

‘CONNECTING TO DISASTERS’

The Critical Success Factors of Mobile Phone Utilisation within
Disaster Management Operations:

The Case of Vanuatu

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ABSTRACT

This study was an endeavour to contribute to the understanding of mobile phone use in disaster management. The main purpose of the study is to identify the factors necessary for mobile phones to successfully facilitate communication and information dissemination in disaster management operations in Vanuatu, which is viewed as a region experiencing significant risks to natural disasters, as well as a rapidly expanding mobile phone industry.

The research uses qualitative data collected through semi-structured interviews from two months of fieldwork in Vanuatu. Interviews were conducted with participants sourced from mobile phone providers, civil society organisations, government departments, and Vanuatu communities.

The research revealed a set of 16 critical success factors that affirmed a number of conclusions drawn from the literature but also revealed information unique to the Vanuatu context. The emerging factors necessary for mobile phone success were developed into a top-down framework with four categories. At the top, factors at the 'Government Level' highlighted the need for government leadership and 'ownership', particularly in 'policy formulation' and 'sanctioning' of disseminated information. Below this, key stakeholder groups involved in mobile phones and disaster management make up the 'Stakeholder Level', where there was a critical need for 'communication', 'alignment' and 'collaboration' between these groups. Stakeholder groups also need effective 'staff training', and a clear understanding of their 'roles and responsibilities' surrounding the mobile phone application. The means that enable stakeholders to operate this process make up the 'Technology Level', where critical factors include an 'extensive network' containing 'resilient infrastructure' with swift 'maintenance and repair processes'. Finally, at the grassroots, community members make up the 'User Level'. For users mobile phones must be both 'affordable' and 'easy to use', they also need 'electricity access' to meet phone charging needs, as well as knowledge of local areas with sufficient 'network access'.

These results reveal the importance of addressing ways to improve mobile phone use in disaster management. Mobile phones are now the most widely used information communication technology in Vanuatu, so improving their effectiveness in disaster management operations is important and could have significant implications for communities that are vulnerable to natural disaster hazards.

KEY WORDS: Mobile Phones; ICT; Disaster Management; Natural Disaster; Development; Vanuatu

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KEY TERMS AND ACRONYMS

Communications System	A communications system is a collection of individual communications networks, transmission systems, relay stations, tributary stations usually capable of interconnection and interoperation to form an integrated whole.
CSF	Critical Success Factor
Disaster	A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.
Disaster Risk	The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.
Disaster Hazard	A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.
Disaster Management (DM)	The systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters.
Disaster Risk Reduction (DRR)	A systematic approach to identifying, assessing and reducing the risks of disaster.
End-user	The person who uses a product. The Consumer of a product.
Global south	Refers to the north–south divide, a socio-economic and political division that exists between the wealthy developed countries, known collectively as “the north”, and the poorer developing countries (least developed countries), or “the global south.”
ICT	Information Communication Technology
Information System	Any combination of information technology and people’s activities that support operations, management and decision making.
METEO	The Vanuatu meteorological and geo-hazard department.
Mitigation	Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and

technological hazards.

Mobile Phone User	Those who use mobile phones on a regular basis, at least once a month.
NDC	National Disaster Committee
ni-Vanuatu	Collectively refers to the indigenous people of Vanuatu.
NDMO	National Disaster Management Office
Preparedness	Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations.
Recovery	Decisions and actions taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk.
Response	The provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of an immediate, short term, or protracted duration.
TVL	Telecom Vanuatu
VTRR	Vanuatu Telecommunications and Radio-communications Regulator
Vulnerability	The conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

CHAPTER I

INTRODUCTION

1. 1. Introduction

In February 2008 I began a one year volunteer assignment with a non-governmental organisation in Port Vila, Vanuatu. During my time, I frequently experienced damaging forces of nature, most notably Cyclone Gene in February 2008. There were also a number of severe storms, frequent earthquakes and the occasional volcanic eruption. I soon realised that this was a region facing constant and considerable disaster hazards. And it was often the communities based in the most isolated environments that were the most affected by these disaster events.

I was often struck by the isolation of the islands and communities that I travelled to, and the struggles people encountered with communicating across large distances. In many communities, I witnessed people travelling for hours, even days, in order to pass on a message, or to reach the nearest form of communications technology, usually a landline. Mobile phones existed, yet the market was small and many Vanuatu citizens had not been able to access the technology due to high costs and poor coverage. Then things changed. Six months into my stay, new competition in the mobile phone market led to a price drop and improved coverage. Ownership rates surged throughout the nation. This struck me as a significant event, that in a matter of days the range of communication for people in isolated communities expanded from local to global, as mobile phones literally enabled local people to talk with someone on the opposite side of the planet. There was a sense of empowerment that mobile phones brought to isolated communities, and to people throughout the nation. People now had the power to communicate to almost anywhere across the country, unhindered by the barrier of distance.

Towards the end of my assignment, I received a text message from my provider; it was a tsunami warning advising me and my colleagues to seek higher ground. Of course we did as requested, and whilst the tsunami did not eventuate, the experience provided me with a unique insight; mobile phones had directly impacted on my vulnerability to the risks posed by this potential disaster. To me, this event revealed that mobile phones could have a unique role in Vanuatu disaster management, as an avenue to promote communication in disaster management operations. This thesis is the result of my quest for knowledge and understanding relating to this experience.

1. 2. Statement of Problem: Mobile Phones, Natural Disasters & Developing Countries

In 2002, the total number of mobile phones in use worldwide exceeded the number of landlines, at the time there were estimated to be 1.1 billion subscriptions. A decade later, in 2012, there are currently an estimated 5.9 billion mobile cellular subscriptions worldwide (ITU, 2012). Through processes of globalisation, this decade has seen the socio-geographic reach of mobile phones expand at an accelerating rate throughout the world, particularly into the developing world, where current trends show household access is growing significantly faster compared to developed countries. Therefore, in the global south the rise of new technologies has given rise to new opportunities. An early report from the International Telecommunication Union (2007) explains:

“The greatest impact of mobile communications on access to communication services can be seen in developing countries.” [Furthermore] “In countries where mobile communications constitute the primary form of access, increased exchange of information on trade or health services is contributing to development goals.”(4)

It is therefore unsurprising that the development sector¹ has been quick to embrace the merits of this new communications technology. In comparison to alternative information communication technologies, the simplicity of mobile phones have proven to be a major advantage for their use in developing countries and they are proving to be a more effective tool for development than many more elaborate and highly promoted alternatives (Harvey & Sturges, 2010).

Therefore, many research communities and development practitioners have been interested in the topic of mobile phones in development: many have been concerned with economic development, they see mobile phones as an enabler of economic prosperity; others have been concerned with the social, and cultural implications of mobile phone use in the developing world; and others have been concerned with their application into a range of development areas such as education and health. A recent application of mobile phones which warrants attention from both the research community and development sector is their use in disaster management.

Natural disasters pose a significant threat to development outcomes throughout the global south. Each year natural disasters impact the lives of millions of people, particularly within the developing world. Between 1991 and 2005, more than 90% of natural disaster deaths and 98% of people affected by natural disasters were from developing countries (IFRC, 2008). Natural disaster hazards are primarily posed by tectonic related activity (earthquakes, volcanic activity, and tsunami) and weather related activity (storms, floods, cyclones, droughts). Human vulnerability to these natural hazards is rising, with more people living in low-lying coastal zones, seismically hazardous

¹ The Development sector refers to researchers, practitioners and aid institutions involved in community, provincial and international development in the global south.

areas and concentrated urban environments (Burton et al., 1993; El-Masri and Tipple, 2002; Briceno, 2004; Amendola et al., 2008).

Natural hazards tend to be more destructive in developing countries because of economic, political, social and cultural factors that increase vulnerability (Guinau et al., 2005). Natural disasters also jeopardize important social development goals such as addressing poverty, ensuring adequate food, water, and sanitation, and protecting the environment. A recent report by the Secretariat of the Pacific Community (SOPAC, 2009) noted:

“Natural disasters have had significant socio-economic impacts on the Pacific island countries. The “costs” incurred by the disasters have been high, exacerbated by little attention paid by Pacific island governments to disaster risk management. It is therefore imperative that natural disasters are recognised as more than just a humanitarian issue, but also a development issue, which indeed requires appropriate mitigation actions to protect investments in national development” (1)

Despite efforts to reduce the risk caused by natural hazards, such as the designation of the 1990s as the International Decade for Natural Disaster Reduction (IDNDR), the impact of disasters are expected to increase worldwide (IFRC, 2008), climate change is further compounding these impacts by influencing an increase in the magnitude and frequency of weather related events (World Bank, 2006). The particular vulnerability of developing countries to natural disasters underscores the need to develop feasible solutions to reduce vulnerability, and in general improve overall disaster management capacity.

Disaster management has become the major driver of organisational responses to the risks posed by natural disasters. Although natural disasters cannot entirely be prevented, disaster losses (e.g. casualties, economic and environmental) can be minimized with effective disaster management – the process of mitigation, preparation, response and recovery. Therefore, the potential for mobile phones to have a role in disseminating information in disaster management, to improve communication flows and communication operations, presents a significant rationale for critical inquiry. Mobile phones have improved communication capacity in developing countries that are increasingly vulnerable to natural disaster hazards. Their ability to instantaneously acquire and disseminate information therefore presents a useful tool in all areas of disaster management.

1. 3. Statement of Purpose: The Research Question & Objectives

This thesis aims to contribute to a small body of literature that addresses the role of mobile phone technology as a communications mechanism in disaster management operations. By exploring the experiences of mobile phones in Vanuatu, it aims to identify a set of critical factors that are contributing to the successful application of mobile phones into disaster management communication operations. With this in mind, the following research question is utilised as the guiding mechanism of critical inquiry for this thesis:

‘What are the critical factors that contribute to the successful use of mobile phones as a mechanism for communication and information dissemination in Vanuatu disaster management operations?’

In order to achieve the above-mentioned research question, the following objectives frame this research:

1. To investigate the government roles in the process of integrating mobile phone use for disaster management purposes.
2. To explore the experiences of key stakeholders in relation to managing and facilitating the use of mobile phones as a communications tool within disaster management operations.
3. To identify the technological factors that contribute the successful operation of mobile phones and the mobile cellular network in Vanuatu.
4. To examine the experiences of Vanuatu ‘end-users’ in operating a mobile phone.

1. 4. Structure of the thesis

This thesis is organised into six chapters, including this introduction chapter.

CHAPTER II outlines the context of the thesis in relation to Vanuatu, the research site for this thesis. This covers aspects relating to Vanuatu’s history, economy and population. As well as Vanuatu’s past experiences with natural disasters and the rise of information communication technologies in the region.

CHAPTER III provides the development framework of the research and a review of the relevant literature pertaining to mobile phones, disaster management and development. First, the chapter examines ICT and mobile phones in the contemporary world. Then it explores human vulnerability to

natural disasters and disaster management responses in developing countries. Literature on critical success factor analysis is then presented and justified as an appropriate measure for this research. Finally it situates this research in an appropriate academic context and demonstrates its original contribution.

CHAPTER IV provides a broad overview of the approaches and methodology used, drawing on methods from both development research and information systems research. It discusses the bias and positionality of the researcher. In addition, this chapter describes and details the methods, tools and techniques used in this research. Finally, it explains the processes of data collection and analysis with its limitations and benefits.

CHAPTER V exposes the research findings and analysis of the interviews with a number of Vanuatu NGOs, government offices, mobile phone providers and members of the public. This chapter then offers a discussion which reconnects the findings with the aims and the wider literature.

CHAPTER VI summarises the aims of the thesis along with its contribution to development studies. While coming back to the research questions, it stresses wider issues in development. In this chapter, conclusions and contributions are presented in relation to each research objective. Additionally, gaps for future research are identified along with some recommendations for mobile phone utilisation in disaster management. Finally, I present some closing reflections for this research thesis.

CHAPTER II

VANUATU: BACKGROUND AND CONTEXT

2. 1. Introducing Vanuatu

As mentioned, Vanuatu has been identified an important site for research. Vanuatu, officially the Republic of Vanuatu, is an island nation located in the South Pacific Ocean. The nation has a rich and often complex history, so it is important to outline the past and current economic, social and environmental influences that contribute to what Vanuatu is today. And in turn explain why Vanuatu is an appropriate site for this particular research study.

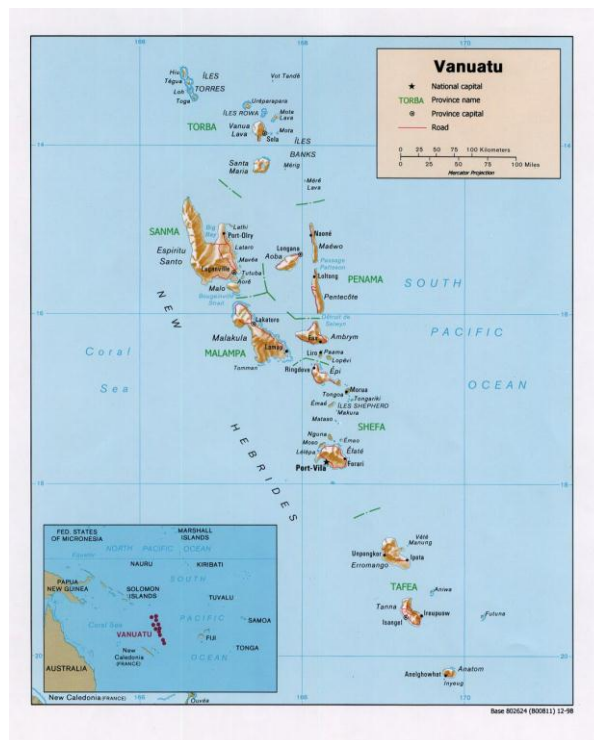


Figure 2.1: Islands of the Republic of Vanuatu
(Source: <http://www.graphicmaps.com/>)

History & Colonialism:

The Vanuatu group of islands was discovered by the Spanish in 1606, and then rediscovered again by the French in 1768. Captain Cook named the islands the 'New Hebrides' in 1774, a name that lasted until independence. It has a complex history of colonialism, with immigrants first arriving after the discovery of sandalwood in 1825. Initially, British subjects from Australia made up the majority, but the establishment of French businesses in the region tipped the balance in favour of French subjects by the turn of the century. In 1906, French and British colonialists agreed to administer the islands

jointly. This form of government lasted until a ni-Vanuatu political party established in the 1970s, pushed for independence, and the Republic of Vanuatu was created in 1980 (Bureau of East Asian and Pacific Affairs, 2011).

Population:

Vanuatu has a population of 224,564 (July, 2011). The population is predominantly rural with 75% of the ni-Vanuatu population living in rural environments. There are two main urban settlements, the capital Port Vila has a population of 40,040 and Luganville in the north has a population of 13,167 (Bureau of East Asian and Pacific Affairs, July 2011).

Economy & Development:

Vanuatu's economy is primarily agricultural; 80% of the population is engaged in agricultural activities that range from subsistence farming to smallholder farming of coconuts and other cash crops. Copra is the most important cash crop, followed by timber, beef, and cocoa. Kava root extract exports also have become important. Coconut oil, copra, kava, and beef account for more than 75% of Vanuatu's total agricultural exports, and agriculture accounts for approximately 20% of national GDP. Tourism is another key driver of the economy, also makes up approximately 20% of GDP (World Bank Indicators, Sourced: January 2012).

Since 1980, Australia, the United Kingdom, France, New Zealand, and more recently the US and China have provided the bulk of Vanuatu's development aid. Multilateral organizations, such as the Economic and Social Council for Asia and the Pacific, the UN Development Program, the Asian Development Bank, the European Union, and the Commonwealth Development Corporation also provide developmental assistance. From 2002-2007 Vanuatu's official development assistance has sat around 11% of Gross National Income, this has risen to 15% in 2008 and then to 18% in 2009. The IMF has projected that Foreign aid to Vanuatu will remain stable from 2011–16 and then gradually decline over the long term as Vanuatu's per capita income level rises (IMF Staff Report, 2011).

Disasters:

Vanuatu is considered as a region with high risk to natural disasters. The geography of Vanuatu makes it susceptible to cyclones and storm events. Vanuatu is also located in a region with high tectonic and volcanic activity, making it vulnerable to earthquakes, tsunamis and volcanic eruptions. Below are figures detailing the impacts and frequency of natural disasters in Vanuatu, firstly by category (Table 2.1), and secondly by specific disaster events with the most impact on Vanuatu in the past two decades (Table. 2.2).

Category	Type	# of Events	Total Affected	Average Affected per Event
Storm	Tropical cyclone	23	242573	10546
Earthquake (seismic activity)	Earthquake (ground shaking)	8	15105	1888
Volcano	Volcanic eruption	5	18900	3780
Flood	General flood	2	3951	1975
Mass movement wet	Landslide	1	3000	3000
Earthquake (seismic activity)	Tsunami	1	100	100

Table 2.1: Natural Disasters in Vanuatu for the period 1940 to 2011 arranged by number of events (Source: "EM-DAT: The OFDA/CRED International Disaster Database. Created on: Jan-31-2012)

Disaster Event	Date	No Total Affected
Storm – Cyclone Ivy	25/02/2004	54008
Earthquake + Tsunami – PENEMA & surrounding regions	27/11/1999	14100
Storm – Cyclone Perma	30/03/1993	12005
Volcano - Ambrym	01/12/2008	9000
Volcano - Aoba volcano, Ambae	27/11/2005	5000
Volcano – Lopevi	08/06/2001	4500
Flood - Tanna	21/12/2002	3001
Storm – Cyclone Yali	21/03/1998	2400
Flood - Ambrym	15/04/2009	950
Storm - Cyclone Sose	07/04/2001	800

Table 2.2: Top 10 Natural Disasters in Vanuatu for the period 1993 to 2012 arranged by numbers of total affected people. (Source: "EM-DAT: The OFDA/CRED International Disaster Database. Created on: Jan-31-2012)

Tropical storms and cyclones pose the greatest impact on the population of Vanuatu. Recently, in 2004 tropical Cyclone Ivy affected more than 54,000 people (or a quarter of the national population) around the country, damaging over 11,000 houses and destroying important cash and food crops. Earthquakes can also negatively affect economic activity on the island nation. A severe earthquake in November 1999, followed by a tsunami, caused extensive damage to the northern island of Pentecost, leaving thousands homeless. Flooding can also cause problems, a tropical storm in 2004 impacted heavily on Tanna causing flash floods and land slips that left many homeless. Volcanic activity is another major concern for communities living in proximity to Volcanoes, in 2008 the Ambrym Volcano erupted ash and causing acid rain to fall on surrounding communities. Almost 95% of the population was dependent on rainwater collection which was contaminated by acid rain. Acid rain also damaged agricultural crops which had adverse impacts on food supply.

Communications:

Mobile phone service in the islands is provided by Telecom Vanuatu (TVL) and Digicel. A landline and internet service is provided by TVL. In the last 4 years Vanuatu has experienced accelerating access to mobile phone technologies with the new provider Digicel entering the market in 2008. Mobile cellular subscriptions have increased from 6.7% in 2006, to 52.7% in 2009. The latest figures in presented by the ITU in 2010 were to 115% per 100 head of population, due a number of users owning more than one subscription or sim-card. Mobile network coverage in Vanuatu currently reaches an estimated 90% of the Vanuatu population (ITU, 2011). Mobile phone subscription increases are presented in two forms below, in Figure 2.2 and Table 2.3:

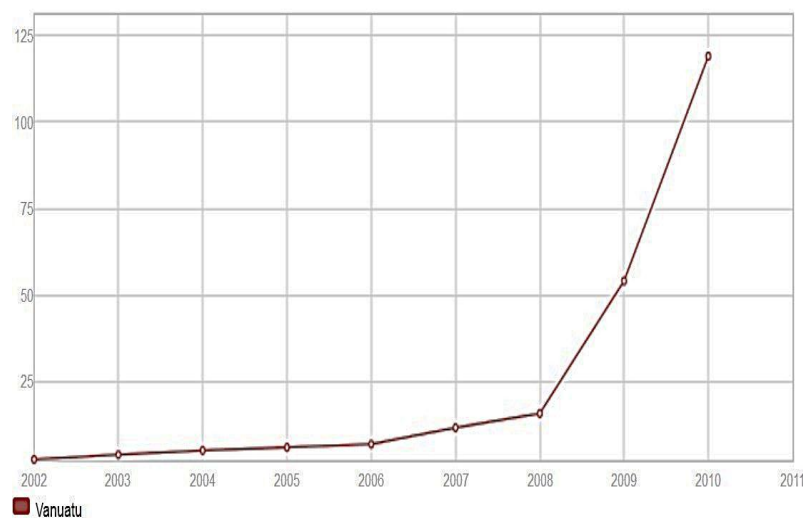


Figure 2.2 Vanuatu trends in mobile phone Subscriptions, per 100 head of population, 2000-2010. (ITU, 2011)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Subs	365	350	4,900	7,800	10,504	12,692	15,000	26,000	36,000	126,452	285,300

Table 2.3 Vanuatu trends in aggregate national mobile phone subscriptions, 2000-2010 (ITU, 2011)

2. 2. Chapter Summary

This chapter sought to introduce Vanuatu as the site for this research. The background and history of Vanuatu was briefly outlined, as was the current situation of Vanuatu relating to the populace, economy, disaster risks, and the communications situation.

CHAPTER III

LITERATURE REVIEW

3. 1. Introduction

This chapter presents a comprehensive analysis of relevant literature that is important for placing the research problem in the context of current discussions going on in related subject areas. The main subject areas related to this thesis are ‘information systems’ -which encompasses ‘information communication technologies’ (ICTs) such as the mobile phone-, ‘disaster management’, and ‘development studies’. This review first covers the emergence of ICTs and mobile phones, looking specifically at their use within development and disaster management. The impacts of natural disasters in the developing world and subsequent disaster management responses are then explored. Following this, a comprehensive assessment of the ‘critical success factor’ (CSF) identification process is undertaken. This looks specifically at the CSFs derived from enterprise resource planning, various applications for mobile phones in development, and also CSF analysis in disaster management. Finally, a framework is derived from the assessed literature which informs the research process.

3. 2. ICT and Mobile Phones

Firstly, it is important to critique what is known about mobile phones, what they have been used for in the past, as well as their current and prospective uses in the future. This section covers the evolution of mobile phones as an information communication technology. The incorporation of mobile phones into the development sector is then explored, and more specifically a review of the potential integration of mobile phones into disaster management is undertaken.

3. 2. 1. Globalisation of ICTs and Mobile Phone Technologies

Innovation in ICTs is providing new opportunities for communities throughout the globe. And the subsequent advance in this global capacity to communicate information is spurning increased attention in the academic world. Much of this attention is being directed at the role of mobile phones and the opportunities they can bring to developing countries.

The relationship between mobile phones, distance and time is at the core of this topic area. David Harvey (1989) theorised this idea as ‘Time-Space Compression’, which in the context of mobile phones, sees them as a technology which renders distance to be insignificant. In short, there is consensus that mobile phones allow instantaneous communication over vast distances, so in

essence they contribute to ‘the annihilation of space through time’ (Harvey, 1989; Giddens, 1990; Green, 2002).

In a developing world context, distance is the major barrier to communication. Lash & Urry (1994) describe this as the ‘tyranny of distance’, and it is apparent from the literature that ICTs –and more recently mobile phones- have become one of society’s greatest ‘weapons’ against it (Green, 2002; Lash & Urry, 1994). As a result, the scope of daily communication has increased from 10’s of kilometres, to being able to communicate with networks that span the entire planet.

The recent, literature also covers the extent of mobile phone penetration into the developing world. Librero et al. (2007) projected that mobile penetration levels will increase at an accelerating rate over the next decade in developing countries. This observation is supported by official reports and data collected by the United Nations funded International Telecommunications Union (ITU) in 2011 (See Figure 3.1).

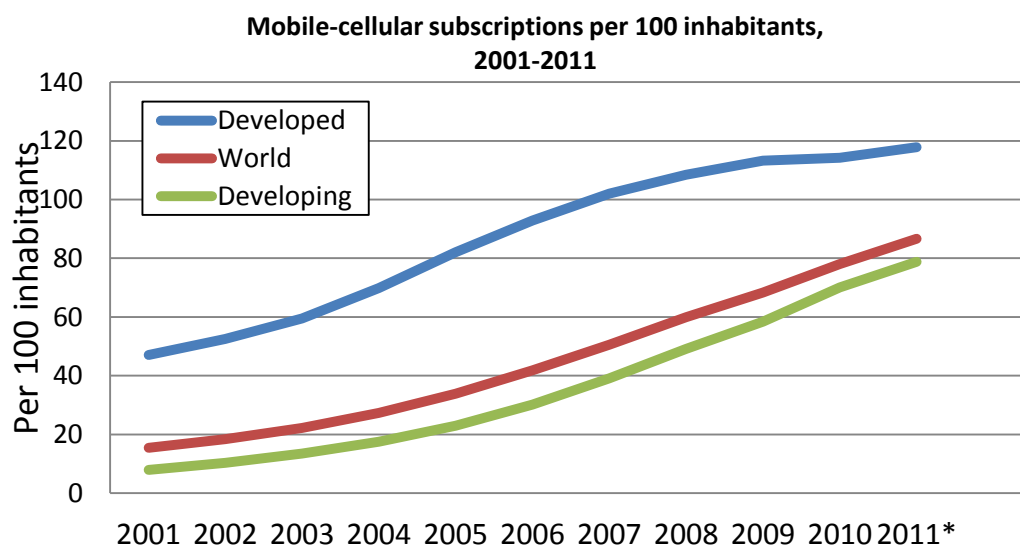


Figure 3.1: Global mobile phone users per 100 inhabitants (ITU, 2011)

These figures show significant increases in mobile phone usage by both the developed and developing worlds. Most recently, in 2011, the developed world shows considerable mobile phone penetration with 117 mobile subscriptions per 100 people. This would suggest that the developed world has almost completely adopted ICT technologies such as mobile phones.

With this in mind, the increases in mobile phone usage in the developing world suggest global processes are also enacting in developing areas, suggesting ICTs are spatially expanding into the developing world. Most notably, the ITU World Telecommunications Indicators (2011) show that

mobile cellular subscriptions in 2011 reached 78.8% per 100 people in the developing world, and this trend is accelerating at a significantly faster rate than the developed world.

But are these trends relevant to developing countries within the Pacific? A survey carried out in Vanuatu by the Pacific Institute of Public Policy (2008, p2) found “approximately 51 per cent of respondents indicated the first mobile in the household was acquired in the last year”. Similarly, trends presented by the ITU (2011) mirror these findings (see figure 3.2). This suggests that the accelerating mobile phone use in the Pacific is unique because it is significantly higher than the growth rates of the general developing world, as reported in 2007 by the ITU to be 8% per annum (1997-2007). This recent increase suggests it is important to ask what benefits the Pacific could see from this improvement in mobile phone capacity. Furthermore, and relating to the thesis topic, what benefits could be attributed by their integration in Vanuatu disaster management?

