market, it comes with inherent problems to cope up.

2. "No denial response identified for this driver"

   - The setbacks of collaborative leadership could be revealed through the experience of projects which have undertaken collaborative efforts. This study contacted SPREAD Sustainable Lifestyle 2050 project which is a collaborative project funded by European Union. However it was not possible to could get inputs from SPREAD team.

Driver 5 – Attractive services: Making the traditional services attractive could replace product ownership and usage

Affirmative Responses:

"People have the feeling of social status by owning a product and shifting the focus towards service usage needs more advocacy, incentives and platforms to gain social identity by other means" – **Interview, participant 8.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "Breaking the obsessive bond of product ownership needs fostering of some other bond."

   - People's interest towards product ownership is not only because of need or social status. It is also because of the lack of availability of a good service. With car-pooling, ride-sharing and other services coming into use, it would be interesting to observe how people embrace it. Some companies provide a web service for people to express their wish to car pool and avail benefits from each other, like fuel expense sharing. Nevertheless to mention, these services would definitely extend their service in mobile phones to attract customers.

2. "No denial response for this driver."

   - Popularizing service usage instead of product ownership does come with certain challenges. However, this study could not identify those challenges from the interview responses. Organizations who are focusing on promoting service usage could be appropriate candidates to receive inputs on this issue. This study had participations of this kind of organizations, like car sharing and pooling

companies. However, the web survey sent to them was more generic and does not ask questions on service usage.

Hindrance 1 – Bureaucracy issues: Collaborative leadership brings in time consuming bureaucracy

Affirmative Responses:

"It is not an easy task to deploy an additional feature to our current Nokia Life Tools service as it involves more collaborated work from other stakeholders."- **Interview, participant 1.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "Collaborated work leads to lengthened project execution."
   - Perhaps, if the service creates clear value benefits for the stakeholders, it could expedite the development and execution time.
2. "No denial response for this hindrance"
   - Though the reason for no denial response could be because of limited interviewee participation, it might also be true that collaborative leadership does come along with bureaucratic issues. However, it would be interesting to note if there are any projects which are successful amidst bureaucratic issues.

4.3.1.5 Legislation and policies

Driver 1 – Online reporting: Increasing interest towards online reporting for communicating sustainability issues

Affirmative Responses:

No relevant responses

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "No affirmative or denial response identified for this driver."
   - It would mean that the participants of this study are not associated with this driver. Some companies like Tofuture.eu who provide services on sustainability reporting could be a good source of reference to understand about this driver.

Driver 2 – Environmental policies: Companies can be made to comply with policies aiming to reduce environment impacts.

Affirmative Responses:

"Environmental policies not only levy penalties to enterprises not adhering to the policies, but also provide incentives to enterprises reducing environment impact" - **Interview, participant 7.**

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "Incentive based policies to reduce environment impact can attract more company participation."
   - Policy alone is not enough to make companies reduce their environment impact. New service providers have to sprung up and offer 3rd party sustainable services for companies and ease out their burden. Motiva offers good range of 3rd part services to industries. However they are mainly focused on energy sector. Opportunities exist in areas like waste management, operation efficiency.

2. "No denial response for this driver"
   - In order to understand the problems in creating policies and deploying them, it is important to listen to the story from both sides namely, the policy maker and the companies ought to oblige them. This study could get response only from the policy maker perspective and hence might lack the views from the other side.

Hindrance 1 – Challenging economy: Approach towards sustainability as a triple bottom-line faces challenges in a capitalist market economy.

Affirmative Responses:

No relevant responses

Denial Responses:

No relevant responses

Key take-away points and critique:

1. "The study did not involve participation of any business leaders whom could shed light on challenges faced by sustainability projects in a capitalist driven economy." - The inputs from the business leaders would have been beneficial in terms of understanding how sustainable services have to be projected in order to exist and be accepted in the market.

4.3.2. Response analysis based on empirical data

Section 4.3.1 discussed in detail how the drivers and hindrances of the driving forces are perceived in reality by customers of mobile sustainable services. Though the previous section discussed the responses in detail, it is important to get an overview of the responses, spanned across the drivers and hindrances. This overview would help to gain understanding of the significance of a driver or hindrance from customer perspective. Therefore, a pictorial illustration of relevant responses count for drivers and hindrances of five driving forces is shown in Figures 22 – 26. Response count of technological innovation driving force out of 36 total respondents is shown in Figure 22.

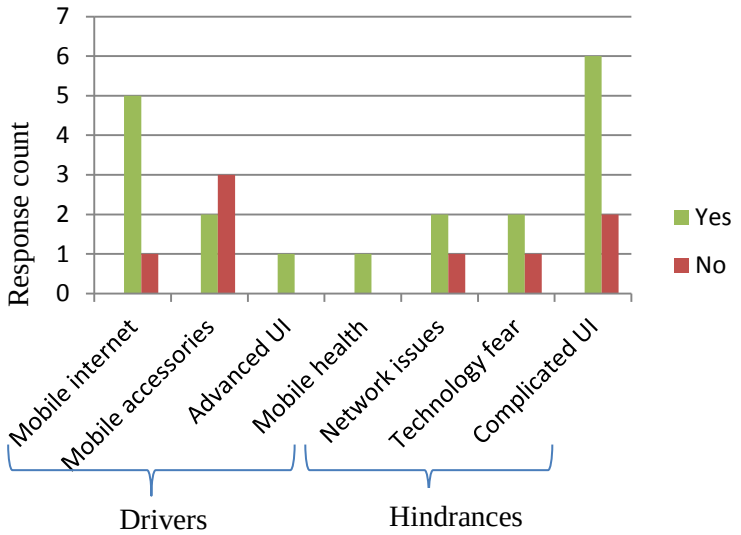


Figure 22. Response count of technological innovation driving force (N=36).

It could be seen in Figure 22, that "Complicated UI" as a hindrance has got high affirmative responses and few denials as well, which could indicate a high degree of agreement for that hindrance from customer perception. "Mobile accessories" as a driver on other hand has more denials than affirmative responses. However, with very few interview responses, it would be difficult to conclude the relevancy of the driver. Nevertheless, this visualization when applied on large sample data could provide good insights.

Figure 23 below shows the response count of value chain evolution driving force.

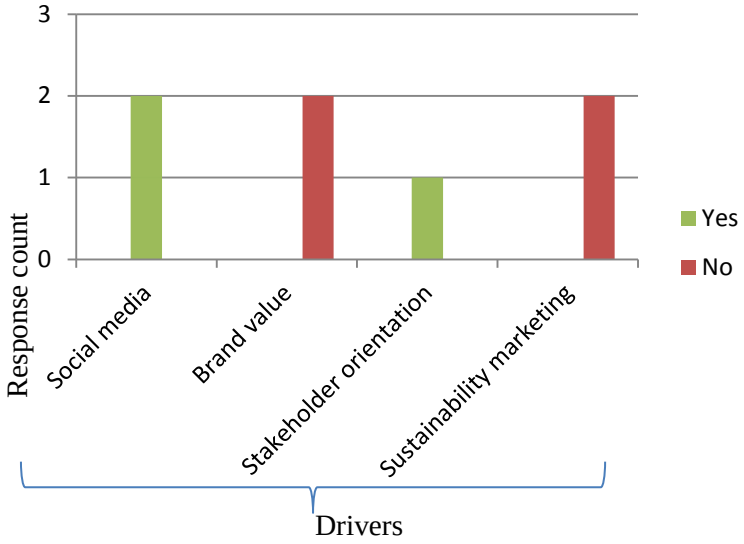


Figure 23. Response count of value chain evolution driving force (N=36).

The responses of value chain evolution as seen in Figure 23 are polarized to majority of affirmative or denial responses. This could indicate that "Social media" is perceived more highly relevant than "Sustainability marketing" from customer's point of view. This kind of analysis could help make decisions in sustainable service design and also to invest time and money in aspects which are felt appropriate by customers.

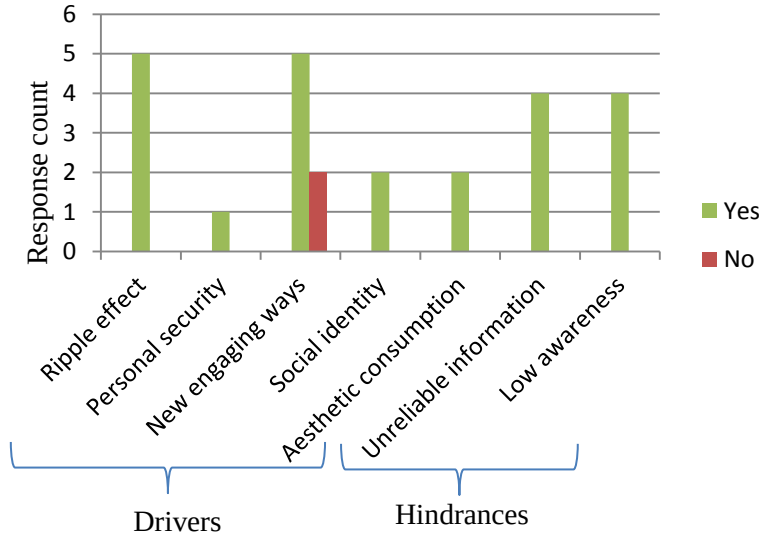


Figure 24. Response count of customer demand driving force (N=36).

Customer demand driving force has more number of drivers and hindrances and as could be seen in Figure 24. Most of the responses are affirmative which indicates that they are highly relevant from customer context. As a word of caution it has to be

mentioned here, that though “Personal security” has the lowest response count it should not be taken for granted that it is not relevant from customer context. As discussed in the key take-away points and critique discussion in Section 4.3.1.3, this could be because of the lack of knowledge about the security aspects among the interview participants of this study. This sends a message on the importance of choosing the profile of interview participants, which in essence should be a mix of people who are aware and not aware of the sustainable issues. This kind of participant profile would evoke responses that shed light on problems in the existing service and ways to improve the service.

Figure 25 below shows the response count of structural change driving force.