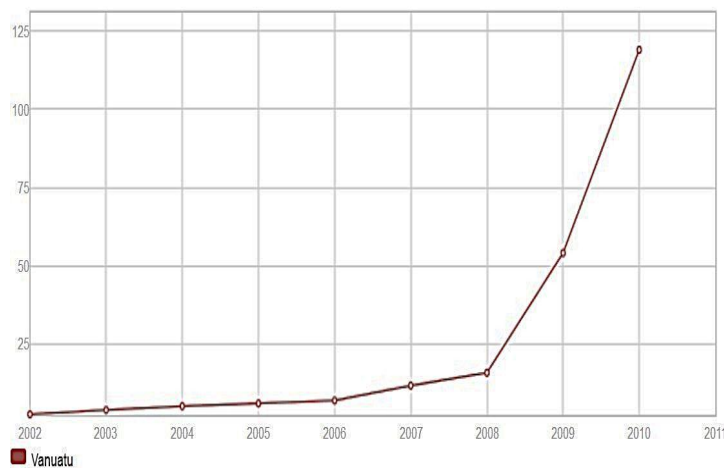


Figure 3.2: Vanuatu - Mobile Cellular Subscriptions per 100 head of Population (ITU, 2011)

3. 2. 2. Mobile Phones in Development

So mobile phones are becoming prevalent in developing countries, and particularly in Vanuatu. But what evidence suggests mobile phones can be used effectively for development purposes? Kenneth Lynch (2003, p1) acknowledged that mobile phones are starting to play an important role in development: “In Africa mobile telephony is currently the most cost-effective technology for connecting rural areas to urban-based information networks”. Similarly, James and Versteeg (2007, p117) suggest “Mobile telephony is considered to be particularly important for development... mobile phones are an opportunity for developing countries to close the digital divide”.

More specifically, there is also important evidence that mobile phones applications are being integrated successfully as a resource to achieve development goals. For example, recent

findings from ICT and education literature have led to the development of frameworks and innovations intended to facilitate education and improve learning outcomes in developing communities, known as *m-learning*. Within this setting, m-learning has been seen to bring a host of benefits to students in isolated communities (Arunachalam, 1999; Valk et al. 2010).

Valk, Rashid and Elder (2010) completed a case study of m-learning experiences with communities in five East Asian regions. They concluded that mobile phones are convenient and affordable –for both students and the educators-, and they reduce the barriers of education while attaining educational outcomes that are comparable to traditional education methods: “It is believed that ICTs can empower teachers and learners by facilitating communication and interaction, offering new modes of delivery, and generally transforming teaching and learning processes” (Valk et al. 2010, p118).

The above literature suggests mobile phones can be an appropriate development tool for improving education outcomes in these East Asian regions. Related studies also suggest mobile phones are appropriately and effectively applied in developing countries to achieve health objectives through m-health programs (Kahn et al., 2010; Vatsalan et al., 2010; Afridi & Farooq, 2011; Asangansi & Braa, 2010) and also business objectives through m-commerce programs (Karunanayake et al., 2008; Saidi, 2010). It is therefore appropriate to explore how effective other applications for mobile phones may be, such as in disaster management.

3. 2. 3. Mobile Phones in Disaster Management

Within the disaster management literature, some authors have recently suggested mobile phones are significant for both ‘disaster relief’ and ‘disaster management’ outcomes (Harvey & Sturges, 2010; John Mulrow, 2010). It suggests that mobile phones are an appropriate technology for development and specifically, disaster relief. Harvey & Sturges (2010) wrote “the cell phone now has to be taken as a truly influential technology which is enabling society to achieve a host of benefits, some small and some large, that were previously unachievable” (p148). Mobile phones may therefore be appropriate for disaster relief coordination. John Mulrow (2010, p22) explained that “mobile phones played a vital role in the Haiti earthquake relief effort”, he highlighted how mobile phones were used by Haitians to inform relief operations of their location and situation enabling aid resources to be delivered more effectively resulting in better outcomes for the earthquake survivors.

A study completed by Norris et al (2009) on ‘mobile health’ applications acknowledged how improvements in communication facilitated by mobile phones can impact positively on patients who permanently reside away from a medical facility: “mobile technologies offer the possibility of

managing non-critical care within the community, thus reducing hospitalisation, improving patients' quality of life and controlling costs" (p247). This may have implications for disaster relief scenarios, the increase in communication to communities impacted by disasters could mean the delivery of more appropriate aid that meets the needs of these communities, and results in a reduction of inappropriate aid resources, and in turn an increase in efficiency for aid relief organisations. In this way it would seem the use of mobile phones can have significant benefits for disaster relief scenarios.

There is a need for further research on how mobile phones can be used to minimise the impacts of disasters for developing communities. For example, it is necessary to ascertain what benefits the Pacific could gain from mobile phones when applied to disaster management. This research study will therefore attempt to address this knowledge gap.

3. 3. Disasters in the Developing World and Small Island States

But what are the impacts of disasters on the developing world, and why do the risks and vulnerabilities for developing communities influence both researchers and practitioners to look for technological solutions in disaster management?

3. 3. 1. Vulnerability: The Concept

Firstly, what is understood about 'vulnerability', particularly in relation to disaster events? The term 'vulnerability' has been used in many fields of study, including social science, geography, and environmental science. The term is used most often in the discourse of disasters (Twigg & Bhatt, 1998), and within fields of study that relate to disasters such as risk, hazard, disaster management, climate change, environment and development studies (Weichselgartner, 2001). Vulnerability, therefore, is a dynamic and multi-dimensional concept which can be used in different contexts in the developmental discourses, such as socio-economic, cultural, gender, political and environmental, income, health and poverty related issues (Campbell, 2003; Chambers, 2006; Ramachandran & Eastman, 1996; Twigg & Bhatt, 1998; World Bank, 2000/2001).

In general terms, Chambers (2006, p33) defines vulnerability as defenselessness, insecurity, and exposure to risk, shocks and stress, and he differentiates 'vulnerability' by pointing out that it does not mean "lack or want" which relates more appropriately to the term "poverty". Twigg and Bhatt (1998, p5-6) (quoting Warmington, 1995; OECD-DAC, 1994), define the term 'vulnerability' in the context of socio-economics as the following:

“A condition or set of conditions which adversely affect people’s ability to prepare for, withstand and/ or respond to a hazard”.

Or

“Concerns the propensity of a society to experience substantial damage, disruption and casualties as a result of hazard”

Further, Campbell (2003, p97), in his discussions on definitions and meanings of vulnerability, argues that “being vulnerable also often incorporates having a lack of agency, or an inability to respond to duress or hardship”. It is also believed that people with lower coping abilities who are more exposed to vulnerability have a higher risk than those with high coping abilities who are less exposed to vulnerability; this has implications for developing communities who often do not have adequate systems to cope with hazards such as natural disasters (Ramachandran & Eastman, 1996).

Vulnerability therefore is a core aspect of this thesis, because it is relative to the extent to which a natural disaster will impact on a developing community. A working definition of ‘vulnerability’ for this study is taken from the most recent United Nations International Strategy for Disaster Reduction (UNISDR, 2009. p30): “The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard”.

3. 3. 2. Disaster Impacts for Developing Countries and Small Island States

So to what extent do natural disasters impact on developing nations? There is consensus that disasters have significant impacts for the developing world (Desai, 1990; Troy et al, 2007; Aysan & Davis, 1992). Schilderman (1993, p422) writes “Increasing numbers of people particularly in the third world are vulnerable to disasters. And disasters are making their impact felt, in casualties, injured and damage, in an ever-accelerating way”. Similarly, although in a Pacific context, a recent World Bank Policy note (2006, p2) stated:

“Pacific Island communities are particularly vulnerable to natural disasters...Each year these events result in significant loss of life and destruction of homes, public infrastructure and livelihoods and the reversal of hard-won economic gains...For Pacific Island leaders, and their development partners, the lessons are clear. Communities across the region need to counter the negative impacts of extreme climate events and other natural disasters by improving their preparedness and response”

Giving this statement some statistical relevance, the World Bank (2006) reported that over the last six decades the Pacific has experienced increases in the frequency and magnitude of reported natural disaster events. The data is presented in Figure 3.3.

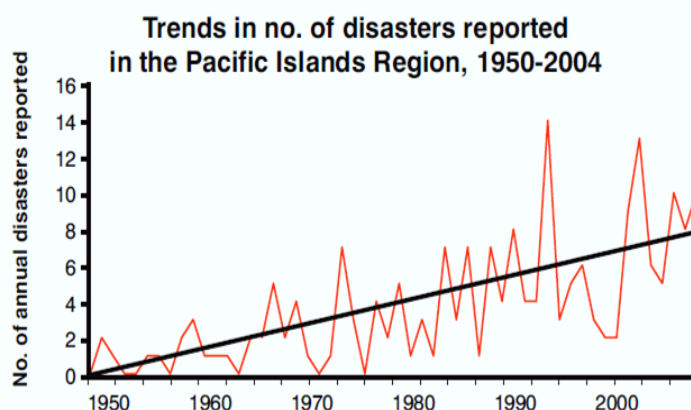


Figure 3.3: Trends in number of reported disaster in the Pacific 1950-2004 (World Bank, 2006)

Pelling & Uitto (2001) suggest that this disaster vulnerability in the Pacific stems from the predominance of ‘small island developing states’ (SIDS). A study conducted by Pelling & Uitto (2001, p49) highlighted that “of the 25 countries that suffered the greatest number of natural disasters during the 1970’s and 1980’s, 13 were SIDS.” Similarly, Briguglio (1993) concluded that worldwide, nine of the ten countries most vulnerable to natural disasters were SIDS.

These findings suggest that disasters have significant impacts for developing nations, particularly for SIDS in the Pacific. Research into how to minimize the impacts of disasters for communities in the Pacific is appropriate and relates to issues within the literature. Utilising Vanuatu as a case study for this research is also appropriate due to it being a Pacific based small island developing state.

3. 3. 3. Disaster Management in the Developing World and Small Island States

As mentioned, both the World Bank (WB Policy Note, 2006) and UN (APCICT, 2010) identified the need for improved disaster management in the Pacific. But what is known about the current practices, processes and policies of ‘disaster management’?

It is important to firstly explore the meanings that surround ‘Disaster Management’ (DM) or as it is often referred to ‘Emergency Management’. DM is the generic name for the interdisciplinary field that deals with the strategic organizational management processes used to protect critical assets of an organization from hazard risks that can cause disasters. It also serves to ensure the continuance of the organization within their planned lifetime (Haddow and Bullock, 2003). Therefore, Disaster Management typically resides at the executive level in an organization, and serves as an advisory or coordinating function of more targeted aspects. Such targeted aspects and important practical implementations of DM include the processes within ‘Disaster Risk Management’

(DRM); the United Nations International Study for Disaster Reduction (UNISDR 2009, p9) refers to DRM as:

“The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.”

DRM operates from an important conceptual framework called ‘Disaster Risk Reduction’ (DRR), the UNISDR (2009, p10) defines this as:

“The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.”

Within the conceptual framework of DRR, the management of disasters is described as consisting of four phases that are concerned with risk reduction, preparing resources to respond to the hazard, responding to the actual damage caused by the hazard and limiting further damage, and returning as close as possible to the state before the hazard incident (Haddow, 2003). Drawing from a recent UN initiated study surrounding disaster risk reduction Table 3.1 presents a summary of these four phases (UN- APCICT, 2010).

PHASE	DESCRIPTION
Mitigation	The lessening or limitation of the adverse impacts of hazards and related disasters. It encompass engineering techniques and hazard-resistant construction as well as improved environmental policies and public awareness.
Preparedness	The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions. It is based on a sound analysis of disaster risks and good linkages with early warning systems.
Response	The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected.
Recovery	The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Recovery programmes, coupled with the heightened public awareness and engagement after a disaster, afford a valuable opportunity to develop and implement DRR measures and to apply the ‘build back better’ principle.

Table 3.1: The Four Phases of Disaster Management (UN- APCICT, 2010, p.12)

3. 4. Critical Success Factors

So what is the best way to go about studying the application of mobile phones in Vanuatu disaster management? What process would draw information that is significant and could impact positively on reducing disaster vulnerabilities? Mobile phones are an information communication technology and they therefore relate to the field of Information Management (IM). A common analytical process in IM is the identification of Critical Success Factors for the application of a specific Information system (Rockart, 1979). This research study will employ this identification process.

It is therefore important to explore how past authors have utilised the process of identifying 'Critical Success Factors' (CSF) in various fields. And subsequently critique what CSFs are relevant to the integration of mobile phones in disaster management. There is a significant body of knowledge surrounding the CSF identification process. The following is a literature summary detailing aspects of the CSF process that are relevant to this research study. This section of the literature review covers the history and formulation of the CSF process, and their application in the fields of commerce, development and disaster management. The CSFs identified for a number of mobile phone applications are also covered.

3. 4. 1. CSFs: The Background

The body of knowledge contributing to the formulation of Critical Success Factors (CSF) first emerged in the late 1950's, when businesses and organisations were experiencing significant inflows of information in the evolving –and increasingly competitive- public and private sectors. This led to authors such as Spencer (1955, p77) asking "What are the essential factors that produce success in my company?" Similarly, Lebreton (1957, p103) briefly detailed how students looking into the efficiency of businesses for case studies were recommended to look at "the factors which seem to be paramount in determining success in this industry". Taking these ideas further, Ronald Daniel (1961, p120) discussed critical elements and non-critical elements of a business leading to "controlling competitive success". Daniel (1961) refers to 'success factors' in the context that we would understand today, however 'CSFs' were not referred to specifically by Daniel or other authors during that time.

Almost two decades later, Roackart (1979) coined the phrase 'Critical Success factor' as a process to determine organisational informational requirements. According to Rockart (1979) CSFs are the essential areas where things must go right to ensure the success of the organisation. He discussed four prime sources of CSFs: the particular industry structure; the competitive strategy; environmental factors; and temporal factors. Boynton and Zmud (1984) looked at Rockart's CSF

method and concluded that senior managers would endorse the use of CSFs as an appropriate means of identifying areas of importance for an organisation's success.

Bullen and Rockart (1981) proposed that CSFs can be used effectively as a 'Management Information Systems' (MIS) planning tool, which was what CSFs were predominantly used for in the early 1980's. However, in an earlier study, Rockart (1979) noted that the process of identifying CSFs would differ from one organisation to another and they therefore can be useful as a tool in many disciplines. This is supported by Shank *et al* (1985) who noted the CSF process is flexible and not limited explicitly to information needs or computer applications. This would suggest that the CSF identification process could be relevant to aspects of the thesis topic such as mobile phone applications and in disaster management; literature on this will be explored shortly.

Accordingly, a number of authors continued to discover the positive applications of Rockart's (1979) CSF method across many disciplines. Schnitzer (1979) showed CSFs to be useful for financial accounting in Non-Profit Organisations. Alternatively, Pinto & Slevin (1987) found CSFs were an effective method in 'project management' analysis. Boynton and Zmud (1984) carried out two separate case studies. One concluded that CSFs were both effective in identifying key management concerns, as well as an effective means of developing strategic plans and identifying critical implementation issues. The latter case study found that CSFs were effective in identifying a firm's future information infrastructure and in providing senior management with information in strategic planning.

However, Boynton and Zmud (1984) also identified three key limitations to the early proposed CSF model: (1) difficult to use and thus not appropriate unless key stakeholders possess the ability to successfully apply the CSF identification process; (2) questionable validity because of potential analyst/stakeholder bias introduced through the interview process; (3) questionable applicability as a requirements analysis methodology as the resulting information model may not accurately represent the environment. However, Boynton and Zmud (1984) concluded that despite these criticisms, the CSF identification process works well at the policy, operational and strategic levels of information systems planning.

3. 4. 2. CSFs in Enterprise Resource Planning

In the early 2000's a common application of the CSF identification process has been in 'Enterprise Resource Planning' (ERP) systems. ERP is a highly integrated IS application containing multiple business functions including human resources, finance, supply chain and materials management (Markus & Tannis, 2000; Pinto & Shanks, 2000). There have been many studies on CSFs

within ERP implementations, drawing from six key studies done in the last decade, Table 3.2 identifies a number of important CSFs for ERP implementation.

Critical Success Factor	Source
Top Management Commitment	Al-Mashari et al, (2003); Akkermans & Helden, (2002); Marble, (2000); Nah et al. (2001); Umble et al. (2003); Somers & Nelson, (2000)
Training	Al-Mashari et al, (2003); Marble, (2000); Umble et al. (2003)
Clear Objectives/goals	Akkermans & Helden, (2002); Marble, (2000); Umble et al. (2003)
Vendor/Consultant Support	Akkermans & Helden, (2002); Marble, (2000)
Effective Project Management	Nah et al. (2001); Umble et al. (2003)
Co-Location/Cross Functional teams	Akkermans & Helden, (2002); Marble, (2000)
Evaluation Performance Measure Establishment	Nah et al. 2001; Umble et al. 2003
Project Champion	Akkermans & Helden, (2002); Nah et al. (2001)
ERP Consultants integration	Al-Mashari et al, (2003)
Resources Selection Utilisation	Al-Mashari et al, (2003)
Teamwork	Nah et al. (2001)
Effective Communication	Nah et al. (2001)

Table 3.2: Frequency of CSFs sighted by five studies of CSFs in ERP implementation

It should be noted –in reference to the research problem- that the CSFs for ERP implementations relate specifically to organisation and managerial functions. In this respect, when discussing CSFs surrounding mobile phones and disaster management, it is important to incorporate elements of success factors derived from these upper levels. In this respect, the top three CSFs of ‘top management commitment’, ‘training’ and ‘clear objectives/goals’ are especially relevant. It is now appropriate to look at what is understood about other applications of the CSF identification process.

3. 4. 3. CSFs of Mobile Phone Applications

The uses of CSFs are not limited to ERP; the process has been applied successfully within a number of other areas. One such area that relates to the thesis topic is the identification of CSFs within various applications of mobile phones. Three main applications of mobile phones are in *m-learning* which involves mobile phone uses within learning and education. *M-commerce*, which involves applications within business and commercial contexts. And finally, *m-health* with involves applications within the health and medical industry. The advantages and limitations of applying mobile phones within these areas have been studied significantly, and there are some useful insights

into CSFs that relate to the user directly. Below is a summary of the CSFs identified within these three applications for mobile phones.

3. 4. 4. CSFs in M-Learning

M-Learning has received significant academic attention recently. Due to the increase of mobile phone use in many educational arenas, authors have sought ways to integrate the technology into learning activities. Schmiedl *et al.* (2010) identified six key CSFs in m-learning relating to the use of mobile smart phones in secondary schools within Germany. Similarly, Lindquist *et al.* (2007) discussed key factors of using an m-learning technology in US secondary schools to allow students to submit solutions to learning exercises via text or photo formats. Scornavacca *et al.* (2009) undertook a case study applying mobile text messaging exercises in large university classes. Likewise in a tertiary setting, Cochrane (2010) looked at the CSFs of utilising mobile smart phones in university learning environments.

The above studies highlighted a number of important success factors in m-learning. Most notably, the stability and ease of connection to the mobile network, Schmiedl *et al.* (2010, p78) noted that “Stable WLAN or 3G connectivity is essential for trouble free working in a technical supported environment”. Another important factor is the appropriate and manageable costs of owning and running a mobile phone. For example, Scornavacca *et al.* (2009, p145) discussed “The main inhibitor for adoption of SMS in the classroom was the cost of text messages”. Table 3.3 summaries the main success factors of m-learning derived from the related literatures.

Critical Success Factor	Source
Stable connectivity and ease of connection	Schmiedl <i>et al.</i> (2010); Lindquist <i>et al.</i> (2007); Cochrane, T (2010);
Manageable phone costs	Schmiedl <i>et al.</i> (2010); Lindquist <i>et al.</i> (2007); Scornavacca <i>et al.</i> (2009);
Supportive teachers	Schmiedl <i>et al.</i> (2010); Cochrane, T (2010);
Open/dynamic/evolving learning platforms	Schmiedl <i>et al.</i> (2010);
Simple inputs/operations/procedures for students	Lindquist <i>et al.</i> (2007)

Table 3.3 CSFs associated with m-learning

The above CSFs predominantly relate to elements directly impacting the mobile phone user. For example, the ‘manageable costs’ and ‘stability and ease of connection’ associated with phone use are factors that impact on the user experience and ultimately contribute to the success of the m-learning application. In this respect, there may be some relevance to mobile phone integration in disaster management, especially with regards to how mobile phone users might employ the application of mobile phones in a disaster management context.

3. 4. 5. CSFs in M-Commerce

M-commerce as defined by Cronin (2003, p1) “refers to all data-driven business transactions and exchanges of value by users of mobile devices via wireless telecommunication networks”. The literature exploring the CSFs with this application predominantly revolves around user based factors. In short, these are the factors that influence the successful consumer adoption of mobile phones for m-commerce functions.

Ankar & Walden (2003) completed a survey of 1000 mobile phone consumers in Finland. They found a number of factors for the use of mobile phones by consumers who are mobile internet adopters. They noted that the CSFs for m-commerce adoption go beyond the service and features of traditional mobile phones, which was typically peer-to-peer communication: “consumers will be driven towards m-commerce by the fact that what was previously simply a phone will now turn into a personal trusted device, through which all kinds of commercial activities and transactions can be managed” (p891).

Drawing on data collected through expert interviews of, Buellingen and Woerter (2002) highlighted four critical success factors for the use of mobile services in 3G mobile environments. Vrechopoulos et al. (2002) presented a similar list of CSFs for accelerating mobile commerce diffusion in Europe. Studies by Xu & Gutiérrez (2006) and Muthaiyah (2004) also resulted in similar conclusions regarding m-commerce CSFs. The compiled results of these studies in m-commerce CSFs are presented in table 3.4; some strong similarities are evident across the literature.

Critical Success Factor	Source
Good/Reliable Connection and Transmission Rate	Ankar & Walden, (2003); Buellingen & Woerter, (2004); Xu & Jairo A Gutiérrez, (2006); Muthaiyah, (2004)
Ease of Use/User Friendliness	Ankar & Walden, (2003); Buellingen & Woerter, (2004); Vrechopoulos et al. (2002); Xu & Jairo A Gutiérrez, (2006); Feng, Hoegler, & Stucky, (2006); Muthaiyah, (2004)
Low initial and operating costs	Ankar & Walden, (2003); Vrechopoulos et al. (2002); Muthaiyah, (2004)
Personalisation	Ankar & Walden, (2003); Buellingen & Woerter, (2004); Muthaiyah, (2004)
High Data security	Ankar & Walden, (2003); Buellingen & Woerter, (2004); Vrechopoulos et al. (2002); Xu & Jairo A Gutiérrez, (2006); Muthaiyah, (2004)
Convenience	Ankar & Walden, (2003); Xu & Jairo A Gutiérrez, (2006)
Good network coverage	Ankar & Walden, (2003); Vrechopoulos et al. (2002)

Table 3.4: CSFs associated with m-commerce

Reliable Connection and Transmission rate features highly as an important CSF within m-commerce. For example, Buellingen & Woerter (2004) explain that transmission rates in ICT are

gaining further importance yet mobile phones are somewhat constrained when compared to fixed line internet for computers. They noted that users therefore are more inclined to employ m-commerce for specific functions: “video-on-demand or internet surfing are applications demanded via the fixed network, while local travel information or traffic news will be applications with great affinity to mobile networks” (p1407). This may relate to the thesis topic when exploring the data transmission requirements associated with the application of mobile phones in disaster management.

Initial and on-going operating costs were highlighted consistently as an important CSF (Feng et al, 2006; Buelligen & Woerter, 2004; Ankar & Walden, 2003, Shuster, 2001, Vrechopoulos et al. 2002). Feng et al (2006, p6) noted “Both initial costs and operating costs need to be in the right ratio to the value the user receives from the mobile application”. Relating to the thesis topic, it will be important to look at the user costs –if any- of mobile phone integration in disaster management. And to compare this to the value users get out of the mobile application.

Convenience also rated highly throughout the literature as an important CSF of m-commerce (Xu & Gutiérrez, 2006). Xu & Gutiérrez (2006, p74) noted “The most important reason for people to own a mobile is the convenience it provides”. *Ease of use* -or user friendliness- also features highly (Feng et al, 2006; Buelligen & Woerter, 2004; Ankar & Walden, 2003, Vrechopoulos et al. 2002). In short, m-commerce service must be simple and intuitive or users will not adopt them due to difficulty of use.

3. 4. 6. CSFs in M-Health

M-Health refers to new and emerging mobile and network communications technologies used for healthcare. Istepanian et al (2006, p3) explain “This emerging concept represents the evolution of e-health systems from traditional desktop ‘telemedicine’ platforms to wireless and mobile configurations”.

Norris et al (2009) proposed a framework for sustainable m-health applications, and compiled the CSFs for this framework through surveying a number of senior strategists in the New Zealand health service: “The technologies must be affordable, reliable, acceptable to consumers and providers, easy to use and convenient, and fitting in with existing lifestyles rather than demanding substantial changes in skills or existing practices” (p250).

Further studies on M-Health have commonly focused on the success factors surrounding ‘people’, ‘process’ and ‘technology’ (Wickramasinghe & Goldberg, 2005). For example, (Wickramasinghe & Goldberg, 2005) wrote “the technology must be correct and functioning as desired... it must integrate seamlessly with existing ICT infrastructure and enable the processes”.

According to Yu et al (2006, p183), successful m-health processes rely on “cost saving, seamless integration of applications into workflow and managing cultural change associated with the implementation of m-health solutions”. Finally, and arguably the most important CSF highlighted by m-health literature is ‘People’ or as Wickramasinghe & Goldberg (2005) noted, the ‘web of healthcare players’ critically involved in implementing successful m-health applications. Yu et al (2006, p182) explained that there were concerns with older physicians integrating successfully with m-health applications, therefore “a strong training and education program is critical for smoothing clinicians’ learning curve of new practice”. See table 3.5 for a summary of the CSFs presented by the literature covered.

Critical Success Factor	Source
Affordable for patients	Norris et al (2009); Yu et al (2006)
Cost saving for practitioners	Yu et al (2006); Wickramasinghe & Goldberg, 2005)
Reliable	Norris et al (2009)
Acceptable to consumers and providers	Norris et al (2009)
Easy to use and convenient	Norris et al (2009)
Integrating with existing lifestyles of patients	Norris et al (2009)
Seamless integrating with existing practices	Norris et al (2009); (Wickramasinghe & Goldberg, 2005); Yu et al (2006)
Strong Practitioner Training program	Yu et al (2006)

Table 3.5: CSFs associated with m-health

The CSFs for m-health applications encompass both managerial and user elements. Costing is important, with both user ‘affordability’ and ‘cost saving’ for the managerial (practitioners) body being deemed integral to the success of m-health applications. Given the importance of successful information transition between patients and practitioners, ‘reliability’ was also deemed to be an important success factor. In this respect, this may relate to mobile phone integration in disaster management, the reliability of connection could be an important factor to determine the success of disaster management operations.

Further, ‘integration with existing lifestyles and practices’ was consistency identified as being important within the literature (Norris et al. 2009; Wickramasinghe & Goldberg, 2005; Yu et al. 2006). Norris et al. (2009, p.250) noted that mobile phone technologies should “fit in with existing lifestyles rather than demand substantial changes in skills or existing practices”. This may be relevant to the integration of mobile phones into disaster management, and it is important to explore how mobile phones could fit into existing disaster management practices as well as how their specific applications could fit into the lives of users.

3. 4. 7. CSFs in Disaster and Emergency Management

So the literature shows that CSFs have been used widely in the commercial context, they are appropriate for use in ERP implementation and analysis of a number of mobile phone system applications. But relating back to the thesis topic, there are a number of examples of CSFs being applied in emergency and disaster management. Summarised in 'Table 3.6' are three studies that have identified CSFs in disaster and emergency management. Petit and Beresford (2009) applied CSF in the context of humanitarian aid supply chains. They highlighted that CSFs had been widely used in business environments, and discussed a number of CSFs which are consistently identified within commercial realms that have relevance to the implementation of successful supply chains in a humanitarian context. Moe and Pathranarakul (2006) looked at developing an integrated approach to natural disaster management. Using the case study of Thailand's 2004 tsunami they highlighted a number of CSFs relating to the disaster management response. Oloruntoba (2009) highlighted the effectiveness of the emergency relief response during the 2006 Cyclone Larry disaster in Northern Australia. He subsequently analysed and highlighted the CSFs that existed in the emergency relief chain and the overall emergency relief effort relating to the preparedness and planning phase, and the aftermath response phase.