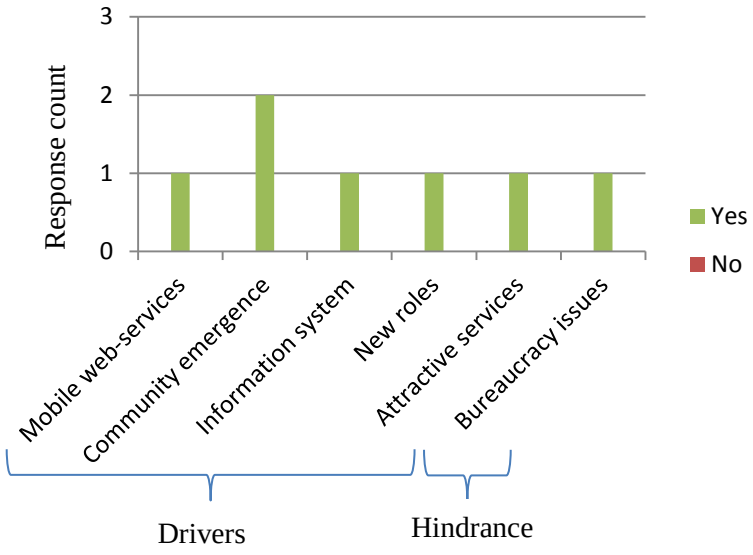


Figure 25. Response count of Structural Change driving force (N=36).

As seen in Figure 25, all of the responses for structural change are affirmative indicating a strong relevancy of these in customer perception. However, as discussed in the key take-away points and critique in Section 4.3.1.4, various reasons could be attributed for not identifying any denial response. Therefore, a holistic study of this kind has to pay attention towards these reasons to get an unbiased result.

The response count of legislation & policies driving force is shown in Figure 26.

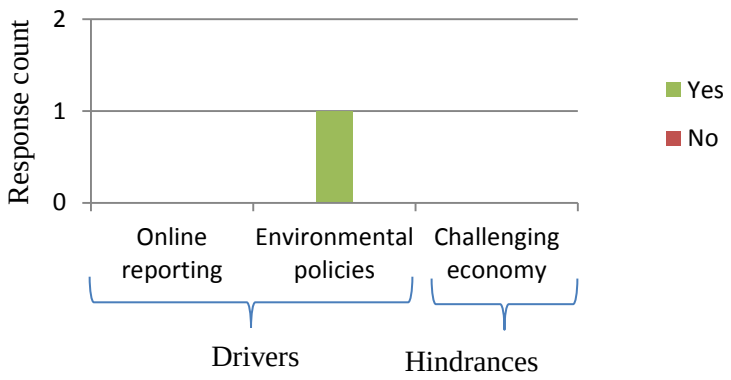


Figure 26. Response count of legislation & policies driving force (N=36).

As could be seen in Figure 26, there is only one affirmative response for "Environmental policies" in legislation & policies driving force. This clearly indicates the need to get more customer responses from this customer segment, in order to interpret the relevancy of the drivers and hindrances.

5. POSSIBLE AVENUES TO INCREASE CUSTOMER BASE

The objective of this research is to identify ways to augment customer usage of mobile sustainable services and is carried out through landscape analysis of MSS and driving force analysis of customer segments. The results of the landscape analysis and driving force analysis are shown in the Figure 27.

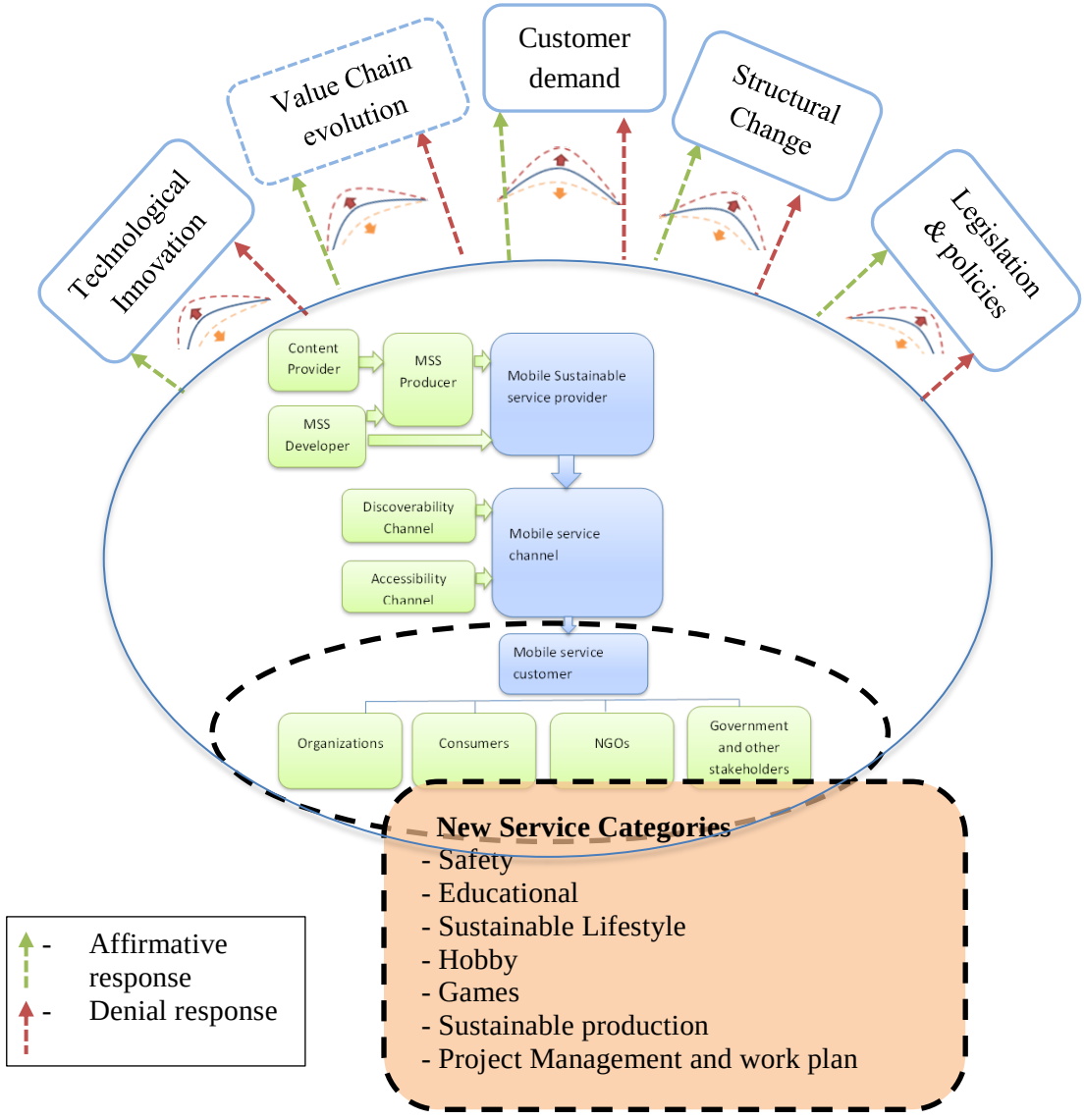


Figure 27. Results of landscape and driving force analysis.

The dotted lines in Figure 27 highlight the results of landscape and driving force analysis. Landscape analysis is carried with an aim to understand the service categories of MSS and identify possible new service categories. The result of the analysis indicated

that MSS available in the market are heading in a new direction and new service categories are identified from empirical data. These service categories are not identified in theoretical literature and could hint the lack of comprehensive mobile features which could benefit sustainable services in Section 2.2.2. However, the study underscores that this process of compare and contrast study of mobile sustainable services from theoretical discussion and market offering, would provide useful insights on the evolution of this market.

The driving force analysis is performed with an aim to understand the motives of customer usage of MSS, which would help in augmenting customer adoption of these services. The analysis of the responses grouped under the drivers and hindrances indicated how these triggers are perceived from the customer point of view. This understanding would add value during concepting, design and deployment of mobile sustainable services and facilitate in taking these services to masses. For example, as could be seen from Figures 22 – 26, one of the drivers which counted highest affirmative response counts is “New engaging ways” driver in customer demand driving force. The affirmative responses grouped under this driver indicate the high interest from customers in welcoming new ways. This is a strong supporting signal for those mobile sustainable services which employs innovative ways to enable sustainable development. There are two denial responses for this particular driver, which would provide critical inputs for the service design.

Similarly, as could be seen from Figures 22 – 26, the highest affirmative response count in the case of hindrances is “Complicated UI” in technological innovation driving force. Six affirmative responses grouped under this hindrance places strong emphasis on user interface perceived as a critical aspect of mobile sustainable service usage. This hindrance would apply to all MSS. The two denial responses identified under this hindrance, elucidates simple features of some MSS namely Nokia Maps for biking and EcoGuru, which helped them to use it more often.

The driving force analysis in this research is carried out with small group of customer respondents. Therefore, the results of this analysis cannot be used as a direct indication. However, the research process could be deployed in larger scale and could be used as a guiding theme in decision making in service design and concepting.

6. CONCLUSIONS

6.1. Research summary

Though sustainability and services surrounding it are in discussion for few decades now, the subject is gaining attention now more than before for reasons like climate change. Also recent technology evolution has fuelled the awareness about sustainability issues among people and increased the participation of people, NGOs, environmental stakeholders and governments towards solutions and services for sustainability issues. Mobile technology with its highest penetration rate is eyed upon by many services and is a key driver for the growth of mobile services. During these few years, sustainable services have also started taking advantage of the mobile technology and there is an increase in the number of mobile sustainable services. While the MSS is in growth stage, there are still many challenges in making these services utilized by many mobile customers. The fact that the characteristics of mobile sustainable services and the players involved vary largely from other mobile services, indicate the need of profound study of this market. This research aimed to address this challenge, by identifying avenues which would augment the customer usage of mobile sustainable services. Customer usage could be boosted by providing new services which satisfy their needs or tune existing services to serve better, which would demand understanding of customers' motives behind using them. Therefore, the research specifically focusses on the landscape analysis of MSS and driving force analysis of customer usage, which would help identify new services and drivers of customer usage.

For the purpose outlined above, different data gathering methods are employed, as each customer segment of MSS is unique. Landscape analysis of mobile sustainable services is performed by analyzing hundred MSS available in the market. The theoretical framework of customer segmentation and service categorization is applied to the list of hundred MSS and the analysis identified few new service categories from empirical data. The analysis also underlined the importance of mobile features which is used as a filter to obtain sustainable services benefitted by deploying using mobile technology. This process could also be used to evaluate if a particular mobile feature could provide added value to any of the sustainable services as discussed in Section 2.1.2.