Critical Success Factor	Source
Strategic planning and clearly defined goals	Petit and Beresford (2009); Oloruntoba (2009); Moe and Pathranarakul (2006)
Effective Information management system and technology utilisation	Petit and Beresford (2009); Moe and Pathranarakul (2006)
Supportive laws and regulations Government unity	Moe and Pathranarakul (2006); Oloruntoba (2009)
Continuous improvement and collaboration	Petit and Beresford (2009); Moe and Pathranarakul (2006)
Effective transport, logistics and capacity planning and management	Petit and Beresford (2009); Moe and Pathranarakul (2006)
Effective institutional arrangement	Moe and Pathranarakul (2006)
Competencies of managers and team members	Moe and Pathranarakul (2006); Petit and Beresford (2009)
Effective consultation with key stakeholders and target beneficiaries	Moe and Pathranarakul (2006)
Effective communication mechanism	Moe and Pathranarakul (2006)
Sufficient mobilisations and management of resources	Moe and Pathranarakul (2006); Petit and Beresford (2009)
Routine disaster awareness and education campaigns	Oloruntoba (2009)
Specific early warnings	Oloruntoba (2009)
Participation of military unit	Oloruntoba (2009)

Table 3.6: CSFs in disaster and emergency management

Whilst there is an emerging body of literature relating CSFs and disaster management, there is also a significant amount of literature that discusses the influences and causes of emergency management successes. These authors don't specifically refer to CSFs –or highlight them as an issue- however they do involve criteria that impact on the success of emergency management efforts. For example, Cook (1984) emphasized 10 elements in relief logistics and summarized them as guidelines. Oloruntoba (2005) discussed strategies NGOs adopted to ensure the effectiveness and success in the 2004 tsunami response. Kovacs and Karen (2007) created a framework distinguishing amongst the relief processes of emergency management, and pointed out several elements that managers should concern before and after disasters. These three studies conclusively refer to information management and information technology utilization during disasters as important success factors (See Table 1.4). Further illustrating the importance of this success factor, Long (1997, p26) stated conclusively that “communication technology decides the success of a rescue operation”.

A number of studies also highlighted some important success factors within emergency management. Both Pettit & Beresford (2009) and Power (2005) concluded that in crisis situations key factors influencing the success of emergency management outcomes were effective facilitation of information transition and management, effective decision support systems and effective communication information systems. In an earlier study, Power et al. (2001) explained that making full use of new technologies and decision support systems appropriate to emergency management can have a great impact on the success of emergency relief. Perry (2007) and Thomas (2003) highlighted that to make full use of new technologies an organisation must provide well-trained relief and logistics professionals; this factor will greatly improve the efficiency of an emergency response. Furthermore, Thomas and Kopczak (2005) noted that the way in which these relief professionals are managed will impact on their ability to distribute relief aid.

Finally, the literature consistently identified that coordination of relief response was often an inefficient aspect of emergency aid, and success factors have been derived from this issue. Oloruntoba (2005) wrote that government in different levels should have long-term effective cooperation and coordination. For example, guidelines of cooperation should be made to ensure the communication and cooperation among different departments, the military and local government. Therefore, a revised, updated and dynamic emergency plan is an important success factor for effective emergency relief operations (Oloruntoba, 2005). A summary of the success factors from these literatures is presented in Table 3.7.

Success Factor	Source
Information management and information technology utilization	Cook (1984); Oloruntoba (2005); Kovacs and Karen (2007); Long (1997)
Effective facilitation of information transition and management	Pettit and Beresford, (2009); Power, (2005)
Effective full use of decision support systems	Pettit and Beresford, (2009); Power, (2005)
Full use of communication information systems	Pettit and Beresford, (2009); Power, (2005)
Full use of new technologies and decision support systems	Power et al. (2001)
Provide well-trained relief and logistics professionals	Perry, (2007); Thomas, (2003)
Effective management of relief staff	Thomas and Kopczak, (2005)
Coordination of relief response	Oloruntoba (2005)
Government in different levels should have long-term effective cooperation and coordination (Collaboration)	Oloruntoba (2005)
Revised, updated and dynamic emergency plan	Oloruntoba (2005)

Table 3.7: Success factors for disaster management

3. 5. People, Process, Technology and Policy

As mentioned, both Wickramasinghe & Goldberg (2005) and Yu et al (2006) categorised CSFs of mobile phone applications in m-health into three important groups: ‘people’, ‘process’ and ‘technology’ (PPT). In order to categorise the highlighted CSFs into a legible framework it is important to explore more comprehensive meanings of these groups and relate them to the CSFs highlighted in this review.

The PPT model is commonly used by businesses and organisations as a valuable tool to address specific aspects of operation, hardware, software, management, and performance. The three aspects are integrated and directly impact on one another (Quinn, 2004; Chapman and Arunatileka, 2010). So relating to this study, to reach IS objectives such as integrating mobile phones into disaster management, PPT must be addressed and each must be appropriate. Chapman and Arunatileka (2010, p4) wrote “It has been proven beyond doubt that the most successful projects always had the secret of integrating people process and technology successfully.” So, what does that mean? Kemp (2009) provided some insight into the aspects of the PPT elements:

A. People consists of all those involved in the process. They can be both those who own/run the process (management) or end users that the process is directed at (for example mobile phone users). They are impacted by education, organisation, roles, skill sets, training, communication, devolution, intelligence, psychology and anticipation.

B. Process can be defined as starting with a trigger event that creates a chain of actions that results in something being prepared for an end user of that process. Processes are therefore related to business/organisational operations, frameworks, production and strategy.

C. Technology can be applied to ensure consistently in application of the process and to provide the thin guiding rails to keep the process on track. It consists of hardware, software, infrastructure, tools and applications.

D. Policy – Policy is not commonly linked to into the typical ‘people, process, technology’ model. However, policy holds significance to the research problem due to the multi-faceted nature of disaster management involving government, civil society and in the case of mobile phone integration, private entities. It consists of Laws, regulations, support, government alignment, donor alignment, and cross-organisational alignment.

The above four elements therefore hold significance to the research problem. The integration of mobile phones into disaster management is impacted by these four elements which contribute to the outcome of the application. Accordingly, this suggests the CSFs identified within this study may be categorised into these four elements. This model, as stated previously, has been utilised by Wickramasinghe & Goldberg (2005) and Yu et al (2006) who were looking at CSFs of mobile phone applications in health systems.

3. 6. Summary of Literature and Research Framework

This literature review has explored the body of knowledge within three significant topic areas that surround the research problem: *what are the CSFs of integrating mobile phones into Vanuatu disaster management?* With these topic areas in mind, the research framework presented in Figure 3.4 has been constructed to represent where the research problem (indicated by white diagonal lines) fits in relation to the relevant areas of literature that have been reviewed. The corresponding figure represents the specific aspects of the topic areas for which the research problem focuses on. This includes the four stages of disaster management: mitigation, preparedness, recovery and response. And the four elements integral to an IS application for which CSFs can be categorised into: people, process, technology, policy.

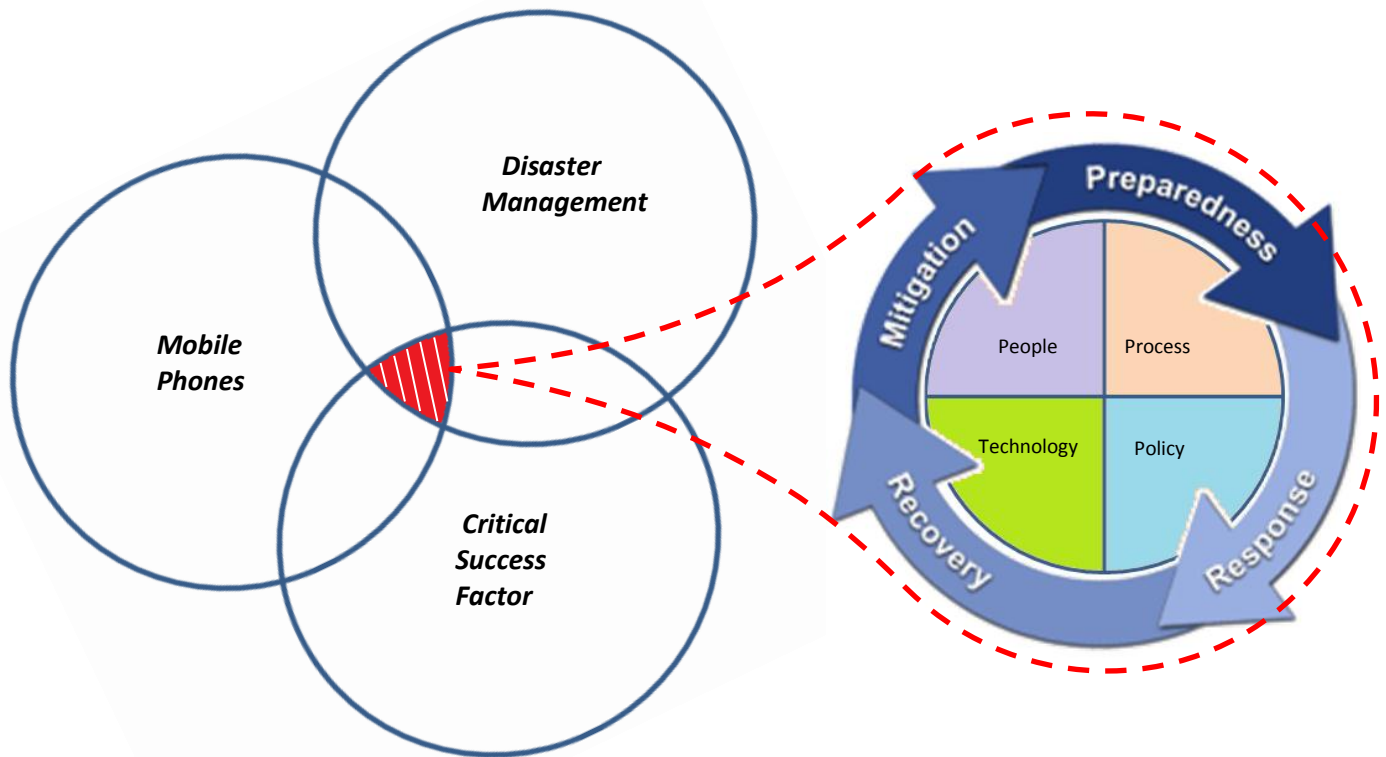


Figure 3.4: The Research Framework

An integral aspect of the research framework in Figure 3.4 is Critical Success Factors, in the context of the research problem, the process of identifying CSFs is the means by which this study will assess the critical elements involving mobile phone integration in disaster management. The CSFs derived from the various literatures can be separated into four key elements based on models by Wickramasinghe & Goldberg (2005), Yu et al (2006), and Kemp (2009) (See section 3.5). (1) 'People', which encompasses mobile phone user and manager related factors; (2) 'Process' which relates to organisational, operational and strategic factors surrounding a specific system or application; (3) 'Technology' which relates to technological factors involving software and hardware; and finally (4) 'Policy' which relates to political and bureaucratic factors necessary for success. Within each group there were a number of key CSFs that hold significance to the research problem and will provide an appropriate point of reference for comparing and contrasting the research data on CSFs specific to the integration of mobile phones within disaster management (see table 3.8 and 3.9).

		CSFs	
CSF Category		Component	Description
People (education, organisation, roles, skill sets, training, communication, devolution, intelligence, psychology, anticipation)	User Impacted	Affordability	Low initial and on-going costs
		Usability	Easy to learn and user-friendly phones and applications
		Convenience	Easy to access phones and credit
		User Synthesis	Seamless integration with existing user lifestyles
	Manager Impacted	Training	Strong training programs for practitioners/managers
		Education	Routine public awareness and education campaigns
		Consultation	Effective consultation with key stakeholders
		Supervision	Project Champion oversees all phases of operation
		Communication	Effective communication within organisation and between stakeholders
Process (business/organisational operations, frameworks, production, strategy)	Top management commitment	Support and alignment from executive level of organisation/business	
	Strategic Planning	Clear objectives and goals which are revised and updated	
	User Support	Effective support for mobile phone users	
	Vendor Support	Effective support from mobile phone providers and suppliers	
	Organisational Synthesis	Seamless integration with existing organisational practices	
	Evaluation	Effective clear performance measures	
Technology (hardware, software, tools, infrastructure, applications)	Connectivity	Stable, fast and reliable Connection	
	Network Coverage	Extensive reaching essential areas	
	Technology Synthesis	Seamless integration with existing technologies	
Policy (laws, regulations, alignment)	Government Unity	Long term cooperation and coordination	
	Policy	Supportive Laws and Regulations	

Table 3.8: Summary of Critical Success Factors related to ICT and mobile phone applications

			CSFs
CSF Category		Component	Description
People	Manager Impacted	Training	Provide well-trained relief and logistics professionals
		Education	Routine disaster awareness and education campaigns
		Management	Effective management of relief staff
		Competence	Competencies of managers and team members
Process (business/organisational operations, frameworks, production, strategy)		Emergency Plans	Revised, updated and dynamic emergency plan
		Strategic Planning	Strategic planning and clearly defined goals
		Coordination	Coordination of relief response
		Communication	Effective communication mechanism
		Information Flows	Effective facilitation of information transition and management
		Stakeholder Cooperation	Government in different levels should have long-term effective cooperation and coordination
		Collaboration	Continuous improvement and collaboration
		Consultation	Effective consultation with key stakeholders and target beneficiaries
Technology (hardware, software, tools, infrastructure, applications)		New Technology Utilisation	Full use of new technologies and decision support systems
		Early Warning	Specific early warnings
Policy (laws, regulations, alignment)		Government Support	Government unity
		Policy Support	Supportive laws and regulations

Table 3.9: Summary of Critical Success Factors related to disaster management

The review of current knowledge surrounding the above areas has shown that little if anything has been written regarding how to integrate mobile phones in disaster management. And whilst there is an emerging body of literature that explores the CSFs of mobile phones and mobile phone applications in various areas, as well as some literature covering CSFs in disaster management. The two are not explicitly linked together. Further, there is no literature which addresses these two aspects within a single study. And importantly, the understanding of these factors within a developing world setting is less understood. This study aims to address this void by identifying the factors that are critical for the application of mobile phones within disaster management to be successful.

CHAPTER IV

METHODOLOGY

4. 1. Introduction

This chapter describes the research approach, design procedures, and ways used to ensure the credibility and trustworthiness of the research data. The research design section describes the ethical procedures, interview protocol, the participants and the treatment of the data collection and data analysis procedures. The study adopts a qualitative approach with an interpretative paradigm; this approach is supported by a 'case research method' as a means of generating knowledge about a contemporary situation within its real-life context (Stake, 1998; Yin, 2003). This is the methodology best suited to the nature of the research question and for effective CSF analysis. It fits appropriately within the fields of Information Management and Development Studies.

4. 2. Interpretative Paradigm

An interpretative paradigm is utilised as it is assumed the human aspects of this research cannot be studied using a positivist approach. An interpretative approach supports the belief that reality is constructed by subjective perception. It therefore recognises that both the researcher and the social phenomena being researched are constructed through discourse. This results in inductive research, exploring social relations and subjective lived experiences (Giddens, 1986; Creswell, 2009).

4. 3. Qualitative Research Design

The study aims are consistent with the purpose qualitative research which is to gain rich narrative descriptions through inductive inquiry that will provide meaningful and contextually based constructions (Denzin & Lincoln, 2005; Creswell, 1994). Qualitative study is defined as "an inquiry process of understanding a social or human problem based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting" (Creswell, 1994, p.1). Qualitative research is exploratory, and the researcher focuses on the social construction, experience of reality, meaning, and the situational constraints that help model the inquiry (Denzin & Lincoln, 2005). In this study, the context is attempting to make sense of the lived experiences, knowledge and beliefs -and meanings and interpretations attached to these experiences and beliefs- of four groups: ni-Vanuatu mobile phone users, government institutions, mobile phone providers, and NGOs.

This study used qualitative data collection methods to collect data to answer the research questions. These were chosen because of their focus on naturally occurring, ordinary events in their

natural settings (Miles & Huberman, 1994, p.10) and were, therefore, viewed as being most suitable for eliciting an in-depth understanding of a phenomenon, especially where little was known about what was being investigated, as was the case in this study where there was little contextual literature pertaining to the utilisation of mobile phones for information dissemination in disaster management in Vanuatu. In addition, qualitative methods are inherently flexible and could be varied in the course of the study to allow for newly emerging and divergent themes (Powell & Connaway, 2004). Thus, data gathering was envisioned as a process rather than a procedure, in that it required analytic judgement rather than a pre-planned routine (Bryman, 2004; Creswell, 2003).

Also, the preference of qualitative methods to see through the eyes of the people being studied helped to probe beneath surface appearances relating to the utilisation of mobile phones within disaster management, resulting in rich, holistic and complex information and meanings (Bryman, 2004). Miles and Huberman (1994) see qualitative methods as the best strategy for exploring a new area and generating and revising conceptual frameworks. Hence, qualitative methods were ideal for this research study, which sought to develop a contextual framework for ICT-enabled research communication in Vanuatu.

4. 4. Method – Case Research

A case research strategy has been selected as an appropriate method of inquiry for the proposed research. This strategy is consistent with the interpretative research as the adopted paradigm. Walsham (1995, p.74) supports this: “the vehicle for such interpretive investigations is often the in-depth case study, where research involves visits to the field over a period of time”.

Yin (1994) described case research as a source of rich, empirical descriptions of phenomenon, based on multiple sources of data. Yin (2003) also notes that even though there are different kinds of case studies, they all have the common purpose of investigating a contemporary phenomenon within its real-life context. Further, Creswell (2003) highlighted that the researcher explores in-depth, a program, an event, an activity, a process, one or more individuals or elements. From this, the idea is to develop theory by using a process of induction. The theory emerges as a result of observing patterns that develop as the data is collected, analysed, and interpreted.

Case method is most useful when the research is focused on a “specific, unique, bounded system” (Stake, 1998, p.88). The focus of the case can be an individual, an event, a family, an organization, or even a place (Mariano, 1995). The uniqueness of case method lies in the focus of the study on the case (Stake, 1998). A case study involves a single case being examined in order to provide an “in-depth account of the events, relationships, experiences or processes occurring in that particular instance” (Denscombe, 1998, p.32). Thus relating to case research method, this thesis

presents is an inquiry into a single case, the case of mobile phone utilisation for information dissemination in disaster management operations within Vanuatu. In pursuing the case method of inquiry, two months was spent undertaking field research in Port Vila Vanuatu, specifically looking at mobile phone utilisation over a period of time within a number of organisations and by a number of stakeholders.

4. 4. 1. Critical Success Factors in Case Research

The CSF concept resulted from four decades of cumulative research about decision making, planning, and Information Systems. Relating to the adopted approach for this thesis, Rockart (1979), referred to CSF analysis as a qualitative, interpretative case-based research strategy. Rockart proposed the CSF method to help CEOs specify their own needs for information about critical firm issues so that systems could be developed to meet those needs. He suggested that CSFs should be collected from three to six hours of interviews with the CEO, but Rockart's concept only focused on the CEO's information requirements. However there is no standard procedure for CSF data collection or standard application for CSF method. Since its inception, the CSF method has been adapted for a broad range of uses including, information requirements determination (Byers and Blume 1994), performance evaluation (Bergeron and Begin 1989), and IS planning (Bowman et al. 1983). More so, CSF data collection has drawn on a range of alternative methods such as interviews, questionnaires, and organisation observation. In this study, CSF data collection was obtained solely through semi-structured interviews.

4. 5. Data Gathering Methods - Site Selection and Participants

The purpose of this research was to understand the factors affecting the integration and utilisation of mobile phones as a tool for facilitating communication in Vanuatu disaster management. Consequently, a purposive sampling technique was employed in selecting the research sites and research participants. Bradley (1993) argues, "In purposeful sampling, members of the sample are deliberately chosen based on criteria that have relevance to the research question rather than criteria of randomness of selection" (p. 440).

4. 5. 1. Research Sites

I purposively sampled research sites that were relevant to the goal of the research study before going to the field. These included groups, organisations and individuals that are key actors within the mobile phone market, the disaster management sector, the government, and the public of Vanuatu:

- Three government institutions, including the office designated to oversee operations surrounding disaster management. Also, ministries and departments with key roles in disaster management. And finally the semi-autonomous body designated to oversee and regulate the telecommunications market.
- Seven civil society organisations, specifically NGOs and humanitarian organisations involved in disaster management operations. Of the many NGOs operating in Vanuatu, these seven organisations were chosen due to their long standing and/or current involvement in disaster management operations throughout Vanuatu.
- Two mobile phone providers – There are two mobile phone providers operating in the Vanuatu market, both were as selected research sites.
- Seven members of the Vanuatu general public – specifically mobile phone users who own or have regular access to a mobile phone.

From each research site participants were chosen based on their experience with disaster management, mobile phones and/or the mobile phone industry. Owing to confidentiality required by the Victoria Human Ethics Committees when dealing with human subjects, the institutions are referred to in this thesis by their group and then a corresponding number. For example, the three government groups are allotted the synonyms 'Govt. 1', 'Govt. 2' and 'Govt. 3'; whilst the seven NGO groups are allotted synonyms from 'NGO 1' through to 'NGO 7'. The providers are referred to as 'Provider 1' and 'Provider 2'. And finally the user group is referred to as 'User 1' through to 'User 7'.

4. 5. 2. Sample population

Altogether, 19 participants were selected to take part in semi-structure interviews over a period of two months based in the capital of Vanuatu, Port Vila. In this study the type of participants that were interviewed included:

- NGO directors that guide and manage the operations of NGOs in disaster management throughout Vanuatu. Ultimately they make the final decisions on organisational process and strategy.
- Disaster management officers within NGOs who run disaster management operations. They run the processes and are more directly involved in operations.
- Mobile Phone general operations managers and regional operations managers who support mobile phone operations throughout Vanuatu.

- Government officers and officials who oversee the government role in nationwide disaster management operations.
- The general public who utilise mobile phones on a daily basis and are the target market of mobile phone providers, and target recipients of disaster management operations.

4. 6. Data collection

4. 6. 2. Interviews

The interviewing phase of qualitative research was dynamic and ever changing. Guided by semi-structured, open-ended questions, in-depth face-to-face interviews were utilised. This was intended to keep structure to a minimum, in order to enhance the opportunity for genuinely revealing the perspectives of the people being studied, and to allow for additional explanation, counter questions and even open discussion. These in-depth, semi-structured interviews were appropriate to use because they offer participants the opportunity to describe their own experiences and the meanings they attached to those experiences (Patton, 1990). A list of key topics of discussion were established beforehand as a guideline for the interview, however this was not an inflexible or standardised guideline. This interview format ensured that all participants addressed certain topics, which was essential for comparison. The major topics included in the interview guideline were:

- People factors impacting mobile phone utilisation in DM
- Process factors impacting mobile phone utilisation in DM
- Technological factors impacting mobile phone utilisation in DM
- Policy factors impacting mobile phone utilisation in DM

In all 19 face-to-face semi-structure interviews were completed with key informants relevant to my research topic. The interviews were conducted in English, which is a commonly spoken language in Vanuatu; although care was taken to establish that each participant felt comfortable conversing in English. To capture the information, the researcher tape-recorded and transcribed the interviews, in order to ensure complete data collection, and to avoid the disturbance of note taking (Patton, 1990). As Johnson (2002) notes, tape-recording in depth interviews is essential if interviewees' words and perceptions are to be captured. Interview locations were chosen for the convenience and comfort they offered interviewees (Warren, 2002). Privacy was an important element of getting participants to relax and the interview flowing. Interview times were arranged

prior to the day and at a time convenient to the participant. On average each interview took between one to two hours.

Finally, interviews were transcribed through a process of listening several times to the interview recordings. A semi-verbatim transcription technique was utilised, converting spoken word directly to typed word files. Aspects of the conversation deemed unnecessary and irrelevant to the research topic were omitted from the transcription, this included 'small talk', 'introductions' and 'goodbyes', as well as coughs, 'ums' and 'ahs'. Participants were then sent a copy of the transcription for checking over before giving approval for it to be included as research data.

4. 7. Data Analysis

With the interview transcriptions completed, methods of qualitative data analysis were adopted to organise and analyse the text data. Qualitative data analysis is defined by Hsieh & Shannon (2005, p.1278) as "A research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes and patterns". Through coding and theme identification, qualitative data analysis therefore focuses attention on the content and contextual meaning of the text data. Therefore, qualitative data analysis techniques provided rich and thick descriptions of organisational, social, political, cultural and technological settings and events, to generate contextual understanding of the critical factors affecting mobile phone success in Vanuatu disaster management operations (Denzin & Lincoln, 2005).

4. 7. 1. Coding

Coding was the primary method used for data analysis and reduction. This process took place during and after the interview transcription process. It involved reading through each transcription sentence by sentence, several times, each time drawing out categories and major themes and pulling the main 'stories' from the text data; specific labels were utilised as a categorising measure for these stories. Then with the themes in mind, each transcription was methodically analysed and labels –or codes- were assigned to specific words, sentences and phrases that held relevant meanings and importance to the research topic. On the whole, these labels specifically related to categories based on elements of the research framework and research questions. This included 'people' elements, 'process' elements, 'technological' elements and 'policy' elements. Additionally, categories relating to specific phases of disaster management were also utilised, this included mitigation, preparedness, response and recovery. Finally, categories for positive and negative examples of mobile phone use within specific phases of disaster management were identified and coded throughout the text data.

Care was taken not to exclude emergent codes that did not relate specifically to the research framework or the research questions. To achieve this, open coding was utilised to break down the data and to freely identify first level concepts and categories. Open coding was useful as a way of 'freely' negotiating through the wealth of data letting concepts flow out of it without constraint, leaving behind a "shopping list" of ideas in the margins of each interview transcription. These ideas were compared and merged to create categories that were often renamed and modified as open coding progressed.

Essentially, the coding process allowed the data to be organised into "chunks" relating to the specific categories, which then allowed meaning to be derived from these "chunks" of coded text data, as well as allowing comparisons to be drawn between each specific chunk of coded data (Creswell, 2003). This facilitated insight and the development of theory which provided a basis to facilitate discussion and draw comparison with related research. Therefore, as an analytical tool coding ultimately allowed conclusions and recommendations to emerge from the text data (Kaplan & Maxwell, 2005).

4. 8. Rethinking the Research Framework

As originally intended, the data analysis process utilised the research framework drawn up from the literature review to guide coding and analysis process. However as coding progressed, it became apparent that the emerging CSFs and resulting themes and categories posed issues in fitting with the original research framework. Therefore, it was necessary to rethink the existing framework to make it grounded in the data. This meant evolving from the 'people, process, technology, policy' framework to a framework that reflected the data and was not constrained by preconceived notions of how the results should be represented. The emerging framework incorporated four key categories that were sourced directly from the data: 'government', 'stakeholder' and 'technology' and 'end-user'. These four categories were broad enough to encompass the most important elements, themes and categories drawn from the interview results data. CSFs drawn from the data were able to align appropriately with one of the four categories accordingly.

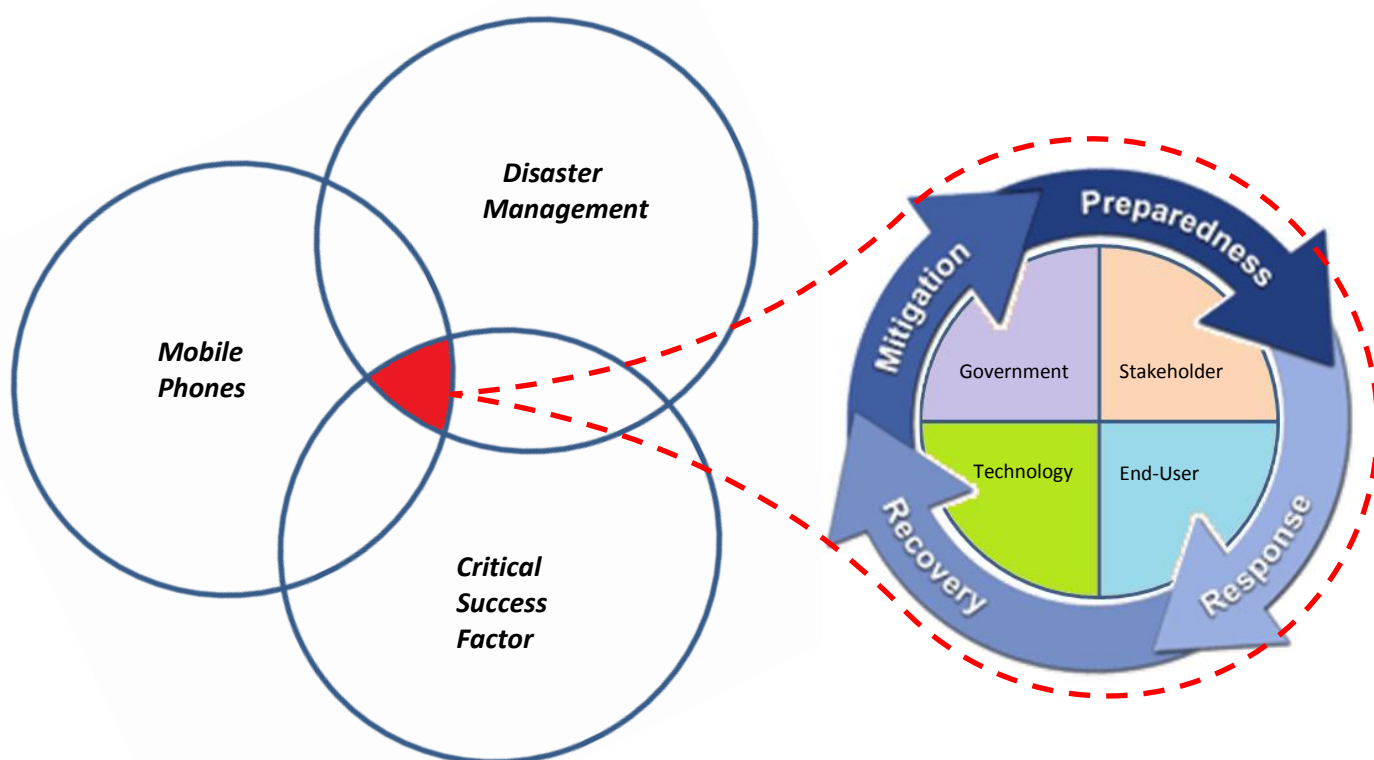


Figure 4.1: The Revised Research Framework

4. 9. Positionality and Bias within a Qualitative Interpretative Research Approach

It is essential for a researcher to reflect on personal 'position' and 'bias' within the research that is being pursued. Interpretive research has often drawn criticism owing to the position of the researcher as a central aspect within the research process and interpretation of results, which presents the possibility of researcher bias. Unlike positivist research, which aims to be objective, interpretive research is subjective and acknowledges that there are multiple realities, and that the researcher and the participants mutually influence and shape a reality (Gorman & Clayton, 2005). In this respect, objectivity in interpretive research is impossible and therefore researcher bias is viewed as a resource rather than a weakness. When a researcher's subjective perceptions are joined with the perceptions of study participants, this contributes to a new, mutually constructed reality (Gorman & Clayton, 2005). Wolcott (1995) views bias as crucial to an investigation because "researcher bias is a manifestation of the cultural self" (cited in Gorman & Clayton (2005, p.191).

On top of acknowledging researcher bias, it is equally important to acknowledge 'positionality', meaning that the researcher brings personal beliefs and preconceived notions that surround a research topic. And so continually reflecting on one's positionality is therefore important. Declaring positionality in research is describing how the researcher sees things based on who the

researcher is, that is the researcher's own epistemologies and life views influenced by various discourses and life experiences, these are things that effect how a researcher has come to 'know what they know'. In this sense, it must be acknowledged that as a researcher brings certain 'personas' that impact on how they relate to, carry out, interpret and present this research. With this in mind, Alzbouebi (2007, p.1) explains that constantly reflecting on positionality is important for researchers to be successful in their work:

"As researchers we need to maintain an informed reflexive consciousness to contextualise our own subjectivity in data interpretation and representation of experiences in the research process. Self-reflexivity promotes the reconciliation of personal motivations for conducting research and the extent of accountability owed to the population studied."

"Since no research, using any mode of inquiry has no point of view and since research is not a value-free exercise, the challenge is not to eliminate but to document the effects of personas that influence our behaviour and positionality."

Development studies researchers are uniquely placed in an environment where a significant disjuncture exists between typical everyday culture experienced by a student of the Victoria University of Wellington, and the culture of interacting and researching in a foreign country of the 'Global South' (Sultana, 2007). Therefore, over the course of this research, it was necessary to consider how my positionality affects my ability to carry out my work.

I therefore had to pay attention to issues of positionality in the field. As a researcher I was committed to showing my place in the setting being investigated. I carefully monitored my position in the research process, and the relationship with participants, which is critical to maintaining a focus on the research agenda. Finally, conducting international fieldwork involved being attentive to indigenous custom and culture of the ni-Vanuatu, as well as recognising Vanuatu's complex histories of colonialism, development and globalisation (Sultana, 2007).

4. 10. Ethical Considerations

The researcher is ethically bound to investigate in a manner that will 'do no harm'. In this respect, to ensure that individuals and communities are not marginalised, it is important to guide the research process with a number of ethical principles. These include honesty, objectivity, integrity, carefulness, openness and confidentiality (Shamoo & Resnik, 2009). It is important to remain self-aware as a researcher, seeking guidance and confirmation on ethical issues where appropriate. To ensure this, the University of Victoria Human Ethics Policy was used as a guiding measure throughout the research process. Additionally, ethics approval for this research was obtained from the Victoria University Ethics Committee on 18 April 2011.

As my research involved cross-cultural relationships with Ni-Vanuatu men and woman, I informed participants before any work was carried out, about what I was going to ask in my interviews, and how I would conduct data collection. This was achieved through emailing or posting participants an informative 'Ethical Approval for Interview: Information Sheet' (see Appendix). This sheet was also presented to participants in hard copy at each interview. This resource stipulated the participant's right to privacy. As an outside researcher, it is important to protect respondents' privacy. Confidentiality was fundamental and shows levels of respect on behalf of the researcher. Before each interview commenced participants were asked to read through and sign 'Consent to Participation in Research' sheet (See Appendix 1).

4. 11. Limitations

Overall, the adopted methodology was successful, rich text data was obtained from interviews conducted with key informants in the field and this data provided a suitable base to draw theory, facilitate discussion and make conclusions. However it important to acknowledge the limitations that were evident during the fieldwork process and also within the results and analysis activities that occurred after the field work took place.

Time

Time is a significant constraint in research. From time constraints in fieldwork to time constraints in post field data analysis, time is constantly limiting the depth and extent of research and therefore is a major limiting factor in this thesis. For example, the semi-structured interviews with participants often led to new sources of information. The limited time available to complete this thesis meant it was not possible to follow up all of these leads.

Participant Schedules

The busy work requirements for many prospective participants meant that often it was not possible to get the time to interview some individuals. NGO and government staff involved in disaster management are often required to be travelling throughout the Vanuatu provinces during the 'calm season' thus in the two months I was there it was difficult to get every intended individual to participate in an interview. This issue was mitigated by contacting participants at least a month before entering the field, organising dates for interviews well ahead of time, and generally maintaining contact with intended participants.

Number of Participants

Due to the limited resources as a solo researcher with a finite time frame to carry out field research, the number of participants was constrained. The research presents the experiences and views of a few individuals. Whilst best efforts were made to include an extensive range of participants the findings in the next chapter are therefore specific to the participant organisations rather than representative of the entire civil society, government, providers and mobile phone users in Vanuatu.

Length

The case study and the individual interviews needed to be a reasonable size in length in order to manage both time constraints and the amount of content within the thesis. This was managed by the development of a semi-structured interview guideline as mentioned previously.

Inability to Generalise

A frequent criticism of case study methodology is that its dependence on a single case study renders it incapable of providing a generalising conclusion because it lacks sufficient numbers of cases (Tellis, 1997). However CSF analysis has previously been applied to many applications of mobile phones in various functions (banking, learning, health); so specifically this thesis should support CSF analysis as a tool for researching the area of mobile phone application in disaster management. A single case study will not prove the value of the tool, but provides support to its application in the field of research.

4. 12. Summary

This chapter has covered the research approach, specific methods and data analysis tools utilised to complete this research thesis. Ultimately the approach and method adopted for the purposes of this research thesis contributed to the successful collection, analysis, interpretation and presentation of data. The following chapters will present these results and analysis. The next chapter reports the findings and analysis, organised according to the major themes developed from the data.

CHAPTER V

RESULTS AND ANALYSIS

5. 0. Introduction

This case research study addressed the critical success factors of integrating mobile phones as a communications mechanism within disaster management operations in Vanuatu. Through research and critical enquiry into this topic, the emerging factors necessary for mobile phone integration in Vanuatu have been presented in a results framework with four categories: 'government level', 'stakeholder level', 'technology level', and 'user level' (See figure 5.1).

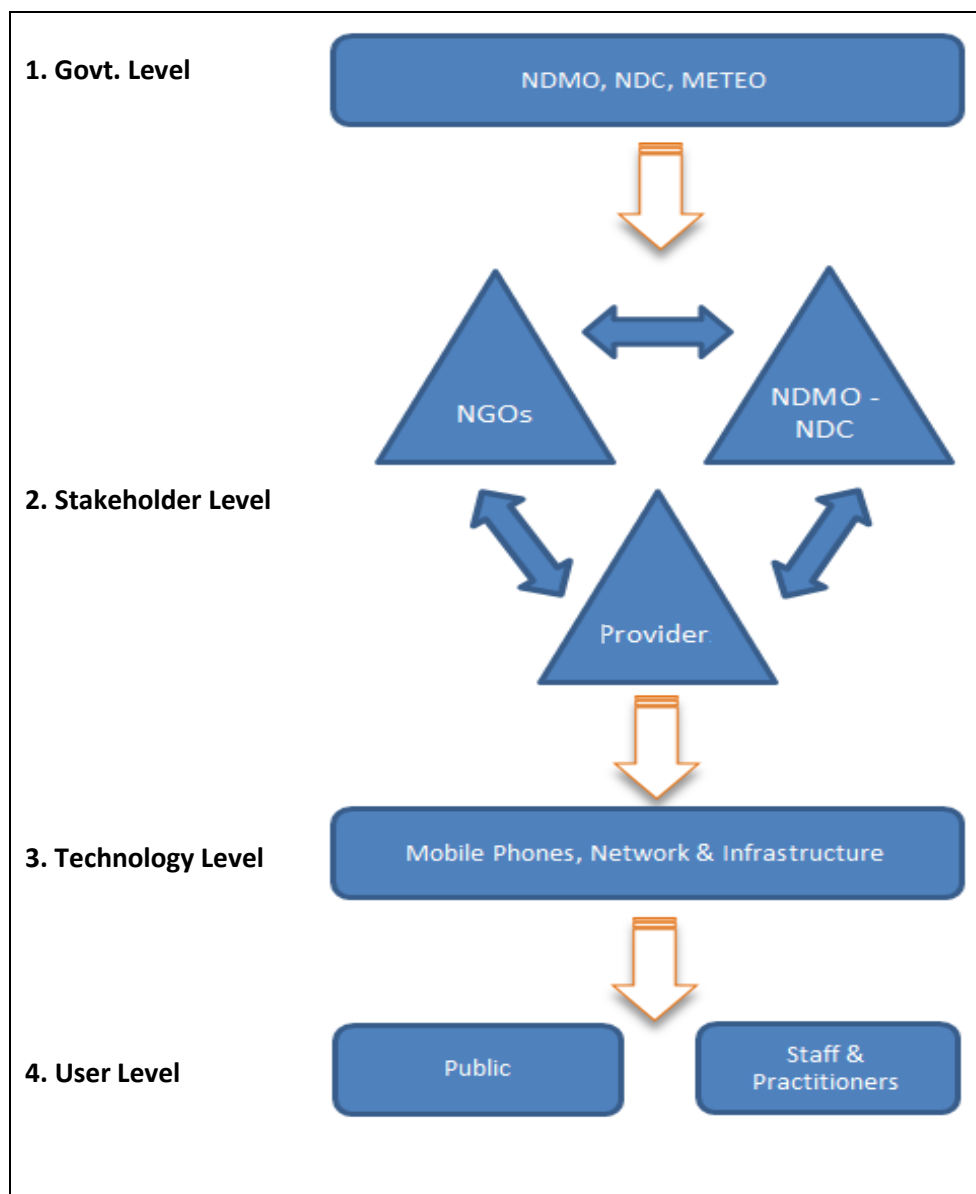


Figure 5.1: Model presentation of the results framework

The model presents a concise example of decision making directives and information flows within the entire process of operating mobile phones in the disaster management sector. The 'Government Level' category is at the top, this illustrates that the Vanuatu government and the government's official disaster management body –the NDMO- own the process of operating mobile phones for communications purposes in disaster management. It reflects that ultimately they govern the disaster management sector; and in turn the decisions made concerning mobile phones. This governance extends down to the groups, companies and organisations that actually operate and run the mobile phone or disaster management industries; they are the stakeholders that facilitate the use of mobile phones in Vanuatu. Thus the level below concerns these groups, and categorises them into the 'Stakeholder Level'.

Central to the operations of stakeholders are the mobile phones and network operating infrastructure. These act as the means for which information communication processes are enabled at the stakeholder level, factors impacting this are therefore categorised under the 'Technology Level'. Finally, at the bottom of the model are the mobile phone users, they receive or send disaster management related information and are therefore the end goal of government level and stakeholder level processes. Factors surrounding the success of users to operate a mobile phone are categorised within the 'User Level'.

So in short, top-down directives start in the government, this impacts on the actions of facilitating stakeholders who utilise the mobile phone technologies to establish flows of communication with the end point of the process, the mobile phone user. Relating to this entire process, the research revealed a set of 16 critical success factors (See Table 5.1). These factors will now be addressed in more detail, presenting the results from key informant interviews and subsequent coding process, with analysis and comparisons with existing research.

		CSFs	
CSF Category		Component	Description
1. Government Level (Government)		Govt. Ownership	Govt. ownership of the national level Mobile Phone processes in Disaster Management
		Sanctioned Information	Govt. consistently disseminates official verified information to meet information needs of organisations and people.
		Supportive Policy	Supportive policy governs and regulates mobile phone use in disaster management operations
2. Stakeholder Level (Govt. NGO Provider)	1. Between Stakeholders	Top Level Communication	Clear and effective communication flows between top level stakeholder groups
		Alignment	Sector wide consistency of process, policies and practices involved in applying mobile phones within Disaster Management
		Collaboration	Collaboration between stakeholder groups on mobile phone initiatives in disaster management
		Key Actor Network	Organisations have comprehensive networks of key actors across the disaster management and mobile phone communications sectors
	2. Within Stakeholders	Training	Strong Staff Training programs & Workshops
		Roles and Responsibilities	Stakeholder groups have a clear understanding of their roles and responsibilities
3. Technological Level (Mobile Phones and network)		Resilience and Constraints	Infrastructure is strong enough to withstand disasters, and providers have Identified the constraints of the Infrastructure and know the level of resilience to disasters
		Maintenance and Repair	Swift and effective repair and maintenance of infrastructure
		Network Coverage	Extensive network coverage reaching essential areas and populations
4. User Level (The User)		Affordability	Low initial and on-going costs of mobile phones and related running costs
		Usability	Easy to learn and user-friendly phones and applications
		Electricity Access	Regular access to mobile phone charging sources
		Network Access	Detailed knowledge and mapping of network access areas and specific access points

Table 5.1: A multi-level representation of the critical success factors of mobile phone use in Vanuatu disaster management operations.

5.1 CSF Category One: Government Level

A key objective of this research was to investigate the government's role in the process of integrating mobile phone use for disaster management purposes.

The participants showed a willingness to utilise mobile phones but many, particularly in the NGO sector, spoke of issues surrounding the application, and there were varied sentiments about a sector wide model for their use. Within this, participants consistently highlighted aspects relating to government roles and government initiatives. Three success factors were deemed critical at the government level, including: the need for government ownership and leadership; the provision of government sanctioned information; and government led supportive policy and regulatory initiatives.

5. 1. 1. Govt. Ownership:

Govt. ownership of the national level Mobile Phone processes in Disaster Management

There was a consensus across the participant groups that the government, specifically through the NDMO has an important role to own and in turn lead the initiative of mobile phone integration and utilisation in disaster management operations.

- Key Findings

Participants consistently indicated that the government should exhibit ownership of the communications processes through mobile phone use in disaster management. There are a number of elements that influence this point of view. Firstly, NGO participants reported that the government is a constant base of leadership in Vanuatu, thus the state branch designated to manage disaster related operations, the NDMO, is a constant in the Vanuatu disaster management sector. 'NGO 2' explains:

"I think the NDMO needs to lead the way with disaster management mobile phone integration processes. Because NGO's come and go in Vanuatu, they can't be the one's always running the programs autonomously without NDMO involvement".

The government also acknowledged their desire for leadership and ownership over disaster management processes. Participants explained that the government should own this process and have a role as the leaders in sanctioning and directing the use of mobile phones as a communications mechanism in disaster management operations. For example, Govt. 1 stipulated:

“The thing is, the NDMO is beginning to realise that there are new uses for mobile phones for Vanuatu, unlike many other countries, that access to them is much easier than the landlines that we were using up until the 90’s. The NDMO must address and be a real leader in the use of mobile phones in Vanuatu disaster management operations”

Furthermore, there is evidence government leadership should extend to applying mobile phones to a number of specific activities, processes and phases of disaster management. For example, ‘Govt’-1’ indicated that the NDMO needs to be *“the public’s go to source for disaster related information”* and they are establishing a toll free number to achieve this. Additionally, participants suggested that the NDMO needs to lead the process of mapping key stakeholders and their contact numbers (See 5.2.4.). Within the disaster preparation phase, participants illustrated the importance of the government leading the coordination of alert systems and early warning systems associated with mobile phones.

The indication from NGO participants was that they should have a minimal role in national scale public information dissemination. On the other hand, providers acknowledged that they play an important role in information dissemination activities, as ‘provider-2’ points out *“we are the middle man, between information being sent and received”*, but similarly to NGOs, providers illustrated a need for top down directives on information dissemination to come from the government before they can act. For example ‘Provider 1’ explains

*“We currently don’t run an SMS warning system, it is something that is up to the NDMO to communicate to the management of ***. They need to lead the initiative. It has been talked about in the past by the NDMO, by the former director. He indicated to the NDMO that we need to come up with a process: “who is supposed to give us the information and approve it before it goes into the SMS system”... Has this happened yet? The NDMO needs to be the leader on this, so we are waiting.”*

Provider and NGO participants also questioned the capacity of the government to exhibit leadership of the mobile phone communications process. In response, government participants recognised the need to improve government capacity in managing mobile phone communications, and they noted the need for their structures and processes to grow and become better, with support from external agencies such as NGOs. Govt-1 explains this:

“The aim is to have all national disaster operations coordinated from the NDMO; we are currently expanding and know we must work towards being leaders of disaster management in Vanuatu, so NGOs and stakeholders need to align with what we do. The NDMO must coordinate all the disaster work and we must take on board all the NGO’s to work along with the NDMO”.

There is also evidence that support for the government seems to be occurring on various levels already. Particularly on the grassroots level, where help for the NDMO's community level initiatives was addressed as being important for the mobile phone process to operate sufficiently. For example, NGO 4 explains:

*"But we at **** do support the NDMO through UN initiatives that come about, for example in this case the last initiative was to support the NDMO on fact finding, the people on the ground, and the contact numbers and stuff like that".*

- **Discussion**

Ultimately, these findings show that NGOs, providers and the government recognise the government's -and in particular the NDMO's- ownership and leadership role in disaster management. There is consensus on the processes that come under disaster management, such as mobile phone initiatives. The government acknowledges they must expand and are consequently going through a re-building phase. Along with the help of NGOs they are working towards improving their capacity to operate mobile phone and telecommunications systems more effectively.

This is consistent with findings drawn from wider studies surrounding ownership, mobile phones and ICT applications in developing countries (Curron, 2006; Smith, 2005; Brown et al., 2001). In defining 'ownership', Smith (2005, p.445) identified "strong leadership and political commitment as the basis for national ownership". Within change management, such as disaster management reform, ownership of the change—requiring participation in decision making leading to a strong commitment to see the change happen—is seen as an essential ingredient (Smith, 2005). In the case of Vanuatu, the results conveyed a number of important aspects to 'government ownership'.

Firstly, the findings highlighted the government, and more so the NDMO, as a 'constant' in the Vanuatu disaster management sector. In contrast, the scope and presence of NGO's in Vanuatu can fluctuate due to funding or aid priorities. However, the NDMO is there to stay; therefore they must act as the leaders of disaster management information communication systems.

Relating to this, the government participants conveyed an understanding of the NDMOs role in leading mobile phone processes. The NDMO plans to establish themselves as the central information source, the 'go to' organisation for disaster management information. In part, this is being achieved through utilising a free to call telephone number that is centrally directed to the NDMO, this is an example of embracing the potential of mobile phones to gain or give information instantaneously from any locality. Furthermore, the 'contacts mapping process' is an example of a government leadership activity that has nationwide implications. So government leadership is

occurring on various levels and they are undertaking measures to own mobile phone processes successfully.

Conversely, it was ascertained that NGOs should hold a minimal but supportive role in terms of ownership of nationwide disaster management information dissemination processes that involve mobile phones. Likewise, providers suggested they should not have a leadership role in the directing of disaster management information dissemination; rather their role was the middle man between sender and receiver. Potentially providers don't want to be held accountable if the process fails. So there is safety in having a minimal role, and giving the government the power to lead.

However as much as governments may 'own' the mobile phone process, their capacity to implement programmes around that need to be adequate (Brown et al., 2001). Both providers and NGOs posed questions of government capacity to run the process, and it was recognised that they had important roles to support the government in this regard. The concept of local capacity, and the need to build or develop it, has become a key issue within development assistance and has been strongly linked to the concept of technical assistance (Brown et al., 2001).

Relating to this, both NGOs and providers want the government to be leading the process, but they also addressed the need for stakeholders to support and help government endeavours to lead the process. In particular supporting the NDMO to help them build capacity, in order for them to sufficiently own and direct nationwide mobile phone communications processes. This stems from the concern that NDMO currently does not have the capacity to manage the entire process of directing information dissemination through mobile phone channels, and also through other communications channels. For example 'NGO 1' explains:

"The NDMO has a particular mandate to lead the initiative on MP integration, but the reality is they don't have the capacity to take on much at the moment. So we could put it all on the NDMO but that would mean it is unlikely things would happen, they would need support until they can manage themselves, and that support will likely come from civil society".

This is indicative of Currion's (2006) report for the Emergency Capacity Building Project (ECB), on ICTs in disaster management. He identified the need for government capacity to ensure effective government ownership and response:

"National capacity in the broadest sense is the single biggest issue in emergency response. In country offices and national staff, capacity affects everything: implementation, monitoring & evaluation, training, security management, and so on. While there will always be a need for external support in the event of an overwhelming catastrophe or political emergency, agencies' priority should be to build the capacity of their country offices to respond on their own terms" (2)

Correspondingly, the research identified that civil society in particular is providing support to help build the capacity and strength of the NDMO. NGOs and donors provide aid funding and budget support to the government which is directed for disaster management purposes. There is often donor funding provided to source specialists and advisers to work with the government to build capacity. These support mechanisms are important to build government capacity to run and own disaster management information dissemination systems, such as the mobile phone application.

Finally, in a development sense, parallels can be drawn between government ownership of disaster management information systems and government ownership of development initiatives encouraged within the Paris Declaration (2005), in attempts to improve aid effectiveness. 'Ownership' is an important principle of the Paris Declaration (2005), which stipulated:

"Developing countries must lead their own development policies and strategies, and manage their own development work on the ground. This is essential if aid is to contribute to truly sustainable development. Donors must support developing countries in building up their capacity to exercise this kind of leadership by strengthening local expertise, institutions and management systems. The target set by the Paris Declaration is for three-quarters of developing countries to have their own national development strategies by 2010."

The Paris Declaration is focused on five mutually reinforcing principles, aimed at improving the delivery and effectiveness of development aid. In this sense 'Government Ownership' as a critical success factor holds some importance in the context of international policy directives in the development industry.

- Summary

In summary, a significant finding from this study has shown that the government, specifically the NDMO, needs to be leading the nationwide communications process that utilises mobile phones. For new initiatives to be successful government top down management needs to apply, with the NDMO directing the process, and then NGOs, providers and other disaster management practitioners operating within their directive. To achieve this, civil society has a significant role in building the capacity of government disaster management processes.

5. 1. 2. Govt. Sanctioned Information

Govt. consistently disseminates official verified information to meet information needs of organisations and people.

Moving forward from government ownership of the mobile phone process, participants conveyed that this extends to the government taking a lead role in the management of information that is being disseminated for disaster management purposes. In other words, the government sanctioning of information.

- **Results**

Participant sentiments often reflected a desire for a consistent official information source, and NGOs in particular seem to be looking for government leadership initiatives to establish this consistent source of influential information. NGO participants illustrated caution about not overtaking the government's role in sending out information about disaster risks and activities. For example, 'NGO-2' points out *"As a non-governmental organisation we need to be careful not to take over the responsibility of communicating in disasters. Communities should know that information is coming from official sources. If people are going to listen, the information must be come from the top, the government"*. The government also held this position, government participants conveyed a need for information to be officially sanctioned by the NDMO, before being disseminated for disaster management purposes.

Furthermore, an important finding was that a user will consider different sources of information to be of different value. Participants described the issues surrounding unofficial sources of information, and they often showed scepticism at the quantity and quality of information flows mobile phones have the potential to generate; 'Govt. 2' explains this:

"With mass messages, like early warnings, we have received several in the last few years. And I think there is a danger of unofficial information being submitted to the phone users by NGOs and providers, even the Churches, people might think 'oh another warning, we get so many' they don't respect the information, Digicel sent out warnings about the Japanese Tsunami but does the public keep trusting Digicel information? I don't know. So public information should be sanctioned by the NDMO first, and then people will know it is official and the risk is real'.

With this in mind, participants highlighted that there must be a nationwide recognition of one source that is understood to be the top directive for all disaster management information. And as NGO-3 points out, *"this may not go towards mitigating all unverified information flows; however official information is likely to hold more influence with mobile phone users"*.