Motives of customer usage are identified by collecting customer responses for the five driving forces identified from literature namely technological innovation, value chain evolution, customer demand, structural change and legislation and policies. The four customer segments namely organizations, consumers, NGOs, government and other stakeholders are contacted through focus group discussion, sustainability survey and

thematic qualitative interviews. The responses are then mapped under relevant drivers and hindrances of the driving forces of customer usage of MSS. During this process, it was observed that there were few responses which deny the driver or hindrance statement. Therefore, it was decided to list both affirmative and denial responses of drivers and hindrances for each of the five driving forces. A response analysis is carried out based on the count of affirmative and denial responses of drivers and hindrances for each driving force. It could be seen from the response analysis in Section 4.3.2, that pictorial representation of both affirmative and denial response is an effective way to visualize the customer perception of these drivers and hindrances. The summary of this analysis identified, that some of the drivers and hindrances do not have any denial responses while some had many denial responses. This result clearly sends a signal that a particular driver or hindrance is not really relevant from customer perception.

6.2. Response to research questions

The goal of this study is to identify avenues that augment customer usage of mobile sustainable services. To achieve this goal, the study focused on a set of four research questions which would shed light on the goal defined. The research process is carried out in a way to find answers to these research questions. This section reflects on the response to these four questions, based on the discussion of empirical data and analysis in Chapter 4. The research questions and respective reflections from this study are discussed below.

1. Are there any benefits in categorizing and analyzing MSS as a domain?
   This study analyzed the mobile sustainable services market by categorizing based on the customers of these services. Many interesting observations could be made through this approach like,

   a. Service characteristics for a particular customer segment, for example theoretical literature review identified some mobile features which could add value to “Repairing & Recycling” service category in consumer segment.
   b. An overview of which customer segment is booming up with more sustainable services. From the study it is found that consumer segment has more service categories while organization segment has the least. This knowledge will help in understanding the market competition for each customer segment.

   This result would indicate that mobile sustainable services are different from other mobile services and the need for categorization of MSS separately. However, it is worthwhile to mention here that the monetary benefits of such a categorization are not analyzed in this study. Nevertheless, this study is focused on analyzing the

service characteristics and driving forces which influence customer usage of these services.

2. How could the academic discussion about MSS and market reality compliment and benefit each other?
   A compare and contrast study of MSS landscape from theoretical literature and market perspective proves that this domain is upcoming and there is much more to learn from each other. Some of the learning points identified from this study are,

   a. Identifying new service categories. For example the empirical analysis of mobile sustainable service landscape identified service categories like "Project Management and work plan" which are not discussed in theoretical literature.
   b. Tuning the list of mobile features which are considered adding value to the sustainable services. As mentioned in Section 4.2.2, some service categories like energy management might be perceived as not beneficial to be deployed using mobile technology. However, the empirical data identified "ecoLamp" mobile application which belongs to this category. This elicits a question of what mobile features are significant in making "ecoLamp". This retrospection would lead to a comprehensive list of mobile features that add value to sustainable services.

3. Are MSS familiar or known to potential customers? How are the MSS perceived in customer's world?
   Total participants in empirical data of this study are 36. Out of 36 people, 20 knew the existence of mobile sustainable services and could relate when given an example, 12 have used some mobile applications related to sustainable services and 4 did not know what a mobile sustainable service is about. Also, it has to be mentioned here, that the term "Mobile sustainable service" itself is new for most of them, but could understand when explained briefly. This result is pictorially represented as shown in Figure 28.

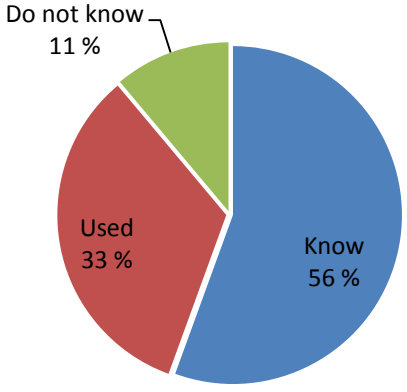


Figure 28. Awareness percentage of MSS from the respondents of this study.

The chart in Figure 28 corresponds to this study only and cannot be generalized. However, as noted in the limitations of this study in Section 1.2, the participants of this study is a very small sample set and do not encompass a wide variety of participant profile. Therefore, to make this chart more meaningful, it is recommended to extend this study to a larger participant base with different profile. While analyzing the lack of affirmative and denial responses for certain drivers and hindrances, the need for certain participant profiles for a holistic understanding are noted. The summary of those could be a good starting point to make careful selection of participants in a more statistic approach of this kind. The participant profile requirements deduced from this study are,

1. Usage experience of mobile accessories
2. Understanding of advanced UI technologies and the challenges that would arise when deploying for sustainable services
3. In need of mobile health services and those who have used them or promoting them
4. Awareness about personal security related issues
5. People working on sustainable and aesthetic consumption design
6. Experts in sociology and technology trends who could shed light on utilization of social media for sustainable services
7. Knowledge and experience in stakeholder orientation, sustainability marketing, mobile operator strategies
8. Organization focusing on service usage
9. Service organizations working in legal front
10. Strategists and executives who could shed light on deploying these mobile sustainable services in a capitalist economy.