There were also issues surrounding how to actually facilitate the sanctioning of information in Vanuatu. Participants suggested the formulation of government sanctioned information regarding disaster management communication should involve two parties:

“The meteorological dept. gathers information on disaster hazard, the NDMO, amongst other things, gathers information on disaster impacts. So both of them should be in charge to write down the message and it should be sent through providers or NGOs to transmit to communities or key people in communities. To do this the message needs to be simple, understandable, and people must know it is from the government” (NGO 3).

- **Discussion**

For mobile phones to truly be considered an appropriate disaster management resource in Vanuatu, there is a requirement for consistent, government led, dissemination of official and verified information. This is essentially the ‘sanctioning’ of information that is distributed via mobile phone to the public for disaster management purposes.

Firstly, there is a need to identify the category and direction of disaster management information that should be sanctioned through government processes. In this respect, participants illustrated that information of relevance and importance to the public is most important. For example, mass messages utilised in early warning systems, messages containing educational information regarding disaster preparedness, or messages relating to the response phase such as information on humanitarian aid activities within a locality. Essentially, this is information of national importance, targeted at communities. So in this respect, the sanctioning of information does not need to extend to NGOs mobile phone processes that communicate unofficial information within one another, such as updates or advice of importance to them specifically.

These findings illustrate that information of national importance needs to come from a single verifiable ‘top level’ source; and the results show that the government –more specifically the NDMO- is in the best position to act as this source of information. This is because information from the government has a better chance of being ‘listened’ to by communities; it holds more ‘weight’ because it is deemed to be coming from an official source. The literature further explains this, Frewer & Shepard (1993, p.385) noted, “What is salient in risk communication, and what is believed [by the public], is likely to be related to factors additional to the informational content itself”. Illustrating that government sources of information are an important influence on the public, Basolo (2009, p.344) noted:

“Dissemination of environmental risk and preparedness information is a responsibility of government. Based on findings from their research on earthquakes, Mileti et al. (1992) asserted that an informational brochure from local government combined with multiple other sources of information about environmental risk is necessary to motivate residents to take protective measures”

However, it is important to note the opinion of Walsh-Daneshmandi & MacLachlan (2000), they suggested that attitudes toward government may vary by community and country. And that risk perception varies by type of environmental risk. Because Vanuatu is unique in regards to environment and population, the perceptions of government information will be unique to Vanuatu, so this may warrant further research in the future.

Conversely, there is also an apparent wariness amongst stakeholders relating to the quality and quantity of unofficial and unverified information being transmitted via mobile phones. Essentially, the government is cautious of the ability that NGOs, providers, community groups and even the public now have to communicate information about disaster hazard, and disaster management initiatives. There are two significant risks that stem from this ability to communicate unofficial information about disasters. Firstly, the potential for a ‘flood’ of unverified information from multiple sources which dilutes the ‘weight’ -or influence- that official mobile phone based information holds.

A second risk factor of unverified information dissemination is that there is no one to hold accountable if unverified information is wrong, particularly if there are negative consequences due to misinformation. In this respect, if information is recognised as coming from a single source it could lead to more accountability, which has potential to encourage the NDMO to manage the process more effectively. If the government understands that they are accountable for sanctioning correct information to the nation, they may be likely to do a better job.

Relating to ‘how’ to actually promote consistent sanctioning of information, the results portrayed evidence that there must be a clear indication to communities, about who is running –and owning- the process of communicating information surrounding disaster management. Similarly, to 5.1.1, there is also a need for civil society to build the capacity of the government to run and maintain effective sanctioning processes.

- Summary

Through sanctioning information and making it official, the government sends a clear message to communities. Thus, sanctioning is critical; it gives information sent via mobile phones a greater influence on users who receive that information. And it validates the usefulness of mobile phones.

Critically, sanctioned information fosters trust in communities and accountability to the information source, the government.

5. 1. 3. Supportive Policy

Supportive policy governs and regulates mobile phone use in disaster management operations

A major CSF illustrated in the research study suggested that for mobile phones to function as a communications resource in disaster management, there must be effective policy formulated that supports and regulates the use of mobile phones in disaster management, as well as supporting and regulating the various stakeholders involved in utilising and managing the application.

- Results

A common idea ascertained from participants, was that setting up national policy is important for telecommunications technologies to successfully operate in any capacity within Vanuatu. In a disaster management sense, participants explained that national policy stipulating the role of mobile phones and the corresponding responsibilities of the stakeholders involved is important. And as NGO-1 explained, *“Public policy creates a policy mandate for the government agencies involved”*. Participants further explained that a mandate on mobile phone use would establish who is tasked with leading the process and it holds this leading agency accountable to deliver on their responsibilities. ‘User-3’ made an important point relating to this:

‘If there is policy, and something goes wrong, then we can ask the government for an answer or they must make a solution. Policy makes them responsible for overseeing that people are receiving the disaster message’.

In discussing aspects surrounding policy formulation, participants consistently identified that a policy consultation process is an important aspect of establishing supportive policy; furthermore consultation was identified as a process that facilitates collaboration and communication (Two CSFs identified in Section 5.2). As NGO-2 suggests:

“To set up policy surrounding mobile phone use, there needs to be consultation between the NDMO, the donor partners, the government and the government Telecom Regulator. And also the private stakeholders, such as the mobile phone providers. Those are the people that should be involved in setting up policy”.

Participants suggested that policy consultation identifies important control measures for organisations, particularly for providers in the commercial realm. Participants acknowledged that policy supports and guides the disaster management sector and mobile phone industry in the form of national regulations and guidelines. Government participants highlighted that these particular

support mechanisms are currently being utilised by the Vanuatu Telecommunication and Radio-Communication Regulator (TRR).

Participants explained that regulations had an important role in supporting provider interactions and reinforcing their responsibilities. This viewpoint came particularly from the NGO sector, especially in relation to price regulation. NGO-4 pointed out: *“In terms of affordability, there needs to be regulations on the providers to make sure the price is not going to increase dramatically, as this would impact on communities using mobile phones”*. From a government perspective, participants explained that ensuring prices are fair and accessible to the population is the role of their regulatory branch, the TRR. Detailing this, Govt.-3 explained *“The role of the TRR is to licence operators, and to ensure that there is fair competition, that consumers get choice of service as well as fair and reasonable prices. And also to develop the market”*.

- **Discussion**

Supportive policy is critical for mobile phones to be utilised as an information system for disaster management operations. The results have highlighted that it holds significance to the research problem due to the multi-faceted and complex nature of disaster management involving government, civil society and grassroots communities, and in the case of mobile phone integration, private companies. With so many stakeholders involved, there is a need for policy, laws and regulations that govern and support mobile phone use in disaster management operations.

Reflecting this, success factor research by Moe and Pathranarakul (2006) on managing disaster related processes in Thailand found that policy initiatives must focus on being supportive of disaster management initiatives:

“Supportive laws and regulations will have positive impact on outcomes of disaster management. There were 34 laws that are related to disasters in Thailand. With such different laws set for different organizations, and without enforcing them, organizations face role and line of authority confusions. Therefore, supportive laws and regulations must be established and they must be enforced so that it will create an enabling environment for managing disasters” (409)

The research identified that national policy is an important first step for telecommunications technologies to successfully operate in any capacity within Vanuatu. This policy is essentially the principles and rules that guide actions, roles and responsibilities taken by the state and national offices –such as the NDMO-, NGOs, and providers with regard to telecommunications and disaster management.

Furthermore, the findings indicated that policy influences a mandate that establishes who is tasked with leading the process and what the roles of other agencies will be. With appropriate policy, the NDMO will have a mandate to manage mobile phones as a telecommunications resource in disaster management, and they must meet their roles and responsibilities written into that policy. Significantly, a policy mandate will influence government accountability, and as 'NGO-3' conveys, it is accountability under the public eye.

In facilitating appropriate policy formulation, the research ascertained that consultation was a necessary first step, particularly because it facilitates collaboration and communication between the key stakeholders in the government, civil society and private sector. Consultation with the private sector mobile phone providers is particularly important, and the results suggest that because mobile phone use crosses over into the commercial world, there needs to be policy measures that support and control how different stakeholders can use the technology, to ensure it does get used appropriately. TRR regulations on the mobile phone industry were identified as important policy initiatives that can support the application of mobile phones in disaster management, particularly if regulations can promote affordability and improve network coverage.

Furthermore, the results suggest that regulations should be used to clarify and reinforce stakeholder responsibilities, particularly provider responsibilities. Providers are an integral stakeholder in mobile phone disaster management, however as a profit driven company their core values are not reflective of non-profit driven organisations and the government. Hence participants conveyed reservations, there is potential for providers, if unregulated, to distort the mobile phone market or be non-cooperative to disaster management initiatives. Therefore providers are licenced under a set of conditions and if necessary regulated to ensure they act appropriately.

- ***Summary***

So both the government and NGOs are vested in maintaining affordable mobile phone prices, and this is occurring through supportive policy initiatives. Consultation is an important aspect of formulating appropriate policy. This research identified that it is critical that regulatory actions and guidelines exist, in order to appropriately guide stakeholder groups that are facilitating the use of mobile phones for disaster management operations. Policy that supports mobile phone initiatives from the national level down to the grassroots is essential for mobile phones to succeed as a communications mechanism in disaster management.

5. 1. 4. Government Level – Summary

As a result of exploring the government's role in the process of integrating mobile phone use for disaster management purposes, this research discovered three success factors that were deemed critical at the government level. These include the need for government ownership and leadership, the provision of government sanctioned information, and government led supportive policy and regulatory initiatives. There was widespread recognition that it should be the government leading initiatives on disaster communication. The sanctioning of information as well as fostering supportive policy processes are an important part of this leadership role.

5.2 CSF Category Two: Stakeholder Level

This study sought to explore the experiences of key stakeholders in relation to facilitating the use of mobile phones as a communications tool within disaster management operations. Stakeholder groups include the major organisations, agencies, offices or groups involved in the application of mobile phones as an information dissemination mechanism in the disaster management sector, drawing from the state sector, private sector, and civil society sector. This section is split into two parts: (1) the CSFs relating to interactions and relationships between key stakeholder groups; and (2) the CSFs relating to interactions within key stakeholder groups.

Part 1 – Between Stakeholder Groups:

The relationship between stakeholder groups continually surfaced as an important theme within the research data. Referring to the sector wide application of mobile phones into disaster management communication practices, participants commonly spoke of the need for sector wide alignment, standardisation, and clear responsibilities; these are factors that primarily stem from stronger relationships between stakeholders. Essentially, it was discovered that stakeholders involved in the application of mobile phones in disaster management, need to be connected through means of communication, alignment, standardisation, clear understanding of responsibilities, and clear knowledge of existing key stakeholder networks.

5. 2. 1. Communication

Clear and effective communication flows between top level stakeholder groups

A key finding of this research highlighted that for stakeholders to succeed in utilising mobile phone technology for disaster management, then ‘communication’ between stakeholder groups must be effective.

- **Results**

Participants representing the NGO and government sector often addressed communication flows between key stakeholder groups. Participants conveyed that stakeholder communication is important to ensure there is sector collaboration (See 5.2.3.) and sector alignment (See 5.2.3.) on a range of policies, processes and applications. Participants showed a good understanding of each stakeholder group’s role within mobile phone integration into disaster management. For example,

NGO-2 explained that inter-organisational communication is important to improve knowledge of other NGOs roles and specialities in disaster management:

“We are working with most of the NGO’s on disaster management. We are working together, we communicate, and we know each other. And so we know which organisations are working on or specialising in each phase of disaster management... Recently we had a disaster management workshop, which shows this kind of communication and coordination between NGO’s and the Government and NDMO. So we can find out together what we need to improve and the ways in which we can do it, such as mobile phone integration.”

Participants commonly indicated that meetings and workshops have been effective at facilitating communication and promoting interactions between stakeholders. Workshops were noted to be particularly important from facilitating government-NGO communication which is another important inter-stakeholder communication flow that participants spoke of. For example, referring to communication problems between NGOs and government, NGO-6 explained how this can inhibit mobile phone disaster management outcomes:

“Communication with NDMO has been something we have identified as being a problem. It is one of the challenges in disaster response. It was identified that after a disaster, in the response phase, communication between the NDMO and NGOs is a problem”.

Government participants also identified communication as an important factor and also something they are endeavouring to improve. Particularly with flows of government-provider communication. One participant argued *“The government needs to state their intentions to providers that mobile phones are to be used as a DM resource and for humanitarian operations”* (Govt-2). But this communication seems to already be occurring as ‘Govt-3’ points out *“we have written to the provider CEO’s to ask them to collaborate with the Meteorology dept. and NDMO in a number of warnings systems”*. So communication from the government to providers is occurring in this respect, and they acknowledge they still have improvements to make.

Relating to provider experiences with stakeholder communication, participants suggested that the government has an obligation to involve telecommunications stakeholders in disaster management. For mobile phones to be used appropriately it was suggested that there needs to be open communication between providers and the government. As ‘Provider-1’ illustrates: *“effective communication between provider-1 and the NDMO is one of the key success factors in all the activities of disaster management we are involved in”*. So providers reported that communication to them is also important.

- **Discussion**

Participants in each stakeholder group consistently acknowledged that communication is an important factor for mobile phones to succeed in their application within disaster management. Essentially, inter-stakeholder communication flows will promote an understanding of emerging telecommunications technologies and applications, such as mobile phones. In turn, communication can promote alignment and collaboration on the processes involved in utilising these technologies. In the case of Vanuatu, the research findings addressed three major flows of communication between stakeholder groups, 'NGO-NGO', 'NGO-Government' and 'Provider-Government'. The findings regarding the communication CSF are consistent with CSFs presented in a number of studies surrounding mobile phone applications in developing countries (Turner and Muller, 2004; Nah et al., 2001; Moe and Pathranarakul, 2006; Al-Mashari et al, 2003).

There were a number of important aspects to the 'communication' CSF that were addressed by this research. Firstly, the findings suggested that communication is an integral aspect of stakeholder alignment and collaboration on mobile phone initiatives. There are a large number and broad range of stakeholder groups vested in the use of mobile phones for disaster management information dissemination, including local and international NGOs, government offices, and mobile phone providers. Communication between these stakeholders is therefore vital for an application like this to be successful. The application inherently involves collaboration and alignment between stakeholders on practice, process and policy. And therefore there must be effective flows of communication and information sharing between these groups. Government-NGO communication flows were highlighted as important due to important collaboration efforts in disaster management operations, particularly during the response phase. This is supported in research by Moe and Pathranarakul (2006) who explored critical success factors for managing disaster related public projects in Thailand:

"Project success is strongly linked to communication and co-operation between stakeholders. Trust resulting from effective communication between the task managers and the coordinator is the key success factor... In other words, such effective communication is described as a collaborative working relationship. It should be maintained between the project owner and project manager, with both viewing the project as a partnership. Thus, effective communication mechanisms must be established among key stakeholders" (410)

Reflecting on the work by Moe and Pathranarakul (2006), in the case of Vanuatu the 'project owner' is the government and the 'project manager' includes government disaster response bodies –such as the NDMO- and NGOs involved in running disaster management and humanitarian operations.

Communication therefore is vital to create a trusting collaborative relationship between these stakeholders on the 'owner' and 'manager' level.

Addressing 'how' to facilitate communication, the findings suggested meetings and workshops as being an effective means of achieving stakeholder communication. This is indicative of work by Nah *et al.* (2001) on information systems implementations. It was reported that:

"Communication between partnering stakeholders is vital and requires partnership trust. Partnerships should be managed with regularly scheduled meetings" (Nah et al. 2001, 289).

Significantly, the study by Nah *et al.* (2001) highlighted the need for regular meetings as a means of facilitating communication between stakeholders that are jointly undertaking implementations. Furthermore, Nah *et al.* (2001) are addressing communication from a private sector perspective and their findings could hold relevance to the private sector perspectives of the Vanuatu mobile phone providers. Providers reported communication as being an important aspect in achieving successful mobile phone integration into disaster management. Government-Provider communication was an integral aspect of this, which is reflective of the important role that providers hold as the stakeholders that run and manage the mobile phone industry. Communication with them is therefore vital, and there is a need to include them in meetings and workshops that address mobile phone use in disaster management.

- Summary

Communication was highlighted as being important for the application of mobile phone communication processes to succeed in disaster management operations. It impacts on important stakeholder factors such as alignment and collaboration. It was discovered that effective communication can be facilitated by stakeholder workshops, meetings and through addressing interactions between stakeholder organisations.

5. 2. 2. Alignment

Sector wide consistency of process, policies and practices involved in applying mobile phones within Disaster Management

Alignment and standardisation are important development principles that occur when there is agreement or consensus among groups with a common cause or viewpoint (Rogerson, 2005). It is an important factor to ensure consistency in the application of mobile phones throughout the disaster management sector, between all the stakeholder organisations.

- Results

Participants highlighted the importance of key stakeholders coming together with a consistent viewpoint on mobile phone processes in disaster management operations. In terms of NGO-Government alignment, participants indicated that this was already occurring in many aspects of Vanuatu disaster management. 'NGO-4' echoed this theme, drawing from past experiences of groups agreeing on the areas they operate within in emergency situations:

There is already a level of NDMO and civil society alignment; it has certainly been strengthened in the past few years. Most of the key players have already been in dialogue with the NDMO, so there is actually activity going on. For example, for the last disaster assessment in Cyclone Sara, the NDMO, UNICEF, Oxfam, Red Cross, World Vision, Water Supply in Govt. Ministry of Health were the key players in looking after the WASH aspect of the response. Then we had another group looking at food supplies, and food. And then others were looking at the logistics side of the response. And it was working. So it shows alignment is working, there is a prior agreement between key players on what their roles are, and it means there is a more effective response. It is important, and for things like mobile phone use the existing alignment channels can be used to influence a sector standard on using them for communications.

Many NGOs also highlighted the importance of getting providers in line with the government and NGO disaster management processes and initiatives. NGO-4 explains how having providers align with disaster management groups is beneficial:

"It's important to have the providers becoming part of the team for emergency preparedness. They should be in line with that. By first of all, giving out clear messages to the population, free of charge. Also, by providing updates on the route of a Cyclone, tsunami or even earthquakes"

Similarly, it is apparent that providers want alignment with the government in order to clarify and define their roles and responsibilities in the disaster communications process. Provider-1 explains:

"Our idea is that, for mobile phones to be used successfully there must strong Disaster communications process in place and strong alignment in place with the NDMO, they are responsible for the disaster management, they are the ones that are leading the programs, Provider-1 is just a facilitator in making sure that the communication flows. And that is where Provider-1 comes in, where we just play a part to facilitate communication in the disaster management process"

Furthermore, participants identified 'standardisation' as a significant aspect of alignment . There was a strong suggestion amongst government groups that alignment of stakeholder organisations on roles, processes and directives will lead to consistency in specific practices –such as standard

operating procedures- of mobile phone use in disaster management. 'Govt. 2' exhibited this idea appropriately:

So I think if we thought about using MPs as a preparedness activity, done some standardisation, by asking 'what's the best way to gather info so that actually you can actually gauge it. Because obviously if info is gathered in different ways it makes it harder to aggregate it. Also sometimes during and after a disaster you can receive large amounts of irrelevant information from mobile phones. So there really needs to be ways to control and analyse what types of information you receive, who gathers the information, how it is communicated in, and to whom. Standardisation, having standard operating procedures that all stakeholders can refer to is important.

- Discussion

Alignment and standardisation between key stakeholders is an important finding of this research study. According to Harindranath and Sein (2007), alignment of stakeholder interests in ICT applications increases efficiency and effectiveness of processes, as well as reducing the risk of stakeholder conflicts arising. It was highlighted consistently as being an important factor that had to occur between organisations, particularly when stakeholders have very different perspectives and needs. Alignment of stakeholder groups in Vanuatu includes the government -most importantly the NDMO, NDC, the VTR, and the Meteorological Department-; civil society organisations -including organisations involved in humanitarian operations-; and finally the two major mobile phone providers, Telecom Vanuatu and Digicel Vanuatu.

There were a number of important findings that came out of the research relating to alignment. Firstly, it was apparent that alignment is already occurring between NGOs and government. Importantly this is being facilitated through top level communication processes. There needs to be a dialogue to create an agreement. The findings proved that alignment does work to improving a system, and so for mobile phones to be successfully utilised, alignment must occur.

Additionally, the findings indicated that it is essential for providers to align with the processes and policies set out by the government surrounding communications in disaster management. Alignment in this regard, will aid to clarify the role of providers in emergency management. For example, this will help providers understand the processes and policies that influence government mass messaging systems and in turn their role in aligning to those processes. The idea here is that alignment between key stakeholders and providers will benefit the application of mobile phones by incorporating providers into the emergency management process.

Therefore, provider-government alignment is particularly important. This is supported by Harindranath and Sein (2007) in their case study on ICT and public-private interactions surrounding the application of the 'e-Seva' project, a government IS that provides electronic payment services for various government amenities in India.

"In the e-Seva project, there was inadequate alignment between the e-Seva centres and participating government departments. This resulted in data irregularities and gaps in transaction data" (7)

From the provider perspective, the importance of alignment was also acknowledged. Providers understood that the process of alignment will facilitate agreement on roles and responsibilities in the disaster management and mobile phone communications process. Specifically, providers endeavour to clarify their role as a facilitator, working under the government role as the leader of the communications process. This essentially will help facilitate sanctioned information flows coming from the government to providers.

Additionally, the research ascertained that alignment of stakeholder organisations on roles, processes and directives will lead to standardisation of specific practices –such as operating procedures- of mobile phone use in disaster management. Essentially, the practices and processes adopted by organisations and practitioners need to be consistent in order for mobile phones to be utilised successfully within disaster management. Through alignment, standardisation will contribute to verifiability, relevance and quality of information inflows and outflows from mobile phones. Therefore, alignment can be considered a precursor to standardisation of information collection and dissemination, and it helps stakeholders understand a common model of how mobile phones are used in specific instances of disaster management.

- Summary

So experiences implied there was a strong case for alignment across the sector, for mobile phone integration to be successful. And Stakeholders showed a consensus that it was important. On the whole, the government, NGO and provider opinions were consistent. Participants portrayed past experience and a future willingness to work with other agencies on disaster management.

Alignment has an influence on, but is seemingly separate to, collaboration. In essence, groups align on process, and collaborate on practice. Therefore collaboration was identified, consistently along with alignment as an important factor. Collaboration is now discussed in the next section.

5. 2. 3. Collaboration

Collaboration between stakeholder groups on mobile phone initiatives in disaster management

Participants illustrated the importance that stakeholders work together on mobile phone related disaster management initiatives. Essentially, it is critical that there is effective collaboration between stakeholders. Stakeholder collaboration will contribute to the success of mobile phone utilisation in disaster management.

- Results

Participants suggested there was a need for collaboration between stakeholder organisations on initiatives that seek to integrate mobile phones into existing information dissemination practices, and on the subsequent mobile phone operations themselves. It was also noted that collaboration can exist between any of the key stakeholders –and stakeholder groups- involved in the application of mobile phones in disaster management. Govt. 3 points this out: *“Facilitating successful mobile phones processes in disaster management stems from working together with all the industry”* (Govt. 3).

Participants highlighted an important top-level collaboration of key stakeholders, the NGO-led creation of the ‘Vanuatu Humanitarian Team’ (VHT). This is an example of an NGO-NGO collaboration initiative that also flows into NGO-government collaboration, with a representative of the VHT working with the government directly on disaster management initiatives. This was viewed positively by the government as an *“effective coordinating body for civil society agencies”*, and it acts to improve NGO collaboration with the government, and initiatives such as the mobile phone application in disaster management.

Participants often indicated the need for provider-government collaboration, particularly when network infrastructure is damaged during and after disaster situations, Govt-1 noted *“...when a tower fails in a disaster situation, providers do have the potential to collaborate with our movements into the affected area”*. Alternatively, relating to information dissemination initiatives, the government participants suggested that providers had to collaborate with them on issuing disaster warnings to the public and disaster management messages to key actors. Govt-3 reported the Telecommunications Regulator had written to providers asking them to collaborate with the Meteorology dept. and NDMO on their initiatives to communicate information via mobile phone. One major provider was reported to be collaborating effectively on this initiative; however there was uncertainty over another provider’s commitment to collaborating with the government.

There was evidence that providers were also of the opinion that collaboration with the government on mobile phone initiatives was important. 'Provider 1' talked about a recent experience where the government and providers collaborated:

With the Mele flood, in the days during and after the flood, the NDMO asked 'provider 1' to help out, so we gave them some handsets which we have available for disasters. And the NDMO gets them, loads credit on them and then uses them, so it's easier. So there is some useful collaboration between the NDMO and 'provider 1', we work very well together.

There was also evidence that the two providers themselves could work to collaborate with one another. This was in terms of infrastructure use and how providers can share infrastructure when one of their networks is damaged during an emergency, as 'NGO 2' illustrates: *"If a Digicel post goes down in Torba, and the TVL one is still up, then the TVL post can service the Digicel numbers. It is obviously a complex commercial discussion, but those are the sorts of things that I think would be important"*.

- Discussion

Essentially, collaboration is working together, and it occurs when two or more groups work with one another on a joint project (Bunker and Smith, 2009). It is often synonymous with 'coordination'. The research shows it is connected intricately with the alignment process identified as a key CSF of the mobile phone application. Through aligning on viewpoints, roles, and directives of mobile phone communication in disaster management, key stakeholders can work together to collaborate on initiatives. Relating to this, Bunker and Smith (2009) highlighted the specifics involved in collaboration on ICT initiatives:

"When organisations (or emergency services agencies in the case of this study) collaborate, they have to come to terms with having a common strategy, common business processes and ICT architectural design". (3)

Relating to specific collaborative relationships, the results indicated the importance of institutional collaboration of stakeholders that have key roles in facilitating disaster management initiatives in Vanuatu. For example, this is apparent in establishment of the Vanuatu Humanitarian Team (VHT). Specifically, the VHT is a coalition of humanitarian actors and organizations who are active in the Vanuatu region; it integrates the major NGOs –Oxfam, Red Cross, Save the Children, UNICEF and World Vision- as well as the NDMO on behalf of the government. Through working together on initiatives the VHT represents a successful collaboration initiative that provides a platform for integrating mobile phones as an information system for disaster management operations.

Supporting this, Oloruntoba (2005) highlighted the necessity of inter-organisational collaboration to the success of disaster management initiatives following the 2004 Indian Ocean tsunami:

“The extent of effective collaboration between national authorities, local actors and international actors so far appears to be adequate, but longer term collaboration, coordination and partnership with the victims themselves and the local authorities and actors would be required for a successful relief and reconstruction effort. Inter-organisational coordination is crucial at all stages of this response; in functions such as asset usage, incident management, search and rescue, division of labour, public information management amongst others. There must be clarification of organisational roles in disaster management” (512)

Another key finding highlighted the importance of provider-government collaboration. Parallels can be drawn with Currión’s (2006) work relating to government-private sector collaboration, he noted:

“External partnerships are essential because we do not possess the capacity to address every aspect of ICT. Therefore collaboration with private sector actors is vital.” (4)

In the case of Vanuatu, government-provider collaboration was deemed particularly useful in terms of improving provider repair processes of disaster damaged network infrastructure. For example, with collaboration between provider and government stakeholders following a disaster, a provider technician is included in the government’s rapid assessment flight into the affected area, with the objective of reaching and repairing damaged infrastructure in a shorter timeframe.

There were reservations from government in regards to provider collaboration with some government initiatives. For example, government attempts to coordinate with providers on a ‘mass-message’ warning system were met with willingness from one provider, however the other provider had yet to confirm their commitment to the initiative. Providers understand collaboration with the government is important, whether they are in fact collaborating is another issue that according to some participants needs to be addressed.

Finally, the research ascertained that providers themselves also had the potential to collaborate in relation to disaster management. This type of collaboration means providers could support each other’s infrastructure so disaster management communication flows are not impacted when a network is damaged. For example, roaming capabilities of modern mobile phones mean that if a user is out of a service provider’s coverage area but are in another provider’s mobile phone network coverage area, their call can be carried on the other provider’s network (ITU, 2009). This suggests providers have the capacity to collaborate and support each other in disaster situations, in order to ensure the success of disaster management information dissemination initiatives.

- **Summary**

So collaboration was shown to be an important factor. This includes collaboration between the government and providers on warning systems, collaboration on repairing networks or sharing infrastructure, collaboration of NGOs to influence and improve processes, or collaboration between key stakeholders on policy initiatives. Working together on these initiatives is important, and effectively working together will improve the success of the mobile phone application in disaster management.

5. 2. 4. Key Actor Networks

Organisations have comprehensive networks of key actors across the disaster management and mobile phone communications sectors

For mobile phones to operate successfully when applied in disaster management, this research highlighted the importance of recording the details and contact numbers of key actors involved in disaster management sector, the private sector and the government sector.

- **Results**

Participants proposed that recording an extensive network of key people and their phone details will help disaster management communication initiatives. The ‘Vanuatu Humanitarian Team’ (VTH) was highlighted as an example of an extensive network of NGO contacts that practitioners could draw on to direct communication to specific people in the humanitarian sector. Disaster management participants –particularly from NGO groups- conveyed that they would benefit from having access to mobile phone numbers of key disaster management actors that they can contact before, during and after disaster situations. This is because mobile phones enabled a direct link to a specific person anywhere in the country, as NGO-1 explains:

“The important benefit about recording and knowing key contacts numbers is that people know that when they call the certain number, it’s not like calling a landline where they have to go find the person. You know that when you ring a number you will be talking to the person you want to talk to. Especially if you want to get in contact with an important person in the community. It’s the one thing about mobile phones, establishing direct access to people”

At the grassroots level, participants identified that disseminating information to a network of key community based actors would improve the influence and ‘weight’ that the information held in the eyes of community members. Key community actors identified by participants were community leaders such as chiefs, church leaders, respected village elders, community volunteer workers and

community disaster management officers. 'NGO 4' reflects on this idea relating to a situation where a community is being evacuated:

"When you have to relocate people in an emergency, you really can't message the whole population involved and expect an orderly outcome, rather it's better to message individual people, leaders in the community, so the message fans out from them".

Identifying influential and relevant people in communities is important aspect of this CSF. From a community member perspective, recording networks of community leaders is an important factor for information dissemination to succeed at a community level, for example 'User 1' notes:

"Community leaders command respect, using them is more effective than any other person. Because of the respect, especially chiefs and church leaders, what they say, there is more 'weight' to it than any other person in the community".

- Discussion

There is an extensive and diverse range of people interacting within the Vanuatu disaster industry, including –but not limited to– government officials, provider representatives, NGO practitioners, and provincial and community based leaders, volunteers and staff. Consequently, there were reservations surrounding how mobile phones can direct relevant disaster management information to the right people at the right time. Addressing this, the research discovered that there needs to be a detailed understanding of key actors involved or affiliated with disaster management operations, and there needs to be a process of consistently recording and updating a detailed network of these people. 'NGO 4' referred to this as a *"key actor identification and mapping process"*, and it was suggested that a detailed network of actors and their contact numbers will contribute to the success of mobile phone utilisation for disaster management activities. There were a number of important factors surrounding this.

Firstly, the findings revealed that an important motivation behind a key actor network was that mobile phones enabled practitioners to establish a direct link to a specific person. In other words, practitioners can confidently assume that number they are calling will be answered by the person they are endeavouring to contact. Therefore, with sufficient knowledge of key actor networks, disaster practitioners can contact each other easily, to disseminate information of coordinate disaster management initiatives.

Additionally, the research ascertained that disaster management information relayed to mobile phones would have more impact on communities when networks of influential community members are known and utilised. Therefore, rather than mass messaging an entire community, or

alternatively not recording the numbers of any community members at all, it is beneficial to identify and record the details of key influential people into a community level network. It was suggested that in rural communities these are community and village chiefs, church leaders, local politicians, NGO field staff, volunteers and if applicable, community disaster secretaries. Essentially, utilising a strong key actor network that incorporates influential community members will create a more powerful message because the information is being passed on by influential actors within the community. This again highlights the 'weight' that different forms and manifestations of disaster management information can have when directed through various pathways.

- **Summary**

An appropriately detailed and consistently updated network key disaster management actors is an important success factor of the mobile phone application. This will contribute to more efficient communication flows within stakeholder organisations, between stakeholder organisations. As well as ensuring effective information flow from government level down to grassroots community level.

Part 2 – Within Stakeholder Groups:

5. 2. 5. Training

Strong Staff Training programs & Workshops

This research found that well trained competent staff members are important for stakeholder groups endeavouring to utilise mobile phones as a tool within their telecommunications operations. Essentially, it is critical that there are strong training programs and workshops that educate staff on the specifics of utilising mobile phones in disaster management operations.

- **Results**

Participants reported that there are existing training programs and workshops that encompassed a wide range of disaster management stakeholders in Vanuatu, and it was suggested that these would provide a good platform for implementing training on mobile phone applications. Govt-2 reported that *"the use and potential uses of mobile phones has already been talked about in some workshops and meetings held by us and some of the NGOs"*, so there is potential to implement more specialised training programs.

Participants conveyed a number of themes that training programs should be directed at. Firstly, in relating to 'usability', participants highlighted the importance of the correct use of mobile phones and overcoming issues of usability. In particular, NGO and government participants

suggested the need for staff training to ensure practitioners are using mobile phones effectively for disaster management purposes. For example, NGO-3 noted *"...the other risk and barrier I would imagine would be 'use'. How can we train people to use the system to accurately enter the data? Given that a lot of people out there haven't been using mobile phones for a long time"*.

Adding to this, it was suggested that training need not dwell on issues of 'ease of use'; rather it should focus on training the processes of using phones in specific activities. For example, 'Govt-2' states:

"We should have staff training if we develop a new program that involves mobile phone integration into disaster management phases. But staff don't really need training on specific running of the phones, they already know how to use them".

Participants identified that training to improve the proficiency of staff to gain access to a mobile-cellular signal is another important aspect of the training CSF. NGO-4 illustrates how this is occurring:

"Another issue is some of the village health workers work in some sites around Vanuatu with limited network coverage. But this is a barrier users and staff are overcoming through training and awareness. We encourage them to identify network spots in our training programs and staff manual. So usually they are able to identify a nearby area that gets service".

Finally, participants indicated that a major benefit of training programs would be an improved awareness and knowledge of the specific roles and responsibilities of staff members within the process of mobile phone utilisation. From a NGO perspective, it was suggested that staff needed to know their specific role within the reporting and information dissemination process for which mobile phones were used. NGO-6 explains *"We have many staff on the ground, they must know whose role it is to report information back to us in Vila. If roles aren't clear then often we won't get that message back to us"*.

- Discussion

The findings suggested that training was an important component of integrating mobile phone use into staff communications processes. Staff are considered to be end-users of mobile phones, so they must be trained to interact with the technology appropriately. Staff training was consistently highlighted as an important CSF within disaster management and ICT literature (Al-Mashari et al, 2003; Marble, 2000; Umble et al. 2003; Yu et al. 2006; Perry, 2007; Thomas, 2003; Olafsson, 2010; Currian, 2006) therefore parallels can be drawn with the application of mobile phones in disaster management.

When disaster management staff are the end users of the mobile phone process, there must be training set up and directed towards them specifically. Umble *et al.* (2003) referred to the critical need for ERP information systems training:

“Education/training is probably the most widely recognized critical success factor, because user understanding and buy-in is essential. ERP implementation requires a critical mass of knowledge to enable people to solve problems within the framework of the system. The full benefits of ERP cannot be realized until end users are using the new system properly” (246)

Accordingly, the findings suggested that training is necessary in order to maximise the effectiveness of mobile phones as an information system for disaster management. Training to improve staff ‘usability’ of mobile phones was identified as important in this respect. However, there was an indication that training to improve ‘usability’ of the mobile phone functions is inefficient because ‘ease of use’ has not been a major barrier for users throughout Vanuatu. This suggests training for mobile phone use should focus on specific processes but not necessarily on basic operations of mobile phone use. For example, training to improve usability of specific applications such as text message data entry would be appropriate.

Additionally, this research ascertained that training programs need to improve the ability of staff to access mobile cellular signal. This relates to the issue of overcoming network connectivity barriers, particularly in isolated communities (See Section 5.4.4). Therefore training to improve network access is particularly important for stakeholders that have staff working in isolated regions. This relates particularly to NGOs that operate in communities throughout the country, as well as government representatives such as community disaster management officers.

Training to improve staff awareness and knowledge of their specific roles and responsibilities is another important part of this CSF. Olafsson (2010) supported this notion in his review of effective coordination in disaster response:

“One of the key critical points is the competency of the people involved. Not only do they need to have the appropriate skills training required to perform their job, but they also need to know what their role is within the entire response and how that role is part of an overall effort to respond effectively. We can address this in part through continuous training efforts”
(3)

Training and workshops need to clearly define the roles of practitioners, this provides staff a platform to utilise mobile phones more appropriately for specific purposes that they are directed for. This is an important aspect that contributes to the success of mobile phone use in disaster management operations.

- **Summary**

The findings suggested that training is essential to address a number of issues which relate to wider critical success factors identified throughout this thesis. Most notably, in overcoming issues of 'usability' (See 5.4.2.), 'connectivity' (See 5.4.4.), and also promoting staff understanding of their specific 'roles' when using mobile phones (See 5.2.6.).

5. 2. 6. Roles and Responsibilities

Stakeholder groups have a clear understanding of their roles and responsibilities

The research ascertained that it is critical for stakeholders to address their own roles within the process of using mobile phones for information dissemination, and in turn adhere to any responsibilities that are attached to their role.

- **Results**

Participants consistently highlighted that providers have an important role, and hold significant responsibility over the success of utilising mobile phones for disaster management purposes due to their pivotal role as the owners and operators of the network. For example, Govt-1 explained that *"...The Govt. relies on the provider's technicians to fix the networks after disasters. That is their responsibility as they are the sole agency that can repair network issues"*. Similarly, from the NGO perspective, NGO-1 noted that *"...the two providers are important 'responding stakeholders' in any disaster, so getting the tower up and running again is one of their responsibilities. We really rely on them to fulfil that role or really mobile phones won't be useful to us"*. So there is a strong indication from NGO and government groups that providers have important roles and responsibilities.

Provide participants held similar opinions to NGOs and government groups about provider roles and responsibilities, and they described their actions surrounding disaster management to be ethically influenced. As Provider-1 explains *"we work with the government and NDMO because one of our baselines is 'dedication to the nation', so it's an ethical obligation to Vanuatu"*. Supporting this idea, it was highlighted that providers have influenced a national reliance on mobile phones, they are now widely used and the use of other communications technologies has subsequently declined. As NGO-4 notes:

"With the introduction of mobile technology there has been an impact on other technologies, like damaged landlines in some places have not been fixed because the village has mobile coverage. Some villages also don't use their VHF radio now. So the priority now, is actually mobile phones"

In practice, participants indicated that providers are acting on their ethical obligation through allowing mobile phone users to access emergency calling lines without cost. Provider-1 highlighted the '112'² initiative as one example of them fulfilling an ethical responsibility as part of their role in Vanuatu disaster management:

"Provider-1' has recently employed a high priority 112 mobile emergency number, this is always open on all networks, all calls into it are free of charge for mobile phones, and they are automatically routed to the emergency operator. It's an effective technology for people using mobile phones; it facilitates their use in disaster situations"

The opinions of government participants suggested they understand the importance of their role as the leaders and key decision makers in the disaster management sector. Govt-2 explains: *"It is important that we define our role clearly, especially because we are the government, we must oversee the sector and so we sometimes have to remind stakeholder groups of their own responsibilities"*. An example of this can be seen in the role of the Telecommunications Regulator, for example Govt-3 noted: *"...the Telecommunications Regulator is playing a small role in ensuring the licensee's live up to their responsibility to connect free of charge for emergency lines"*.

- Discussion

Within disaster management there are many complex interactions between stakeholder groups. Practitioners and groups within the sector often rely on the processes of another group for the success of their own operations. In the case of Vanuatu, it is apparent that stakeholders have complex opinions of their own roles and responsibilities, and also the roles of other stakeholder groups.

Relating to this CSF, the findings revealed that participant opinions frequently focused on the importance of the roles and responsibilities of providers. It was discovered that there is a critical need for providers to understand and act on their responsibility to work with disaster management groups and manage the mobile phone network effectively. Providers hold a pivotal role in disaster management mobile phone communications because they manage and operate the mobile cellular network and the mobile phone industry. In this sense, participants explained that the providers must constantly deliver a working 'mobile-cellular network', and it was their responsibility to make sure the network runs effectively and is repaired promptly when issues arise.

Supporting this, Hlavacek *et al.* (2004) in their work on mobile phone vendor-provider interactions in disaster response, they highlighted roles and responsibility awareness as key to facilitating effecting responses:

² This is a toll free emergency number provided to the Vanuatu public by TVL.

“It is important to have a well-documented disaster recovery plan that spells out what needs to be in place (roles) should a disaster strike... This way, it is clear as to what measures can be taken to proactively avoid network failures and what responsibilities are assigned to participants, allowing them to act quickly and with direction in case of a disaster” (179)

Ethical responsibility was also suggested as an important aspect of this CSF. Due to the decline of older telecommunications systems, such as the landlines and even VHF two way radios, providers need to ethically address the nationwide mobile phone reliance they have created, and the significant role they have subsequently set themselves as the operators of the industry.

Consistent with this idea, providers identified that they had ethical responsibilities to fulfil their roles. They understood that they had a responsibility to provide a functional mobile communications network, called their “dedication to the nation” as one participant put it.

Although risks are present with the interactivity of private-government-NGO in mobile phones and disaster management, the experiences of Vanuatu has been mostly positive so far. For example, by providing the 112 line, provider-1 acted on their responsibility to make sure mobile phones can be used for emergency and disaster management purposes.

In terms of government roles, it was discovered that the NDMO has an important role to lead and oversee the application of mobile phones. This relates to themes of ‘ownership’ and ‘leadership’ that have been covered as wider CSFs within this research. Essentially, their understanding of that role is critical for mobile phones to be successfully utilised as a communications technology in disaster management.

- Summary

Whilst government and NGO understanding of their roles and responsibilities is important, participants illustrated that it is imperative for providers to have an understanding and act on their role as the ‘owners’ of the mobile phone industry and infrastructure. There is recognition that providers have an ethical responsibility to the nation to provide mobile telecommunications services, particularly in disaster situations.

Therefore, it is critical that stakeholders address their own roles within the process of using mobile phones for information dissemination, and in turn adhere to any responsibilities that are attached to their role. This must happen for mobile phones to be successfully utilised as a communications technology in disaster management.

5. 2. 7. Stakeholder Level – Summary

The focus on stakeholder relations drawn from the data has shown that for the application of mobile phones to succeed there must be efficient communication flows between stakeholders, there must be sector wide alignment on disaster management processes, as well as standardisation of associated practices and processes. Key stakeholders across the sector include major NGOs and humanitarian organisations, both mobile phone providers, the telecommunications regulator, and government groups including the National Disaster Management Office, and the National Disaster Committee which encompasses representatives from the Ministries of Health, Transport, and the Department of Internal Affairs, as well as the police force, and military. Between these groups there must be alignment on official mobile phone practices and policies governing use. Including ‘how’ mobile phones are used, ‘who’ uses them, for ‘what’ purposes, and ‘when’ they are to be used in each phase of disaster management.

5.3 CSF Category Three: Technology Level

A central objective of this research was to identify the technological factors that contribute to the successful operation of mobile phones and the mobile cellular network in Vanuatu. The research identified that there must be technological capacity that is sufficient to support the use of mobile phones in Vanuatu as an information system in disaster management operations; this relates to the level of network coverage, the resilience of infrastructure, and repair and maintenance processes.

5.3.1. Resilience & Constraints

Infrastructure is strong enough to withstand disasters, and providers have identified the constraints of the infrastructure and know the level of resilience to disasters.

The capacity of technological infrastructure to withstand a disaster situation was consistently identified as an important issue contributing to the success of mobile phones operating as an information dissemination mechanism.

- Results

Participants conveyed an understanding that the resilience of infrastructure to natural disasters is a current issue in Vanuatu. This was highlighted particularly in relation to the recent Cyclone Vania, where both the TVL and Digicel mobile phone networks went down in key areas at the height of the disaster. For disaster management actors this resulted in significant uncertainty, as 'NGO-4' illustrates:

"In Aneityum, Vania brought the network down for a critical number of days. So up here in Port Vila there was a lot of uncertainty, 'panic mode', we didn't know what was going on. We had to resort to other means of communication like the Satellite phone which is not as common in communities".

Furthermore, both NGOs and the government participants acknowledge that building resilience is necessary, given past experiences such as the network failure during Cyclone Vania. For example, NGO 1 noted: *"We should be looking at ways service providers can improve and strengthen the infrastructure so it's not so susceptible to going down".*

With this in mind, participants reported the need for measures to encourage the building of infrastructure resilience. Government participants in particular spoke of the need for 'infrastructural standards' as a means of ensuring a sufficient quality of infrastructure and in turn promoting resilience. Regulatory measures (also covered in section 5.1.3) are acknowledged as an important part of ensuring standards are met as Govt-3 highlights:

“The infrastructure has to be built to a particular standard, and this is specified in the operator licence conditions. With cyclones all the towers have to be built to withstand a certain cyclone category, in this case up to category 3, which gusts up to 220km an hour winds. So only equipment which is certified and meets certain standards is allowed to be imported, meaning Infrastructural Resilience is maintained”.

Similarly, both providers highlighted infrastructure resilience as an issue they are addressing. ‘Provider-1’ noted *“...we do address issues of resilience and we have action plans to reduce the frequency of outages and general resilience and quality of our infrastructure”*. However, there was also recognition by provider participants that there was a limit to the level of quality that infrastructure can be built to. Provider-2 explains this *“We can’t build our network to be indestructible, it’s impossible, there are always going to be weaknesses to heavy disasters, so we must focus energies on preparing for that”*. In fact, addressing these weaknesses and the importance of understanding the constraints of mobile phone infrastructure was commonly highlighted by participants. For example, Govt-1 exhibited a level of awareness of infrastructure constraints:

“Mobile phones are much better than the landlines but they are still susceptible to natural disasters and general damage. In the past towers have withstood certain disasters but not others. Category four cyclones will damage a tower, but most towers can withstand a category two to three”.

This active knowledge of infrastructure constraints has important implications for the success of mobile phones as NGO-4 illustrates *“when you know the constraints of this technology you can plan around that, so you can plan for a cyclone or earthquake because you know what that will do to the technology and there’s no big surprise that you’re unprepared for”*.

- Discussion

These results indicated that mobile phone infrastructure must be strong enough to withstand internal and external pressures posed by disaster situations. Additionally, disaster management stakeholders and providers must possess an understanding of what constraints exist in the technologies being utilised when they are faced with these pressures. Resilient infrastructure and knowledge of technological constraints is critical for mobile phones to be utilised as an information system for disaster management operations. There were a number of important aspects to the ‘resilience and constraints’ CSF that were addressed by participants.

Firstly, stakeholder acknowledgement of the resilience issue is an important aspect of this. On the whole, participants illustrated an understanding that network infrastructure needs to be able to stand up to external forces for mobile phones to be utilised successfully. If the network ceases to

function then the mobile phone is a redundant resource. Similarly, Asplund *et al.* (2010) touched on the issues with disasters causing damage to mobile phone networks following Hurricane Katrina:

“Imagine a post storm scenario in which electricity and communication infrastructures are almost non-existent. In the aftermath of Hurricane Katrina, for example, the actors in the rescue operations struggled with access to relevant information, and emergency management coordination processes suffered considerable delays and shortcomings” (1)

The case of Vanuatu presented comparable experiences of poor network performance in past disaster events, particularly in the recent Cyclone Vania. Consequently, these experiences have influenced a strong viewpoint from disaster management stakeholders that building resilience is necessary for mobile phones to succeed as a communications tool for them.

In addressing the processes being used to build resilience, the research discovered the use of ‘infrastructural standards’. Through the VTT, the government illustrated that they have the intention to control the quality of infrastructure being imported and set a standard for this quality, with the goal of building resilience to withstand a ‘category 3’ cyclone. However, reports of network difficulties in recent cyclones in Vanuatu would suggest this is not occurring. Cyclone Vania for example, reached category 3 with wind speeds of 140km per hour when it struck Vanuatu (Radio NZ report, January 11, 2011), yet the TAEFA province lost network signal for a number of days. This may suggest Vanuatu mobile phone providers have to improve the infrastructural resilience of their mobile phone network. It also may suggest the government must set higher standards on infrastructural quality.

The providers’ opinion on resilience was that disaster management practitioners and the government have to be realistic in their expectations; they need to be prepared for network issues. Asplund *et al.* (2010) mirrored this notion in their work on emergency management communications in search and rescue operations: *“If we consider wireless communication as a means of information dissemination we should always count on frequent loss of connectivity in the network” (1)*. Essentially, infrastructure resilience is finite, and so it is important that stakeholders understand the potential risk of network failure. It is more so important that stakeholders understand the factors, or infrastructural constraints that contribute to network failure.

‘Constraints knowledge’ therefore is an important aspect of resilience, and stakeholder participants conveyed an active knowledge of how network infrastructure will respond to specific magnitudes of differing natural disasters. Constraints knowledge is therefore recognising that there is a point to which building resilience becomes unrealistic and thus stakeholders must understand

the limitations of mobile phone infrastructure. This will allow stakeholders to plan effective response activities such as maintenance and repair processes, which is covered in the next section.

- **Summary**

So building resilience but also understanding the extent of the resilience of mobile phone infrastructure plays an important role in the success of mobile phones operating as an effective communications tool in disaster management. The ability of network infrastructure to withstand disasters is critical. Mobile phone towers are most at risk to being damaged in cyclones; also the capacity of the network to manage inevitable high loads of traffic following a disaster needs to be high. Providers should seek to improve the quality and resilience of their infrastructure. And with infrastructure resilience in mind, there needs to be a detailed understanding of the constraints of infrastructure to withstand certain levels of disaster. Planning and preparation methods need to stem from this knowledge.

5. 3. 2. Maintenance and Repair

Swift and effective repair and maintenance of infrastructure

The research highlighted that in the event that network infrastructure is damaged, it is important that repair operations are underway swiftly, and processes are in place to ensure those with the responsibility to maintain a working network, are able to access areas affected by disaster events.

- **Results**

There was general consensus amongst participants in all groups that a swift timeframe for repairing network issues is important. And it was apparent that the onus for organising and carrying out repairs was set solely on providers. Yet there was a common opinion amongst the government and NGO participants that providers are not living up to this expectation, particularly in situations where there is network failure. At this critical time, many participants believed the timeframe for repairing the fault was in most cases too long. For example, Govt-1 explains:

“In the past it has taken as long as a month, usually a few weeks to get all network areas working again. Some are up fast, within a few days, but other areas have taken longer. It has important implications for response. Communication really needs to be setup again, at the latest one to two days after a disaster”.

Govt-1 indicated that repairing network faults is critical to the success of mobile phone use in disaster management. So what is hindering providers’ ability to repair networks in a timeframe deemed appropriate by other stakeholders? Participants addressed two major inhibitors. Firstly, ‘weather conditions’, particularly in times surrounding a cyclone disaster, have proven to be a

significant hurdle to providers endeavouring to access and repair damaged infrastructure. Provider-2 explains this appropriately:

“In terms of fixing the network, it really depends on the weather. If there is damage, and we can get technicians into the area quickly, then the network goes back up quickly. But if there is continuing bad weather then it is hard to get people into the area to fix the towers and the network can be down for a while”.

Secondly, the remote environments where towers are often built also present a hurdle to providers endeavouring to repair infrastructural damage quickly. Participants reported the challenging logistics of getting technicians and supplies into isolated environments. So isolation along with weather conditions does hinder the timeframe of repair work, but the current awareness of these issues suggests providers believe swift and effective repair processes are important. And there are encouraging examples of providers fixing damaged infrastructure swiftly, NGO-4 reported the success of TVL’s efforts to repair the network on the island of Aneityum following damage to network infrastructure from cyclone Vania, it took them two days to restore the network.

So what contributed to the success of TVL’s repair processes in the example above? Addressing these barriers, participants identified a number of options utilised to overcome issues surrounding repair and maintenance processes. Firstly, Provider-1 noted: *“In instance of network infrastructure problems we have some teams of technicians which we are able to fly to any island very quickly to fix things, we have a charter helicopter to do this”.* But whether providers will employ these mechanisms is a point of contention, and some participants are dubious of this. For this reason, participants reported of the need for a further coping strategy, formal agreements to address provider repair and maintenance obligations, Govt-2 explains:

“There needs to be some formal agreement with the government to ensure repairs happen in the shortest time necessary, so our disaster communications like mobile phones can function normally. After past disasters, repair times have been sporadic, so we need to address this”.

This suggests that mobile phone providers and government may need to work together to formalise the mobile phone maintenance and repair process, and promote provider accountability of repair processes.

- Discussion

Essentially these findings illustrate that to work effectively, mobile phone technology and infrastructure needs to be maintained regularly, and often repaired swiftly. Effective maintenance and repair processes are therefore critical for mobile phones to be utilised as an information system for disaster management operations. This point is consistent with the views of a number of authors

who addressed the use of mobile phones and ICT infrastructure for disaster management purposes (Asplund et al. 2010; Coyle & Childs 2005; Lundberg & Asplund, 2011).

There were a number of important aspects to this CSF that were addressed by participants. Firstly, the results indicated that the past timeframes for repairing networks following disaster events have been too long. In some cases reports of up to a month were given. This has significant implications on disaster management operations that seek to utilise mobile phones for information dissemination. Ultimately extended repair timeframes bring into question the appropriateness of mobile phones as a primary information system in Vanuatu disaster management, if damage is not repaired promptly then mobile phones cannot be used during a time when they are most needed. Coyle & Childs (2005) reflects this notion:

“In the immediate aftermath of a disaster, it is vital for operators and governments to work together to restore mobile networks as quickly and effectively as possible. Mobile networks, like other important parts of the essential infrastructure, are vulnerable to being damaged, and will inescapably face very heavy demands in the immediate aftermath of a disaster. It is in the aftermath, too, that the distinctive capacity of mobiles to disperse information to where it is most needed comes into play, especially as many people will be displaced from their homes”. (32)

There are examples of infrastructural repairs in recent disasters around the world which indicate that repairs can be achieved on a tight timeframe. Mulrow (2010) reflecting on the 2010 Haiti earthquake explained *“Cell phones were among the first pieces of infrastructure repaired in Haiti. And a free emergency line in was up and running in 4 days”* (22). So why, in the case of Vanuatu, are repairs being hindered?