It could also be inferred from the brand value discussion in Section 4.3.1.3 that mobile sustainable services currently do not play a major role in creating brand value. Therefore MSS might not be a decisive factor for mobile customers while buying mobile phones. However, mobile sustainable services when marketed with a better proposition could vouch in more mobile customers using them.

4. How could adoption of MSS be augmented?
   From the study, it could be inferred that the influence of drivers and hindrances in using MSS largely depends on the awareness level of the customers. Therefore it becomes imperative to understand the awareness level of customers about the issue a mobile sustainable service is targeting to address. For example, in the case of a MSS targeting “Sustainable consumption”, the first important thing to understand is the awareness level about sustainable consumption in consumer minds like what is sustainable consumption mean, how can a family embrace in

their daily lives. The interview responses in this study indicated that the awareness level includes not only the awareness of the service but also includes knowledge about the issue and an update of trends and happenings in that front. Secondly, it is important to understand the usage prevalence of the service among the consumers. This could be done with a statistical study with the help of different participant profiles mentioned earlier. Based on the understanding of these two factors, it is possible to get a picture of where the service domain belongs to, with the help of the Figure 29 below.

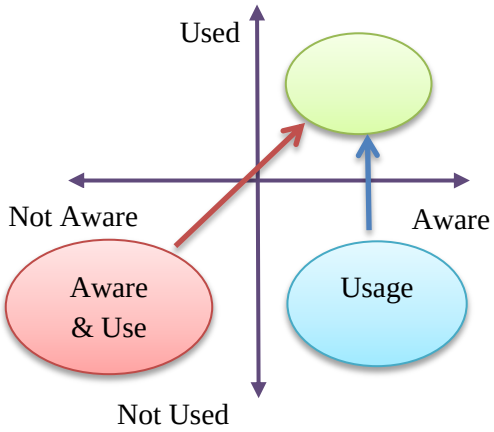


Figure 29. Sustainable service positioning based on customer inputs.

The red, blue and green quadrants in Figure 29 correspond to the percentage of customers who are not aware and not used, who are aware but not used at all and those who are aware and used. Consider the example of "Sustainable consumption" and apply it to Figure 29, the percentages of consumers who belong to the red, blue and green quadrants could be obtained. Later, a strategy could be devised to shift more customers from blue or red quadrant to green quadrant. Based on the strategy, the drivers and hindrances framework described in this study in Figure 27 could be used to augment the adoption of mobile sustainable services. It is important to evaluate and position the service to these red, blue and green quadrants because; it would facilitate correct choice of participants to analyze the driving forces framework. This study has detailed a generic approach to apply the driving forces framework for MSS, by identifying the drivers and hindrances. However, this could be extrapolated and can be applied for specific scenarios like introduction of new services and improving existing services. The pictorial representation and response analysis discussed in Section 4.3.2 will provide indications on the highpoints perceived by customers and therefore guide service design decision making.

With the aforementioned response to the research questions, this study has presented a way to augment customer usage of MSS. While this study has discussed the positive aspects of this approach, it has to be acknowledged that the

study has not discussed if there could be any possible repercussions that might happen by using this approach. However, the possible repercussions will also surface only when this approach is applied to a specific mobile sustainable service and by analyzing the results aftermath.

6.3. Inference and future research

This paper focused on augmenting customer adoption of mobile sustainable services and achieved it by analyzing the landscape of MSS and driving forces in MSS ecosystem from customer perception. The landscape analysis is performed by developing a framework which is used to analyze a list of MSS from the market and later the analysis is complimented with a compare and contrast study of the service categories between market offering and literature findings. Driving forces is analyzed from the customer perspective and a comprehensive approach is provided on how it could be applied to new service introduction and improving existing services.

The comparison study revealed many interesting insights about the segments and service categories of MSS. Firstly, it could be noticed that consumer segment marks the most popular and upcoming segment among the four segments, with an addition of 5 new service categories through empirical data. It is a strong indication of consumer adoption of MSS. Also out of hundred services analyzed around seventy services cater to the needs of consumers. Secondly, the organization segment is seen as the least popular and not so growing segment as it contained only one service category from literature and there were no new service category identified through empirical data. Finally, the study identified the need of a comprehensive list of mobile features which could add value to sustainable services.

The driving forces framework developed in this study could be one of the ways to understand customers of MSS. The approach detailed in this study is fuelled mainly from customer perception, though it also briefly discusses about the players involved in MSS ecosystem in Section 2.4.1. Indications of highpoints and insignificant points in drivers and hindrances from customer perspective could be considered as the advantage of this approach. However, this approach could also have some pitfalls which are not discussed in this study. Being a customer oriented approach, the results of this study could be used to design service characteristics and also for marketing and communication purposes. This study could be used by a mobile services company to boost their sustainable service portfolio or by a sustainable service organization evaluating to extend their service using mobile technology or by companies looking forward to foray into sustainability domain.

The findings mentioned above which could be attributed as results of this study is a contribution to academic literature. While this study has given new highlights from the

market offering, it also triggers the need for profound study about individual service categories and its characteristics across four MSS segments. The knowledge of service characteristics could initiate many new innovations and service businesses in mobile sustainable services market, thus enabling mobile sustainable service providers to position their products efficiently. As mentioned in Section 6.2, the possible repercussions of this driving forces approach is not discussed in this study and could be a good topic to study further, which would give a holistic view on this approach towards mobile sustainable services.

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APPENDIX 1: MOBILE FEATURES ADDING VALUE

Check list of sustainable services and mobile features that could add value to it.

Mobile Features	**Communication**	**Accessibility**	**Realtime information**	**Easy Use**	**Mobile Payment**	**Personal Safety**	**Collaborate seamlessly**	**Added Tools**
Organization								
Green IT			✓				✓	
IT for Green							✓	
Consultation								
Software Service	✓				✓		✓	✓
Third Party Assurance								
Training							✓	
Marketing			✓					
Health monitoring services	✓	✓	✓	✓		✓	✓	✓
Consumers								
Sustainable Consumption		✓	✓					✓
Sustainable transport & tourism	✓	✓	✓	✓	✓	✓		✓
Energy Management		✓	✓	✓			✓	
Repairing & Recycling		✓	✓	✓	✓		✓	
Household services		✓		✓	✓			
Consumer health informatics		✓	✓	✓	✓	✓	✓	✓

Mobile Features	**Communication**	**Accessibility**	**Realtime information**	**Easy Use**	**Mobile Payment**	**Personal Safety**	**Collaborate seamlessly**	**Added Tools**
NGOs								
Fund raising services	✓			✓				
Fellowship services	✓			✓			✓	
Information Access	✓	✓	✓	✓				
Tools to support their cause	✓	✓	✓	✓	✓		✓	
Government, environment stakeholders								
Develop tools for sustainability action plans	✓	✓		✓		✓	✓	✓
Software services	✓						✓	
Literacy services	✓	✓		✓			✓	✓
Microfinance services	✓	✓	✓	✓	✓		✓	
Entrepreneurship and employment	✓	✓	✓	✓	✓		✓	✓

APPENDIX 2: SUSTAINABLE SURVEY PARTICIPANTS & QUESTIONS

Sustainable survey sent to below organizations and forums through twitter and email.

1. Ecomobility.tv
2. Carpooling.com
3. Future Mobility Now
4. Bike Dock Solutions
5. SPREAD 2050
6. Mobile Active forum
7. Do the Green Thing
8. Car Share Directory
9. Climate Action
10. Ecolo-info
11. GreenGuide UK
12. Guardian Sustainable business (guardian.co.uk/sustainable-business)
13. Planet Green
14. anteUP
15. Stora Enso
16. Tofuture.eu
17. Praekelt Foundation
18. Worldreaders
19. Mobile Monday – Kenya
20. Kiwanja.net

Survey Questions:

1. Have you used mobile app to get news, stories & updates about sustainability or climate change? Did you find it useful?
Ex: Sustainability News app for android http://www.appbrain.com/app/sustainability-news/com.hippyapps.sustainability

- Yes, it is useful
- Yes, but it is not useful
- No, I have not used
- Not aware if there are such mobile apps
- Not interested in using mobile app

2. Being part of a sustainability oriented organization, will you be interested to know about the sustainability practices happening at other companies (or stakeholders)?

- I already know the happenings from other companies(or stakeholders)
- Yes, I will be interested to know other company practices
- No, I am not interested to know other company practices
- No, I do not find it useful to know other company practices

3. Do you find it effective to communicate your sustainability activities to your clients/customers/stakeholders/general audience through a mobile app for your company?

- Yes, it would be useful to have a mobile app to publish our sustainability happenings
- Yes it could be effective, but not sure how useful it would be to have a mobile app for that purpose
- No, we already use other platforms (like own website, Facebook, Twitter etc) to publish our activities
- No idea

4. Consider a mobile app listing the sustainability related events (like planting trees, workshops etc) happening around the world and near to your place. Will you be interested in that and use it?

- Yes, I will be interested and use it
- Yes, I will be interested, but not sure if I will use it
- No, I will not use it as I get that information already
- No I will not be interested and do not find it useful
- No Idea

5. With reference to the previous question, will you be interested in sharing the sustainability related events you organize or you know of, through the mobile app?

- Yes, I will share the events I know or organize
- No, I will not be interested to share the events I know or organize
- No idea

6. Are you interested in getting tips to conserve energy, recycling waste, eco-friendly behaviors through a mobile app?

- Yes, I am interested
- No, I am not interested
- No idea

7. If you want to find a mobile app that could provide tips to conserve energy, recycle waste, which keyword will you use to search?

- sustainability tips
- recycle tips
- energy conserve tips
- sustainable lifestyle tips

8. In your opinion, which of the below channels will give you awareness about a mobile app related to sustainability, sustainable lifestyle?

- [ ] Mobile App Store

- [ ] Search Engine
- [ ] From friends,colleagues,
- [ ] Articles from internet
- [ ] App posters at the end of articles
- [ ] Events like conferences, webinars, workshops

9. Have you ever been in a situation when you are not certain of doing an action which could be clarified by some experts in the field. Ex: If you don't know which is the proper way to dispose your waste batteries at home?