The findings indicated that weather is a major barrier to repair and maintenance processes in Vanuatu. The prevalence of cyclones and storms as a major disaster hazard in the region is important, because weather events such as cyclones can last days compared to tectonic events such as tsunamis and earthquakes that are over in a comparably short space of time. This shows a clear distinction in regards to repair processes that have to occur in a Vanuatu disaster situation such as Cyclone Vania, compared to the Haiti earthquake situation outlined by Mulrow (2010).

Additionally, the Vanuatu provider companies have chosen remote and isolated areas to build cellular towers which reflects their attempts to gain extensive network coverage in the region. However it presents a further barrier to repair processes, as the transportation and logistics requirements of fixing a damaged tower often take extended periods of time. This is supported by Asplund et al. (2010) referring to hastily built mobile phone networks in the US region impacted by Hurricane Katrina: *“The notion of hastily formed networks has emerged as a response to the need for*

establishment of communication networks in an area with little or no access to maintenance infrastructure” (1). Similarly, this suggests that isolation is a major inhibitor of maintenance and repair processes due to the lack of proximate infrastructure needed to repair cell towers.

Despite these barriers, the findings identified TVLs success in fixing their network in Aneityum within two days following Cyclone Vania. With this in mind, what contributes to successful repair and maintenance processes and how have weather and isolation barriers been overcome? The results indicated that designating a team of response specialists and utilising swift air transport mechanisms to reach remote locations and repair faults contribute to a fast and effective repair process. Similarly, a report by Coyle & Childs (2005) highlighted an example where specialist relief organisations in partnership with local operators restored telecommunications services in under 24 hours following a disaster:

“When the city of Bam, Iran, was hit by a 6.5 Richter scale earthquake in December of 2003, killing 26,271 people. The partnership between Turkcell and Ericsson Response established communications in the disaster area within a day of the earthquake, responding to the request of the Iranian authorities. Volunteers from Ericsson Response and colleagues at Ericsson Turkey and Ericsson Iran were sent to install an emergency GSM system which was connected via satellite to Turkcell’s network. The network installed in Bam was operational for 10 days, until local networks were repaired” (16)

Thus, response specialists such as ‘Ericson Response’ can be used effectively when working with the national provider in order to repair infrastructure in a short timeframe. Finally, formal agreements between the government and providers were suggested, this stems from doubts about the providers ability to autonomously repair networks in an appropriate timeframe. Promoting provider accountability of repair processes is a major aspect of this. If providers are held to account in this regard, then a swiftly repaired network will allow mobile phones to be used effectively to disseminate information in response and recovery phase disaster management operations.

- Summary

Swift repair and maintenance processes essentially contribute to the success of mobile phone based information dissemination. This highlights that repair processes are important for mobile phones to operate as a communications resource for disaster management, particularly in the response phase.

5. 3. 3. Network Coverage

Extensive network coverage reaching essential areas and populations

The findings in this study reported that the dissemination of information to and from communities via mobile phone relies on areas having access to the mobile phone network. It is important that the network is broad enough to cover Vanuatu to achieve this and providers need to seek to be constantly expanding their coverage areas.

- Results

Participants highlighted the need for extensive network coverage throughout the Vanuatu region. Each stakeholder group generally accepted that coverage is improving, particularly after Digicel was established in Vanuatu in 2008. However, there is still a strong opinion that coverage is not adequate in isolated areas, and participants often questioned how mobile phones can succeed as a disaster management resource for isolated communities, if those communities cannot effectively use the technology in the absence of an adequate mobile-cellular signal.

From a provider perspective, Provider-1 reported: *“we have network coverage of 75% of the population. And about 30% of the geo-spatial area of Vanuatu islands covered”*. Similar figures were described by Provider-2 who claimed to have 80% of the Vanuatu population covered by a mobile-cellular signal. Cumulatively, Govt-3 estimated that currently (July, 2011) 90% of the population is covered by a mobile cellular signal.

But do these statistics reflect user experiences throughout Vanuatu? The experiences of user participants indicated inconsistent and sporadic mobile cellular coverage throughout the provinces of Vanuatu. For example, User-4 explains: *“I walk around my Village in Tanna, some places get signal, near my house is ok but I walk down the hill only 200 meters and there is now no signal at all”*, on a similar note User-1 noted *“In the northern islands, in Gaua, some villages the ones close to the sea have good reception I can make calls, but when I travel into the bush and I lost reception so there I can only make text messages”*. These user experiences are consistent with the experiences of NGO staff working in the Vanuatu provinces, as NGO-5 illustrates:

*“...for us at **** in the different locations where we are working, some of the areas are very isolated, such as currently our staff in the west coast of Santo. Communication to them is very difficult because the providers have not yet got the network up there, there are small pockets of reception but it is still hard to communicate with them consistently using the mobile phone”*.

Despite this, some participants also reported that network coverage is improving, and this is consistent with the ambitions of both the provider companies to continue extending their coverage

throughout the country. However in the current climate of sporadic network coverage, users illustrated that they are overcoming connectivity barriers effectively. For example User-6 explains:

“Communities can overcome problems with reception, people are smart. Many people who don’t have reception in their community know where there are places with reception from the Digicel or TVL towers. For example, in Banks (island) they have reception in some places so the people in communities know where the closest place with reception is. And then they walk to this place every day. Often it is close by but some of them have to walk two or three kilometres to get reception, up a hill or around a hill to get reception. In some places where it is very hard to find reception the communities have put a marker in a certain spot so people can find it easily.”

Similarly, NGO participants have realised the importance of knowing network coverage points. NGO participants reported their endeavours to formalise and promote local knowledge of network coverage areas, NGO-2 referred to this as a “network mapping process” for staff and local communities. This was identified as a way for NGO groups to overcome staff connectivity issues, if effective it will contribute to better connectivity in isolated environments, and ultimately will contribute to the successful use of mobile phones for information dissemination purposes in these isolated environments.

- Discussion

These results indicate that sufficient network coverage is critical for mobile phones to be utilised as a communications resource for disaster management operations. Relating to wider research on ICTs many authors acknowledged that if mobile phones are not covered by a signal, then they will cease to function as an effective information system in their field of use (Anckar & Walden, 2003; Buellingen & Woerter, 2004; Xu & Jairo, 2006; Muthaiyah, 2004). This is reflected by Buellingen & Woerter (2004) who noted “The quality of transmission and coverage are critical success factors of GSM-based mobile communication” (p1406).

Worldwide figures on mobile phone coverage show that access to mobile networks is now available to 90% of the world population and 80% of the population living in rural areas (ITU, 2011). Similarly, in the context of Vanuatu, provider and the government participants indicated that combined coverage reaches an estimated 90% of the Vanuatu population.

However, this is in contrast to the experiences portrayed by user participants. The research identified that users were experiencing sporadic and inconsistent levels of coverage throughout Vanuatu, particularly in rural and isolated environments. This could have implications on the success of rural users to receive disaster management related information, early warning systems for example. This suggests early warning systems could be ineffective in areas where there is no

guarantee the intended recipients are covered by a signal. In this sense, extensive network coverage is critical in early warning system applications.

Furthermore, for the NGO users in communities, such as disaster management practitioners, poor coverage could have implications on their ability to communicate data and information back to urban based disaster management networks. In disaster management, reporting systems are often an essential component that informs preparedness, response and recovery initiatives, and the appropriate delivery of these initiatives impacts on community vulnerability to natural disasters (Olafsson, 2010). This highlights how critical network coverage is to the success of mobile phones to operate as a communications mechanism for disaster management initiatives.

Finally, the results indicated that users are overcoming the connectivity barrier. The 'network mapping process' is an example of this. In Vanuatu it is apparent that users in communities are being innovative in overcoming the connectivity issue, and it seems they have achieved this autonomously with no formal guidance from official groups or organisations. User initiatives to gain access to a wireless signal are covered in more depth in *Section 5.4.4*.

- Summary

These findings portrayed that despite high figures of population coverage, both community users and NGO users have experienced varying and sporadic network coverage in Vanuatu. It is therefore critical that stakeholders acknowledge that network coverage is a critical aspect of mobile phone information dissemination to rural communities. Disaster management stakeholders need to plan their initiatives with this in mind. And providers need to constantly seek to expand the coverage of their mobile cellular network to reach the most isolated populations in Vanuatu.

5. 3. 4. Technology Level Summary

In summary, the research discovered three critical factors relating to the technology level. Firstly, the capacity of infrastructure to withstand internal and external forces in disaster situations is important. In the event that network infrastructure is damaged, it is important that repair operations are underway swiftly. Finally, the dissemination of information to and from communities via mobile phone relies on areas having access to the mobile phone network. These factors are important for mobile phones to succeed in their application in Vanuatu disaster management.

5.4 CSF Category Four: User Level

The final objective of this research was to examine the experiences of Vanuatu 'end-users' in operating a mobile phone. Users must have the capacity to own and operate mobile phones. Participants noted the importance of addressing the needs of users, in order to facilitate widespread mobile phone use for disaster management purposes throughout Vanuatu. In Vanuatu, participants highlighted four major critical factors that must be addressed to ensure users are empowered to operate mobile phones within their everyday lives at the community. This will in turn empower disaster management information to disseminate down to the community level, thus reaching its target who are the end users (both community based staff and the public) at the grassroots level.

5. 4. 1. Affordability

Low initial and on-going costs of mobile phones and related running costs

Affordability is an important factor for mobile phone success. This research indicated that mobile phone costs must be within reach of the personal finances of the Vanuatu population for the technology to succeed as a communications resource for disaster management.

- Results

Participants often talked about affordability and the availability of money for users in Vanuatu. As noted by 'Provider-2' *"Mobile phones are a product of a cash economy"*, thus for an individual in Vanuatu to obtain a phone, he or she must have the means to pay for it. In Vanuatu, this issue has become evident particularly for participants in isolated rural areas, as NGO-1 explains:

"The reality is, the more remote you get in Vanuatu, the less a cash economy is evident, and a mobile phone is a modern day invention of a cash economy product. Because a few Vatu is a major thing for people in these communities"

Similarly, user participants reported that the cost of mobile phones had to be affordable on an on-going basis, or simply people will not use them. For example, 'User-2' pointed out *"People have to pay every time they use a mobile phone. Some people buy a phone and for a small amount of time they are interested in buying credit and use it regularly, but soon they realise, it's running me out of finance... they don't earn enough to keep going"*. Users consistently conveyed that the start-up and on-going costs of mobile phones must be in proportion to the marginal incomes of rural households and individuals, and not become so expensive that use is unaffordable. The risk of high costs, as 'NGO-2' points out, is that there will be a lack of information coming out of communities, from the grassroots level: *"High cost means a lot of the communication is one way, only coming from NGOs and the government at the top, with no proactive information coming from the bottom"*

Providers also recognise the need for affordability, and there was consensus from both provider groups that mobile phone costs have to be in proportion to the economic conditions of communities. Despite this, Govt-3 highlighted the need for government influence in the market to promote fair and balanced prices and in turn maintain affordability. Participants noted that the government is addressing affordability through employing policy and regulatory initiatives that ensure mobile phone costs do not increase out of proportion to what a fair and competitive market would influence. This has been achieved through establishing a Vanuatu Telecommunications Regulator (VTT), an agency tasked with regulating and enforcing competition laws. 'Govt.-3' notes *"The role of the regulator is to licence operators, and to ensure that there is fair competition, that consumers get choice of service as well as fair and reasonable prices, and to develop the market"*.

Competition and regulations aside, participants suggested that in many cases the costs of mobile phones are still too high for many users; however it is apparent that NGOs and even the government are overcoming the on-going affordability issue by minimising the credit burden of phones for users, key actors and field staff within communities. Firstly, participants reported how NGOs are sending credit 'top-ups' directly to the phones of field staff and communities throughout the year, and also in disaster situations. Alternatively instead of sending credit, some NGOs have a 'call back method' which works to minimise costs, as explained by NGO-6:

"We also have a system, where staff call us let it ring once and hang up, then we have their number on our phone and we call them back. Or they text us and we call them back. So they don't have to pay, it minimises the credit burden on their phone accounts. It also works very well in disasters."

Similarly, participants reported another system designed to minimise costs to the end user and make phone use affordable; specifically a free of charge 'text-in' number. NGO-3 illustrates this *"With this system the SMS they are sending can be credited to the NGO-3 account. So they don't pay. They can send information back to us, but that SMS message is credited to our account using the number we have set up"*. Similarly, the government in recognising the importance of affordability is also undertaking measures to ensure the credit burden on users is minimised. Participants reported that the government is building the capacity of their emergency phone-in-line, so that it can operate on a 24/7 basis and is free of charge for users to call in at any time. As Govt-3 pointed out, *"we are looking at expanding the 24/7 emergency line to the NDMO so that disaster management specific calls can be directed to the right people"*. This line would ensure users incur no costs when using mobile phone for disseminating disaster management information to the NDMO.

- **Discussion**

These findings suggest that when mobile phones are affordable, users are motivated to operate them successfully. Therefore, having affordable mobile phone costs is critical to their success as a mechanism of information dissemination in disaster management. This is consistent with CSFs presented in a number of studies surrounding mobile phone applications in developing countries involving health, commerce and education (Schmiedl et al., 2010; Lindquist et al., 2007; Scornavacca et al., 2009; Anckar & Walden, 2003; Vrechopoulos et al., 2002; Muthaiyah, 2004; Norris et al., 2009; Yu et al., 2006). The results addressed a number of important aspects to the 'usability' CSF.

Firstly, an important theme relating to mobile phone use and affordability in Vanuatu is the 'cash economy' system. In Vanuatu there are many geographically isolated communities with low levels of urban development and commerce. Within these remote environments, the cash economy is not as prevalent compared to urban areas; instead subsistence lifestyles often have a stronger influence in these rural areas. Consequently, people in isolated communities don't have as many opportunities to generate a cash income in order to meet the on-going costs of using a mobile phone. Therefore, users consistently conveyed that the start-up and on-going costs of mobile phones must be in proportion to the marginal incomes of households and individuals, and not become so expensive that use is unaffordable.

Addressing the provider perspective on affordability, it must be acknowledged that providers operate towards achieving a surplus. They are essentially a business therefore they are driven by profit. Hence NGO-2 noted *"you have to remember that through using mobile phones we are operating in a commercial realm, and profit pursuits can be a barrier to all sorts of development work"*. However, providers did convey an understanding that prices had to be affordable, and be in proportion to the expendable incomes of users.

Despite the encouraging viewpoint of providers, the existence of the Vanuatu Telecommunications Regulator could be a failsafe for promoting affordability in Vanuatu. The VTT works to ensure mobile phone costs are reasonable and don't rise above levels that are deemed by them to be unaffordable to users. This is being achieved through promoting fair competition in the mobile phone market, which currently consists of two providers and also utilising regulatory action of these providers if necessary. Mirroring the importance of regulators in promoting competition and fair prices in developing countries, Oestmann (2003) stated:

"The development of mobile networks in many developing countries and particularly least developed countries is a very good example of how telecom sectors can grow if regulators liberalise and encourage competition effectively. As there is usually more competition in

mobile services than in fixed services and, mobile access is often more affordable to the marginal user, there is no need to start regulating mobile tariffs now” (9)

Similar attempts by stakeholders to promote affordability which is centred on free ‘text in’ numbers for reporting in disaster management related data. A toll free phone number for calling in disaster emergencies. Additionally, the research ascertained that users are taking alternative routes to overcoming affordability barrier and minimising the ‘credit burden’, such as the ‘call back method’. Reflecting this, research by James and Versteeg (2007) on mobile phones in African communities found that they are often used in creative ways in order to avoid costs completely:

“The phenomenon of beeping deserves mentioning. For instance, beeping once might mean that the person is at a certain meeting point, whereas beeping twice might mean that there is a half-an-hour delay. But one beep might also be a signal for saying “hello.” In this fashion, using a mobile phone becomes costless” (James and Versteeg, 2007, 123)

Thus, studies highlight that people working under economic constraint adopt and use mobiles in different ways. The ‘call back method’ or ‘missed-calling’ as referred to by Donner (2008) is one example of an adaptation of the mobile phones functionality in order to promote user affordability. Users are therefore motivated by affordability, they have some coping strategies to minimise the burden of mobile phone costs, but if prices become exceedingly out of range to the income of users, then they simply will not use them. Therefore, affordability is a critical factor that contributes to the success of mobile phones in disaster management.

- Summary

So this research study has identified that affordability is an important factor for mobile phone success. On-going costs must be within reach of the incomes of the Vanuatu population, in order for users to have the means and the motivation to utilise mobile phones as a communications resource for disaster management.

5. 4. 2. Usability

Easy to learn and user-friendly phones and applications

This research study found that in order for mobile phones to function successfully as a telecommunications resource in disaster management, it is critical that they are easy to use. This relates to the experiences of mobile phone users in Vanuatu, who have only recently had widespread access to the technology.

- **Results**

NGO and government participants reported usability as an issue, in terms of having staff and key actors using mobile phones correctly and effectively. For example, 'NGO-1' reported: *"The risk and barrier I would imagine would be 'use'. How can we train people to use the system to accurately enter the data, given that a lot of people out there haven't been using MPs for a long time"?* Relating to this, NGO participants reported that usability is an important issue for specific mobile phone activities, such as entering data into a text message and sending it out appropriately.

Furthermore, user participants illustrated that they have been able to learn specific functions and applications of mobile phones in their day-to-day lives. For example, User-4 noted:

"I think people will learn to apply mobile phones to situations. Like my futsal coach sending a mass text to the team to say when our next game is. It's a situation where mobile phones are very useful for us. And people don't really think about it being a hard thing to do. They just know that they have to do it that way".

In terms of general use, this also illustrates that users in Vanuatu are assimilating well to mobile phones. This is also echoed from the provider perspective, 'provider-2' explained:

"I think yes, people are learning, and they are learning or have learned very quickly how to use the technology, and we can see that by how quickly mobile phone usage has increased in Vanuatu in the last 3 years. It's just amazing".

The public, the end users themselves, responded in a similar positive manner when talking about usability. There was consensus that when mobile phones first arrived, that users struggled, User-4 recalls his first conversation as just 'hellos' *"We both just said 'hello...' 'hello...' hello...' for almost a whole minute, then he hung up!"*, but in general, participants felt communities overcame these issues in a matter of weeks, User-3 reflects this: *"Now my whole family knows how to phone or text someone. Adding credit is simple now. It's really easy!"*

Participants also suggested users are assimilating well to specific functions of mobile phones, particularly with simple functions such as SMS. NGO-1 noted *"SMS is working really well, because it is easy, it is simple, the ni-Vanuatu have learned how to use it easily, and quickly. A key success factor for communities using mobile phones is to keep applications as simple as possible"*. So there is a perceived benefit of utilising the easy to use functions of mobile phones, such as text messaging.

- **Discussion**

Vanuatu has to a degree been impacted by the digital divide that exists between the developed world and developing countries (James and Versteeg, 2007). However, like many developing countries around the world, the gap is closing significantly in areas such as telecommunications; and previously highlighted statistics have indicated that this is particularly true with mobile phone technologies. With the introduction of these mobile phones into a previously foreign environment, the user community has to learn how to operate often complicated and never before encountered technology.

Therefore, the findings indicated that having user-friendly mobile phones is critical to the success of applying them to disaster management operations. This was consistent with CSFs presented in a number of studies surrounding mobile phone applications in developing countries involving health, commerce and education (Lindquist *et al.*, 2007; Ankar & Walden, 2003; Buellingen & Woerter, 2004; Vrechopoulos *et al.*, 2002; Xu & Jairo A Gutiérrez, 2006; Feng, Hoegler, & Stucky, 2006; Muthaiyah, 2004; Norris *et al.*, 2009). There were a number of important aspects relating to the 'usability' CSF that were addressed by participants.

Firstly, the findings suggested that ease of use of mobile phones is especially important for disaster management practitioners and staff members. And to ensure this, training (see 5.2.5) is an important factor in promoting sufficient learning of how to use mobile phones. This is indicative of work by Yu *et al.* (2006) on mobile phone use in healthcare services. Yue *et al.* (2006) reported that "a strong training and education program is critical for smoothing clinicians' learning of new practices" (182). In the case of Vanuatu, it was highlighted that training is important in terms of using mobile phones for specific functions such as entering data into a text message and successfully sending it to the desired destination. On this note, NGO users reported the benefit of utilising simple functions like text messaging. Similarly, Librero *et al.* (2007) in their study on M-Learning in Mongolia and the Philippines, reported that there is a clear benefit to focusing on the easy to use functions of the mobile phone such as SMS because functions such as SMS "require minimal technical sophistication since the ability to use the technology is learned quickly" (232). Therefore text messaging is an appropriate function for information dissemination and communication within Vanuatu.

Additionally, in terms of public experiences with usability, the findings indicated that community users are already applying mobile phones in various ways and for specific functions for their own benefit. The futsal coach is a good example of this. This suggests that the ease of use of

mobile phones is sufficient for community users this stage, and this is encouraging for addressing how disaster management applications will perform within the user community.

Furthermore, the futsal coach example suggests that Vanuatu people are assimilating appropriately to using mobile phone technology. Public users may have struggled at first but they overcame the barriers and learned the technology quickly. Experiences in Gambia were similar, for example Harvey & Sturges (2010) surveyed 1000 respondents on the success of integrating mobile phones into their daily routines and lives. They noted “Taking into consideration that cell phones do not require technical skills in order to be operational and usable, it is no wonder that the cell phone is making impacts... (157)”. Further supporting this, providers in Vanuatu reported a positive trend in mobile phone use that can be attributed to the population being able to use the technology effectively.

- **Summary**

So the main issue with this CSF centres on ease of use for specific activities that mobile phones are used for, such as sending disaster management data from communities during the response phase. General use is not viewed to be a major issue by participants, and they have assimilated to using phones quickly, particularly with simple applications such as SMS.

5. 4. 3. Electricity Access

Regular access to mobile phone charging sources

Participants consistently highlighted that in order for mobile phones to succeed as a communications resource in disaster management, it is critical that electricity is accessible to users within their communities.

- **Results**

Electricity access relates directly to phone charging. And participants identified the need to have phones charged, especially at times of high risk to disaster hazards. As provider-1 illustrates:

“The most critical success factor is access to Energy. Because on the islands an issue that the communities are having is “how can I charge my mobile phone?” So this is one of the key success factors for Ni-Vanuatu to use mobile phones, including during the critical phases of when we have disasters.”

Participants reported that users are achieving access to electricity in a number of ways. Foremost, by identifying ‘points’ within their locality where electricity is available. For example, ‘NGO 4’ states

“With energy, they (users) rely on ‘electricity points’ where they can go to charge their mobile phones, there are usually certain areas in the community where they can go”.

It was noted that conventional household electricity is not common in Vanuatu communities, however participants identified that users have a number of alternative sources of electricity. Firstly, generators have become the most widely used electricity source in communities. As ‘NGO-6’ explains, *“In the village they (users) are overcoming -the electricity issue- by using generators, and someone in the village will have a generator.”* In terms of generator availability it is recognised that often several families, as well as NGO and government community based offices will own a generator that the community has access to. For example, ‘User-1’ points out, *“when Red Cross office is open or NGOs come and hold a workshop with us, the generator is used at some point of the day, this is when I charge my phone... it is ok with the staff so lots of people do it”.*

To a smaller degree alternative energy sources such as solar panels have been utilised with varying success in communities: *“I remember Digicel were also selling and giving away solar chargers at one time. But I am unsure of the effectiveness of them. In some communities they do use them, when it is sunny; you see the solar charger outside with the MP attached”* (NGO 5). However, the robustness of past and current solar chargers were called into question by some user participants *“Some people use Solar chargers but the reliability of them is poor. They can break easily”* (User-3). So there is uncertainty over whether solar charges are in fact appropriate means of facilitating energy access to charge mobile phones.

- Discussion

These findings highlighted that inadequate access to electricity is one of the major inhibitors of mobile phone use in Vanuatu. Simply, mobile phones are an electronic technology that requires regular energy inputs –charging- to operate. And there is a risk, as ‘NGO 1’ points out, *“...in assuming that if you have mobile phones everyone has got the ability to charge them”*. The mobile phone disaster management application requires widespread electricity access to succeed; there are a number of important aspects to this that warrant further discussion.

Firstly, it is important to acknowledge that it is not common for developing countries to have a national power supply, particularly in geographically spread out Pacific nations consisting of many small islands. In Vanuatu, rural communities are often reliant on small generators for their electricity, and within rural communities typically only a select number of houses are connected to these generators. A recent report on worldwide electricity access revealed that in Vanuatu 81% of the population does not have a household electricity connection (Legros *et al.* 2009).

With this in mind, the findings suggested the need for users to identify ‘points’ of electricity access within local communities, and this is a critical aspect of mobile phone use in disaster management. Through building this knowledge, community users are improving their ability to access electricity sources. Participants highlighted two main sources of electricity that communities use as an alternative to the electrical grid.

Firstly, generators, as mentioned, are common in rural developing communities. Rashid & Elder (2009) identified that in developing countries lacking electricity access, phones are commonly powered using generators in places where there is no electrical grid. In Vanuatu, participants mentioned they were often supplied for NGOs field offices, or attained via community members pooling their resources. In this respect, there seemed to be a culture of sharing within communities, which was important for allowing users to gain access to generators for phone charging purposes.

Another alternative source of electricity that was utilised to charge phones was solar energy chargers. Initially, these were provided free with mobile phones as an attempt by providers to overcome the barriers to electricity access in remote communities. However due to questions of quality and robustness, there is uncertainty over whether solar charges are in fact appropriate means of facilitating energy access to charge mobile phones in remote environments.

However, wider studies on the use of solar energy for ICTs in developing countries suggest that solar energy is being utilised successfully in many cases (Donner, 2007; Manica & Vescovi, 2009). So there is hope on the horizon for solar electricity and as the technology improves and its reach into developing countries expands, this may have significant implications for the electricity barrier.

- **Summary**

This research has shown that mobile phones can only be used effectively as a means of communication with rural communities if electricity sources exist, for the purposes of charging mobile phones. Access to electricity is therefore an essential component contributing to the success of utilising mobile phones into disaster management operations.

5. 4. 4. Network Access

Detailed knowledge and mapping of network access areas and specific access points

Knowledge of how and where to get coverage was recognised as an important factor by participants. Essentially, for mobile phone use in disaster management to succeed, users need to be able to access a mobile cellular signal in order to facilitate communication.

- **Results**

Relating to user network access, participants highlighted that coverage is not encompassing of the entire Vanuatu population, and also that coverage is not consistent across provinces and even within a small locality. For example, User-1 pointed out *“in my Village, in Melekula, you get coverage in some places, some places are ok you can text and other places you can call but even only fifty meters away from there can be no reception at all”*.

When discussing the measures of overcoming network access issues, participants highlighted ‘identifying local access points’ as a coping strategy for overcoming connectivity issues. There was an indication that in communities, users generally know where to get access and as NGO-6 points out *“people know they have to walk from ‘point a’ to ‘point b’ to talk on their phone, and then back when they are done”*. In fact, participants often reported that users in communities actively walked to a point of good coverage within their locality, on a regular basis. For example, ‘User-4’ suggests that people in communities have a sufficient awareness of the connectivity issue and are overcoming it due to the importance of being able to communicate with other parties around Vanuatu:

“Communities can overcome problems with good reception, people are smart. Many people who don’t have reception in their community know where there are places with reception from the Digicel or TVL towers. For example, in Banks they only have reception in some places so the people in communities know where the closest place with reception is. And then they walk to this place every day. Often it is close by but some of them have to walk 2-3kms to get reception, up a hill or around a hill to get reception. Especially because people have something necessary to communicate using their phones on a daily basis. Such as for work or organising business with Vila or other people in the islands. So they must identify and walk to these places”.