- ○ Yes, I have been in such situations
- ○ No, I have not been in such situations

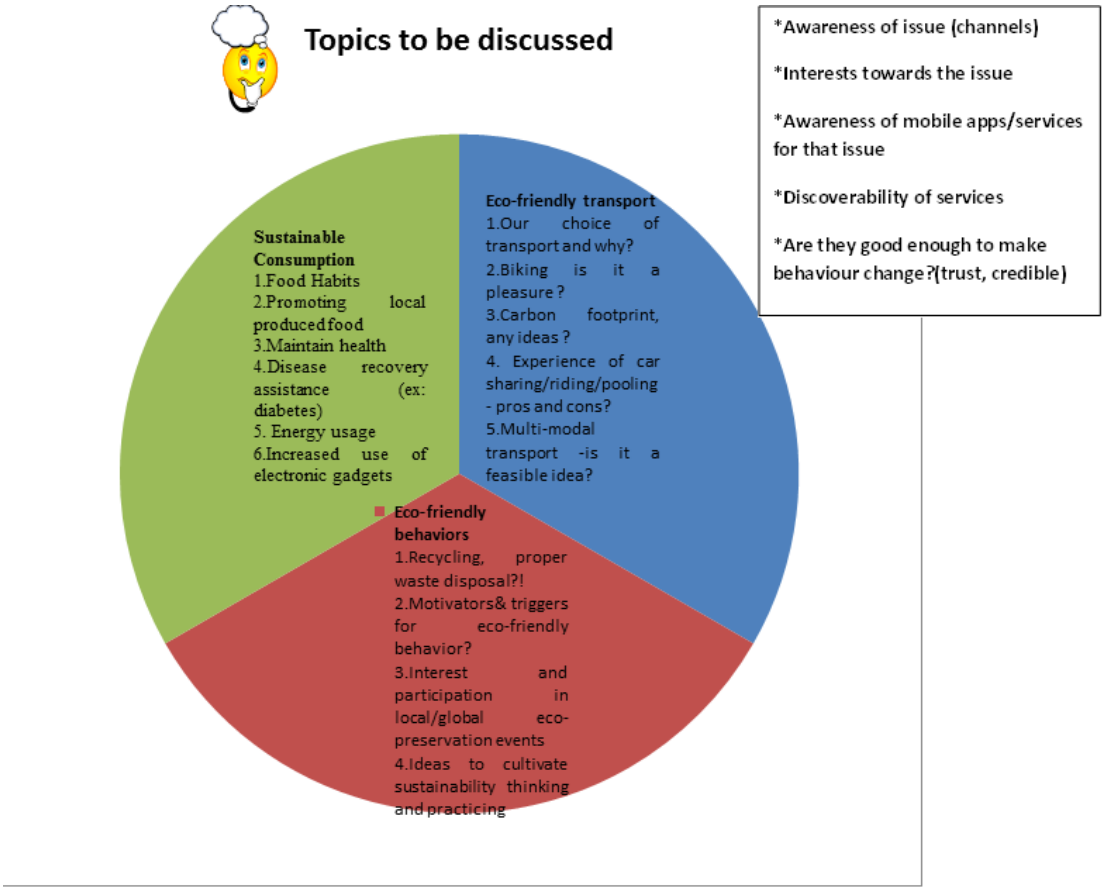
10. Consider the municipality you are residing in provides you a mobile app to ask such questions of yours and help you lead a sustainable lifestyle. Will you be interested in it and also use it?

- ○ Yes, I will be interested and will use it
- ○ Yes, I will be interested but not sure if I will use it
- ○ Yes, I will be interested but will not use it
- ○ No, I will not be interested and will not use it
- ○ No idea

APPENDIX 3: TWITTER DISCUSSION TOPICS

Focus group discussion invitation in twitter

Topics discussed in Twitter discussion



APPENDIX 4: TWITTER GROUP PARTICIPANTS

Participants in Twitter discussion group along with the participant name and profile is listed below. Total number of participants is eight.

S.No	Participant Name	Participant profile
1.	Anusha Narayan	Human resources professional, Finland
2.	Ajith Ganesan	Master's student, Eindhoven University, The Netherlands
3.	Kirsi Sormunen	Vice President, Sustainability, Nokia Oyj, Finland
4.	Harold Ntorinkansah	Social Entrepreneur, Mobile Developer, Tech Enthusiast, Ghanaian
5.	Sriram Gurumoorthy	Researcher, Tampere University of Technology, Finland
6.	Tuukka Hursti	Senior Test engineer, Ixonos, Finland
7.	Venkatesh Govindan	Master's student, Eindhoven University, The Netherlands
8.	Vijay Vishwanath	Senior Software engineer, Nice Oyj, Finland

APPENDIX 5: INTERVIEWEE DETAILS

The interviewee details are listed in alphabetical order (Firstname, Lastname)

S.No	Interviewee	Position & Organization	Mode of interview
1.	Antti Vanhanen	Services Rollout Manager, Nokia Oyj	Face to face
2.	Elina Seppänen	Project Specialist, ECO2	Face to face
3.	Karthikeya Acharya	Researcher, Aalto University, School of Art and Design	Telephone
4.	Leena Karppi	Project Manager, Ilmankos	Face to face
5.	Leena Oiva	Account Manager, WWF Finland	Telephone
6.	Ramana Killi	Founder, Green Basics social enterprise, India	Telephone
7.	Roberto Tarantino	Euro-planning adviser-manager, European Union and juridical – environmental studies and research	Email questionnaire
8.	Satu Kalliokulju	Director, Consumer opportunity identification, Nokia	Telephone
9.	Teemu Turunen	Project Manager, Motiva Services Ltd	Face to Face