Participants also detailed steps taken to formalise and improve network access point knowledge. For example, there was a suggestion to identify and aggregate local access points to create network access maps available to communities, as well as NGOs and disaster management practitioners operating within communities. NGO-6 highlighted how staff, working with communities and volunteers, had gone through a process to identify and map out areas with network coverage. These were in communities throughout Vanuatu that the NGO worked within, and the result was that this information was made public in communities so users would understand where to go to get access. Relating to this ‘Govt.-1’ noted: *“Getting an idea of where the network exists is important. It’s good to know where the access areas are. Because on certain islands, they might not have access everywhere but there are areas that do get reception”*.

- **Discussion**

In Section 5.3.3, 'Network Coverage' was mentioned as an important success factor, and coverage issues were addressed as a major barrier to the success of mobile phone use in Vanuatu. Relating this to the user level, this section addresses the importance for users themselves to have a knowledge and awareness of areas within their locality that have sufficient levels of network coverage. This is conceived as 'network access' referring to the ability of users to access a mobile cellular network signal.

These findings related to CSFs proposed by a number of authors detailing that user connectivity to the network is critical for mobile phones to be utilised as an information system in various fields of work (Schmiedl *et al.* 2011; Lindquist *et al.* 2007; Cochrane, 2010; Anckar & Walden, 2003; Buellingen & Woerter, 2004; Xu & Jairo, 2006; Muthaiyah, 2004). Uniquely, broadening from the connectivity CSF, this research discovered that poor connectivity coupled with a poor knowledge of local network areas is a barrier to facilitating mobile phone use in isolated environments. There were a number of important aspects relating to 'Network Access' that were addressed by participants.

Firstly, the findings indicated that connectivity issues relating to network coverage is an area of concern for users in isolated communities. Participants recognise that sporadic network coverage is an issue in isolated communities, and it was reported that a network signal could be gained and lost just by travelling a short distance. This is not just an issue unique to Vanuatu, as covered in section 5.3.3. Building nationwide extensive network coverage is an issue that is evident in both developed and developing countries (Buellingen & Woerter, 2004; Lindquist *et al.* 2007; Cochrane, 2010; Anckar & Walden, 2003; Muthaiyah, 2004).

In response to network coverage issues, there is evidence that community users are employing a number of coping strategies to ensure they can still communicate on a regular basis using their mobile phone. The research identified that the 'need' to communicate is a major motivation that is driving users to find access points with a sufficient mobile cellular signal. This often relates to new benefits that mobile phones bring to users for organising work or business from isolated communities. Mobile phones also helping isolated users with contacting urban areas to organise personal matters. Reflecting this in their study on mobile phone use in Uzbekistan, Wei & Kolko (2005) noted:

"The enthusiastic acceptance of the benefits of mobile phones by users may echo the accolades that often accompany the introduction of mobile technology to previously unconnected regions of the world" (210).

In this respect, these benefits contribute to the extensive acceptance of mobile phones into Vanuatu communities; hence users are constantly motivated to source a network signal to attain these benefits. The research discovered that this is being achieved by users who identifying local points of network access surrounding their community, and in turn recording and improving local knowledge of these points in order to facilitate successful network access for users in the community. NGOs in communities have formalised this process, referring to it as local area 'Network Mapping'. This has been deemed an effective way of recording and distributing network access knowledge. In this respect, 'network mapping' on a local scale, could have potential to be integrated further within the disaster management sector in order to improve widespread network access by communities throughout Vanuatu.

- ***Summary***

Possessing a detailed knowledge of network access is an important factor highlighted by this research. Consequently, the network mapping process is an important strategy that is occurring in response to the issues of poor access to network coverage. It promotes a better knowledge and mapping of key network access areas and specific access points. This is critical for mobile phones to succeed in their application as a telecommunications mechanism in disaster management operations.

5. 4. 5. User Level Summary

From examining the experiences of the ni-Vanuatu mobile phone users, there were a number of critical factors at the community level which contribute to the success of mobile phones as an information system in disaster management. Phone costs must be affordable, applications must be user friendly, users must have access to electricity sources and users must have knowledge of local area network access points.

The adaptability of local populations to the inhibiting aspects surrounding these CSFs is significant. Users often proved resourceful in overcoming the issues that hinder their ability to use mobile phones. Whether it is related to cutting costs, devising new applications, or gaining access to electricity and network signal, users showed considerable ingenuity. In this regard, disaster management stakeholders can learn some important lessons from the experiences of mobile phone users in Vanuatu.

5. 5. Chapter Summary

This chapter has exposed the research findings and undertaken analysis of the interviews with a number of Vanuatu NGOs, government offices, mobile phone providers and members of the public. Discussion was offered which reconnects the findings with the aims and the wider literature. Relating to each research objective, a total of sixteen critical success factors were drawn from the data. The next section offers some conclusions and recommendations resulting from this process.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

6. 1. Introduction

This chapter summarises the thesis findings in relation to my research question and objectives. It also draws attention to future areas of research and future recommendations. It shows the contribution of this thesis. Finally, the chapter gives my closing reflections and aspirations of this research thesis.

6. 2. Conclusions - A Review of the CSFs of Mobile Phone Utilisation in Disaster Management

In relation to the critical success factors revealed by each research objective, a number of important conclusions can be drawn as a result of this study.

Objective 1

To investigate the government roles in the process of integrating mobile phone use for disaster management purposes.

The findings pointed to the need for a strong focus on building the capacity of the Vanuatu government and their designated agency for disaster management -The National Disaster Management Office-. In short, they must exhibit leadership and ownership over the process of disseminating disaster management information via the mobile phone. The sanctioning of information creates accountability on behalf of the government and promotes an environment where official information disseminated via mobile phones will hold greater influence. Further, the government has a role in creating a supportive policy environment which will facilitate the successful and appropriate use of mobile phones, this extends to regulating the actions, roles and responsibilities of all the stakeholders involved in the application of mobile phones for disaster management. In particular, mobile phone providers need clear guidelines and regulation on their roles in the process. Relative to this, the government assigned Telecommunications Regulator serves as an important actor in facilitating appropriate guidelines and regulatory policy that surrounds mobile phone use and provider responsibility in disaster management.

Objective 2

To explore the experiences of key stakeholders in relation to facilitating the use of mobile phones as a communications tool within disaster management operations.

The research unearthed a number of complex stakeholder interactions, on various levels and across the sector between the state, civil and private stakeholders. Some important conclusions can be drawn from this. Firstly, stakeholder communication at the top level is imperative, there needs to be clear and effective communication flows surrounding the use of mobile phones as a tool in the disaster management sector, this extends to the processes and practices that relate to their application. Effective communication between stakeholders was identified as being important for this to succeed.

The findings revealed that sector wide alignment, harmonisation and collaboration between stakeholders were important factors that stem from effective communication between stakeholders. There is an interrelationship between these factors, and is important for stakeholders to align with each other on process, policy and directives that involve mobile phones, as well as harmonising on practice and establishing standard operating procedures. Collaboration between stakeholders is important on mobile phone information dissemination initiatives in disaster management, particularly in early warning systems and impact assessments. Further, there are significant numbers of practitioners and key actors involved in disaster management in Vanuatu, in this sense the findings pointed to the importance of having an active understanding and recording process of the key actors, practitioners and other key people involved in disaster management from a national level down to a provincial and community level. On the community level, the establishment of a 'points of contact' scheme for each community may be an appropriate initiative that promotes a formalised system of identifying and recording key community actors.

The findings also indicated the importance of addressing the processes occurring within the key stakeholder groups involved in the mobile phone application in disaster management. It is critical that each stakeholder has an adequate understanding of their roles and responsibilities within the mobile phone application in Vanuatu disaster management. Additionally, 'training' is a critical factor, particularly in implementing the processes, policies and regulations surrounding mobile phone use, and also in practice on a user level. The specific disaster reporting functions of the mobile phones were highlighted as an important directive for training, particularly in the response phase following a disaster where mobile phones have the potential to transmit critical data for impact assessment if used appropriately, and training was seen as critical to ensuring appropriate use in this operation.

Objective 3

To identify the technological factors that contribute to the successful operation of mobile phones and the mobile cellular network in Vanuatu.

The research pointed to factors surrounding preparedness and response of providers that were critical in maintaining sufficient technological functions to support a working mobile cellular network in Vanuatu. Firstly, in a preparedness sense, there is a need for providers to build a resilient mobile network utilising high quality infrastructure that functions consistently and effectively on a day to day basis, and also has the ability to withstand natural forces presented by various disasters. Again the Telecom Regulator was revealed to have a role relating to resilience, through promoting the use of quality infrastructure when licencing providers. It was also recognised that no level of infrastructural quality would be capable of withstanding forces presented by higher impact disasters, and so provider knowledge of infrastructural constraints was important. Essentially, it is important to acknowledge that that network can encounter functionality issues during and after disasters, and this has been the case in Vanuatu in the past. Flowing on from constraints knowledge and relating to provider 'responsiveness' to network problems, the findings revealed the importance for providers to enforce swift and effective repair and maintenance processes of damaged infrastructure. This is a critical factor to mobile phone use in disaster management response operations.

The findings highlighted that Providers must also endeavour to extend their network to encompass the population of Vanuatu as well as an expansive geo-spatial area of Vanuatu, reaching out to the most isolated and often highly vulnerable communities. Current provider statistics report that up to 90% of the Vanuatu population is covered by a mobile cellular signal, however the experiences of the users around Vanuatu portrayed sporadic and inconsistent mobile phone coverage throughout many rural communities.

Objective 4

To examine the experiences of Vanuatu 'end-users' in operating a mobile phone.

The experiences of the ni-Vanuatu mobile phone users were similar to those reported by relevant studies of mobile phone users in developing communities around the world. Affordability is an on-going issue in Vanuatu, because remote communities are often isolated from the cash economy and there are fewer opportunities to earn an income. This presents a barrier in terms of attaining the cash resources necessary to operate a mobile phone. Users and

stakeholders are overcoming these barriers with various means of reducing the credit burden associated with affordability, thus ensuring the availability of mobile phones for disaster management communications.

Usability was a further important factor, whilst Vanuatu users showed they can operate the basic functions of a mobile phone effectively; disaster management stakeholders highlighted that phones must be usable when operating them for specific functions in disaster management, such as reporting data from communities to urban disaster management stakeholders. Training could be an important process utilised to ensure usability, and lead to success of mobile applications.

User experiences also showed that access to both electricity and a mobile cellular signal are critical for mobile phones to succeed in disaster management information dissemination to the community level. Regular and accessible electricity sources need to be present and in the context of Vanuatu, generators and to a lesser extent solar power is being used to address electricity issues. Network access barriers are being overcome through the identification and recording of points of mobile coverage on a local scale, in the proximity of communities experiencing sporadic access to a mobile cellular signal.

6. 3. Theoretical and Practical Contributions

This study provides a number of contributions for both academics and practitioners in the field of development and disaster management, particularly those interested in communications technologies and information systems for disaster management in developing countries. On the practical side, this research provides a comprehensive analysis of mobile phone use in disaster management. The case of Vanuatu led to the formulation of 16 critical success factors that can be utilised by practitioners working in the field of communications and disaster management; they have particular relevance to Vanuatu and this relevance could extend to other developing countries, particularly in the Pacific region. Ultimately, these 16 CSFs can assist practitioners in improving mobile phone applications and in turn information dissemination processes in disaster management.

In an academic sense the research and resulting CSFs support evidence presented in a number of recent studies undertaken by the academic community relating to mobile phone use in other areas such as health and education. This thesis sheds some light on emerging factors that hold importance to the success of mobile phones in disaster management. The study was

timely because it was in response to a lack of literature about mobile phone use in disaster management in developing countries, especially in the Pacific. It also contributes a new wealth of knowledge and data relating to the mobile phone in development literature within the global south. The study filled a gap in knowledge and led to identification of further gaps and the need for further research (see section 6.4).

For the Vanuatu government, donor agencies, NGOs, and the mobile phone providers, the CSF results can serve to enrich the mobile phone implementation, planning and decision-making processes surrounding their application in disaster management. It has been informed by not only empirical research but also an extensive review of literature, including studies on various mobile phone and communications technology implementations in developing countries. This should ensure future initiatives in mobile phone and disaster management communications research in developing countries, is focussed around these findings to maximise the gains attained from mobile phone initiatives as well as further CSF research into this topic area.

6. 4. Recommendations for Future Research

Evidence of the role of mobile phones in disaster management is still emerging. From the existing studies and the conclusions set forth by this study, it is apparent that there is scope for further research in this area, and opportunities to build on this research study.

Relating to the government level, there is a need to look further at the government sanctioning of disseminated information, and address 'why' and to 'what extent' the public trusts various information sources from the different government groups. The NDMO is recognised as its own entity within the government, so looking at how other government groups influence communities with the information they disseminate could lead to important discoveries regarding how to best establish a recognition of official disaster related information that is disseminated to communities. This will ultimately create information that can effectively inform and influence community actions surrounding different disaster situations.

Relating to the stakeholder level, aspects that need particular consideration include further exploring the stakeholder roles in the mobile phone application, and looking at whether they should be provided through government, civil or private mechanisms. Also further research needs to determine the kind of standards, regulations and guidelines that should be used to govern key stakeholder groups in Vanuatu.

Relating to the technological level, it was acknowledged in the findings that more effort needs to be put into the speed of repairs following a disaster event. In this sense, the speed of infrastructure repairs needs to be examined further, with an emphasis on mechanisms to overcome the barriers to repair and maintenance operations. Experiences highlighted by existing research (Coyle & Childs, 2005; Mulrow, 2010) show that providers can be effective in undertaking swift repair operations, but there needs to be further research towards the Vanuatu and Pacific context, as repair and maintenance barriers in the Pacific are unique, particularly surrounding the isolation factors of mobile cellular towers situated on sparsely inhabited islands and lacking in proximity to repair infrastructure.

Relating to the user level, further research needs to address the barrier of electricity and explore new technological mechanisms that are being employed worldwide to overcome electricity access issues. Alternative and sustainable electricity generation technologies are improving worldwide and there is a need to apply these new technologies to the Vanuatu context in order to assess if they are an appropriate means of assisting users in overcoming barriers to charging their mobile phones.

In a more general sense, there are some further areas for research surrounding mobile phones in Vanuatu disaster management. For instance, it needs to be determined what model or roll out is best suited to Vanuatu and other developing countries if mobile phones are used as an alerting system or as an impact assessment technology in disaster response. Moreover, the suitability of mobile alerting needs to be examined according to different types of disasters that impact the region, as each disaster presents unique barriers and has unique preparedness and response operations. Ultimately, more case studies of mobile phone use in disaster situations are necessary in order to draw conclusions on the CSFs and effectiveness of mobile phones in Vanuatu disasters and disaster management communications and information dissemination operations.

6. 5. Concluding Remarks

This research study has revealed a number of important findings and conclusions. My hope is that this research will raise awareness about mobile phone use in developing countries and their application into fields which can lead to development gains for communities in the global south. In relation to disaster management, I hope that this thesis can lead to awareness of mobile phone use as an information dissemination resource, and the potential they bring to mitigating community vulnerability to natural disaster hazards.

It is imperative to continue this field of research in order to gain further understandings and build better processes around how to use mobile phones effectively for communications purposes in disaster management. Practitioners and the research community should endeavour to continue to explore and harness the potential of mobile phones as an appropriate tool for mitigating vulnerability, improving development gains and increasing the effectiveness of disaster management operations.

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APPENDIX I: Ethics Forms



Consent to Participation in Research

Project Title: The Integration of Mobile Phones into Vanuatu Disaster Management:
A Critical Success Factor Analysis

I have been given an explanation and have understood this research project and the confidentiality conditions.

I have had an opportunity to ask questions and have them answered to my satisfaction.

I agree to have the interview recorded and understand that the recording will be held for a period of up to 1 year, after which it will be destroyed.

I understand that I will have the opportunity to check the transcripts of the interview before the report is written.

I would like to receive feedback on this research, in the form of a research summary.

I understand that I may withdraw myself (or any information that I have provided) from this project (before data collection and analysis is completed by 28th October 2011) by emailing the researcher or supervisor using the email addresses provided in the research information sheet.

I agree to take part in this research.

Signed:

Name of Participant:
(Please print clearly)

Date:



Ethical Approval for Interview: Information Sheet

Participation Information Sheet for the study: The Integration of Mobile Phones into Vanuatu Disaster Management: A Critical Success Factor Analysis

Researcher: Simon Donald: School of Geography, Environment and Earth Sciences, Development Studies Program, Victoria University of Wellington

I am a masters student in the Department of Development Studies at the Victoria University of Wellington. As part of the fulfilment of this degree, I am undertaking a research thesis. The thesis that I am undertaking aims to identify the critical success factors behind utilising mobile phones in Vanuatu Disaster Management.

To participate in this study I am inviting (i) individuals from Vanuatu who have experience within the mobile phone industry. And (ii) individuals from both Vanuatu and New Zealand who are involved with disaster management organizations. All participants will be interviewed through a semi-structured interview.

If you would like to withdraw from the project, you may do so at any time prior to the 28th October 2011 when data collection and analysis is due to be completed. Please email me at simon.donald@vuw.ac.nz and any related material will be destroyed.

The responses collected will form the basis of my research project and will be put into a written report on an anonymous basis. It will not be possible for you to be identified personally. The report will be submitted to the School of Earth Sciences for marking and deposited in the University Library. The collected, collated, and analysed data may be published in case studies, academic journals, and/or presented at conferences. All material collected will be kept confidential, only myself and my supervisor, Professor Pak Yoong will see this material. The material will be stored securely and destroyed after the completion of this project.

If you have any questions or require further information on the project, please feel free to contact me at simon.donald@gmail.com or my supervisor, Professor Pak Yoong at the School of Information Management, at Victoria University, PO Box 600, Wellington, phone +64 4 463 5878, email Pak.Yoong@vuw.ac.nz.

The consent form is attached, please return it to me.

Thank you for your time.

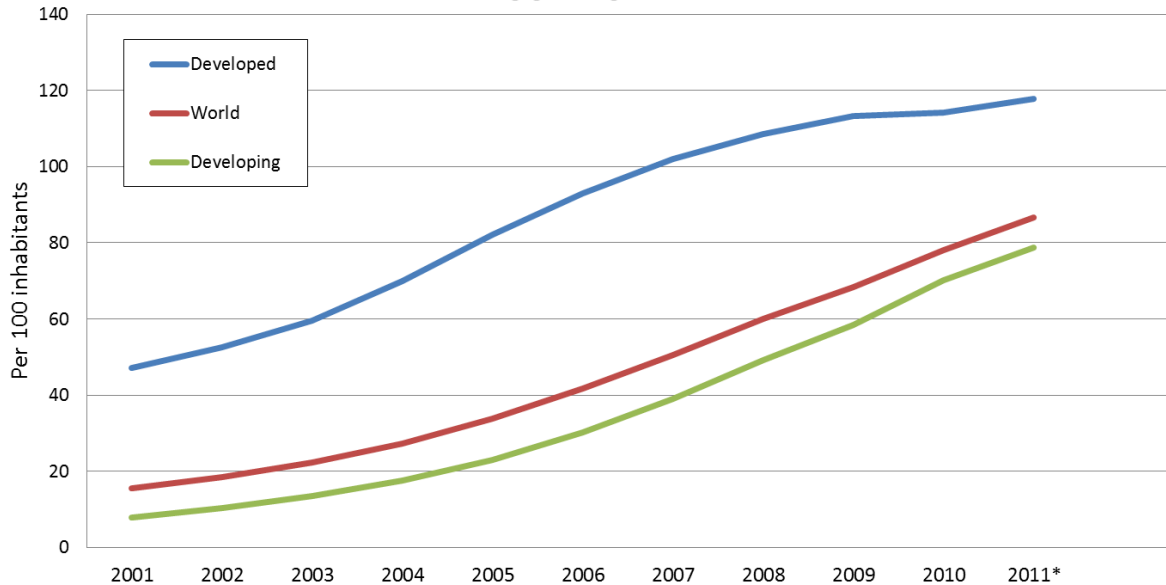
Yours sincerely,

Simon Donald

School of Geography, Environment and Earth Sciences, Development Studies Program
Victoria University of Wellington

APPENDIX II: FIGURES

Mobile-cellular subscriptions per 100 inhabitants, 2001-2011*



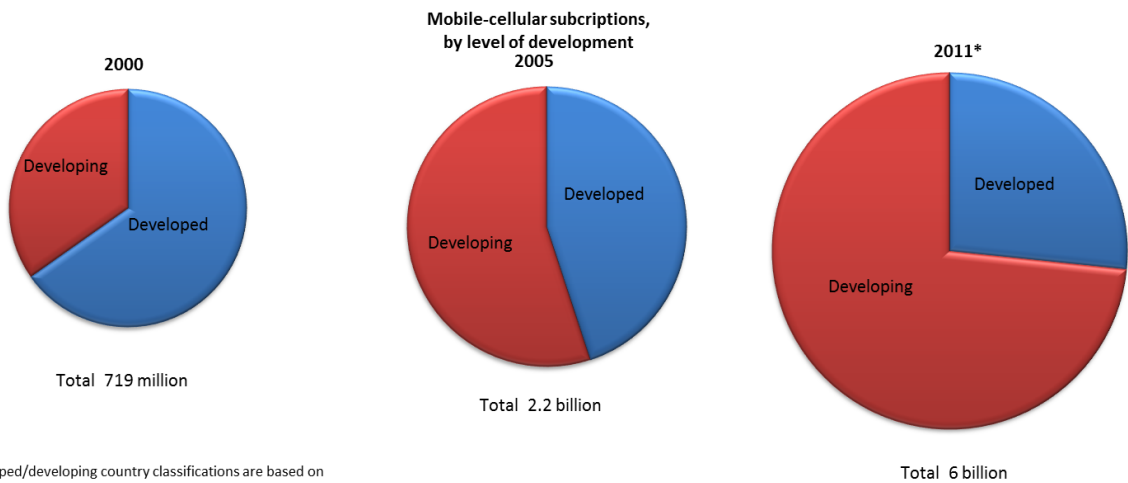
* Estimate.

The developed/developing country classifications are based on the UN M49, see:

<http://www.itu.int/ITU-D/ict/definitions/regions/index.html>

Source: ITU World Telecommunication/ICT Indicators database

(Source: ITU, 2012 - <http://www.itu.int/ITU-D/ict/statistics/>)



*Estimate.

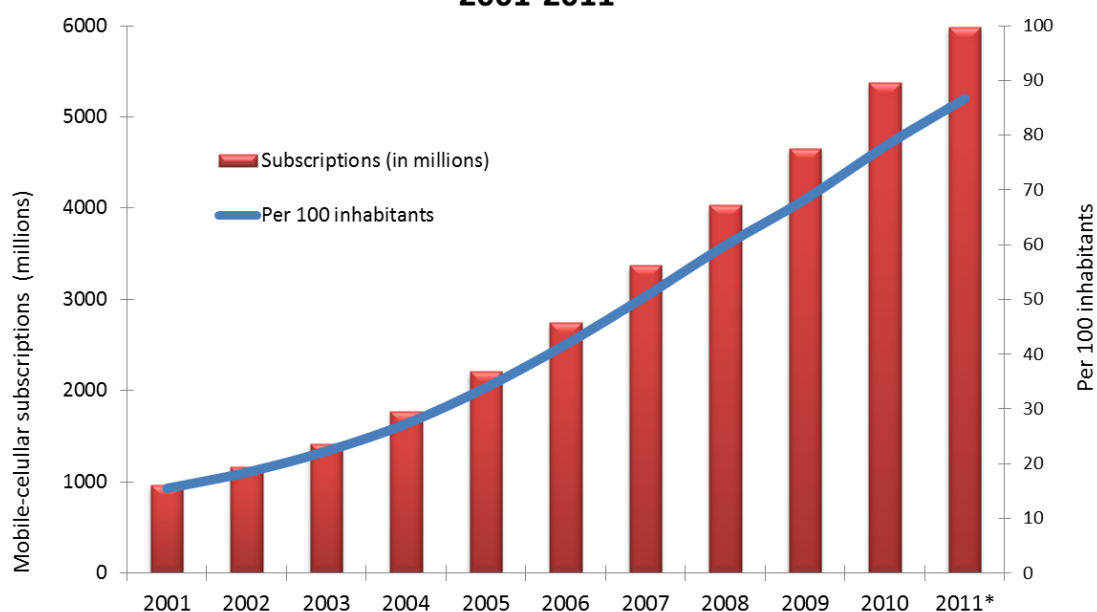
The developed/developing country classifications are based on the UN M49, see:

<http://www.itu.int/ITU-D/ict/definitions/regions/index.html>

Source: ITU World Telecommunication/ICT Indicators database

(Source: ITU, 2012 - <http://www.itu.int/ITU-D/ict/statistics/>)

Global mobile-cellular subscriptions, total and per 100 inhabitants, 2001-2011*

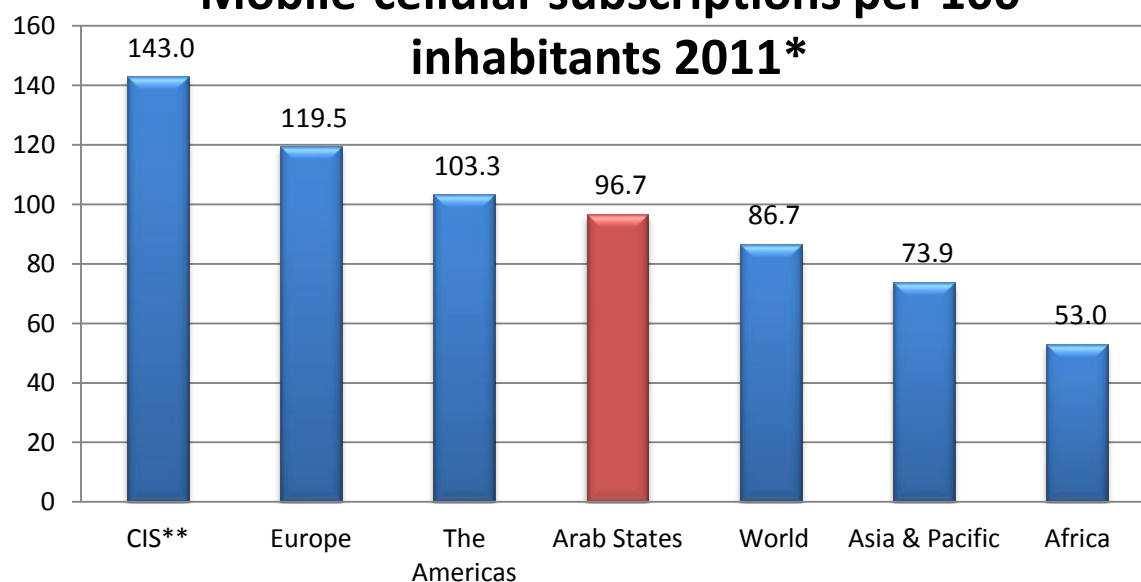


*Estimate

Source: ITU World Telecommunication /ICT Indicators database

(Source: ITU, 2012 - <http://www.itu.int/ITU-D/ict/statistics/>)

Mobile-cellular subscriptions per 100 inhabitants 2011*



*Estimate

** Commonwealth of Independent States

Regions are based on the ITU BDT Regions, see: <http://www.itu.int/ITU-D/ict/definitions/regions/index.html>

Source: ITU World Telecommunication /ICT Indicators database

(Source: ITU, 2012 - <http://www.itu.int/ITU-D/ict/statistics/>)

