

Methodology for Impact Analysis of the Mobile Web in Developing Countries: a Pilot Study in Nairobi, Kenya

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ABSTRACT

In this paper, we describe an impact analysis methodology to measure the impact of the Mobile Web in developing nations. This methodology is needed to anticipate the effects of the Mobile Web on society. Moreover, it can guide advancement of Mobile Web technology to better serve its users.

In May 2010, a pilot study to test the methodology was carried out in Nairobi, Kenya. There were 47 students from 3 leading universities participated in the study. Questionnaires were used to ask how they used the Mobile Web, its impact on their lives, as well as their skills to develop Mobile Web applications. 35 of them were interviewed to explore more information. Semi structured interviews were also conducted to 7 entrepreneurs from informal settlement areas.

Lessons learned from this pilot study were used to refine the methodology, which is based on our Framework of Mobile Web Uptake (FMWU). The methodology covers indicators to be measured, as well as stakeholders associated with each indicator. These indicators are grouped into components of Mobile Web uptake, and their relationships are showed in the Model of Mobile Web Uptake (MMWU).

Categories and Subject Descriptors

K.4.0 [Computer and Society]: General

General Terms

Measurement, Human Factors

Keywords

Web Science, Mobile Web, Methodology, Developing World

1. INTRODUCTION

Mobile phone penetration in the developing world demonstrates remarkable growth patterns. At the beginning of the 21st century, international mobile cellular subscriptions were still dominated by the developed world (Figure 1). However, five years later developing countries dominated mobile cellular uptake. The trend continues; and by the end of 2010 it was estimated that mobile

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WebSci '11, June 14-17, 2011, Koblenz, Germany.

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phone subscriptions in the developing world would reach almost 75 per cent of the total number worldwide [15].

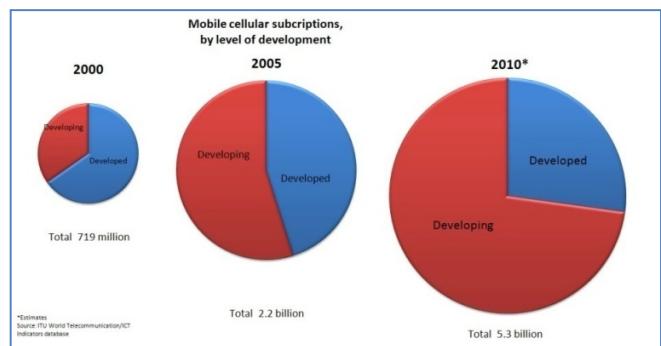


Figure 1 Global mobile cellular subscription by development status in 2000, 2005 and 2010 [15]

Initially, people use mobile phones only for audio or text communications. But as the market matures, browser enabled handsets become cheaper. And mobile operators offer more reasonable tariffs for data communications, which in turn can make Internet browsing up to 1,000 times cheaper per character than sending texts [4] [5]. As a result, people start using their mobiles to browse the World Wide Web, which is called the Mobile Web.

Despite rapid Mobile Web adoption in the developing world, there has been no comprehensive research methodology to define, identify and measure the impact of Mobile Web use on society and Web technology. The absence of this methodology hinders understanding of the intertwining between the Mobile Web and its various stakeholders as shown in Figure 2.

It creates problems to Mobile Web stakeholders anticipating Mobile Web potential effects on society. Besides, it hampers the advancement of Mobile Web technology in order to better meet the need of its users in developing countries. For these reasons, a research question is raised: "What is the appropriate methodology to measure the impact of the Mobile Web in developing countries?"

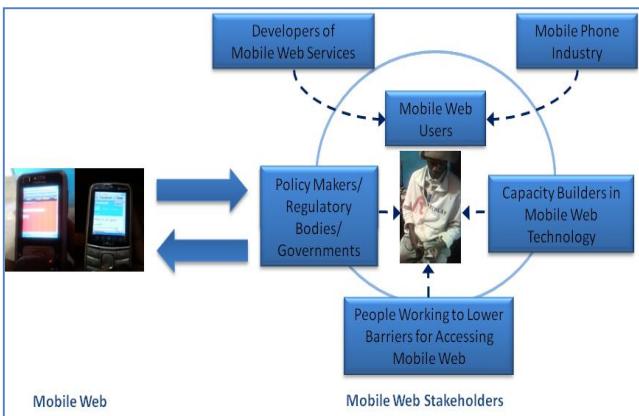


Figure 2 Intertwining between the Mobile Web and its stakeholders, adapted from [2] [3]

2. CONTRIBUTION

With the aim of answering that research question, an impact analysis methodology is proposed in this paper as part of Web Science research. It should fully examine the Web, so this research is inherently interdisciplinary [2] [1] [13] [12]. Consequently the proposed methodology is adopted from several related disciplines, involving computer science, mobile technology and social science.

Computer science is definitely included, because the World Wide Web is application software with communication protocols that are studied in computer science. Mobile technology is also essential to embrace, since it provides infrastructure for the Mobile Web. Mobile phones are part of Information and Communication Technologies (ICT); and their penetration has been extensively examined by the International Telecommunication Union (ITU) [14] [16]. Therefore, this research explores the ICT three-stage model of evolution towards an information society.

This impact analysis methodology also comprises social science, particularly mixed methods research that combines quantitative and qualitative research strategies [6] [8]. Questionnaires can be used to quantitatively measure how people use the Mobile Web and its impact on their lives. On the other hand, interview, focus group and observation from qualitative research can reveal human story behind measured numbers. Moreover, some socio-economic impact, such as how the Mobile Web makes someone feel more connected to the world, is more easily studied with qualitative, not quantitative research. For these reasons, we argue that mixed methods can show complete picture of the intertwining between the Mobile Web and its stakeholders.

3. PILOT STUDY IN NAIROBI, KENYA

A pilot study in Nairobi, Kenya was carried out on 11-25 May 2010. It aimed to test some parts of proposed methodology to measure the impact of the Mobile Web in developing countries. It dealt with Mobile Web users, which is one component of Mobile Web stakeholders. All research instruments have been approved by the School of Electronics and Computer Science Ethics Committee with ethics reference E/10/03/025.

Nairobi was chosen, because there was support from researchers at Department of Social Anthropology, University of Cambridge to arrange the study. There was also fantastic help from

researchers at Kenyatta University (KU) and the British Institute in Eastern Africa (BIEA).

There were two different groups of samples in the pilot study. The first group consists of Mobile Web users from university students as illustrated in Figure 3. Researchers spent 12 days with them conducting surveys and semi structured interviews.

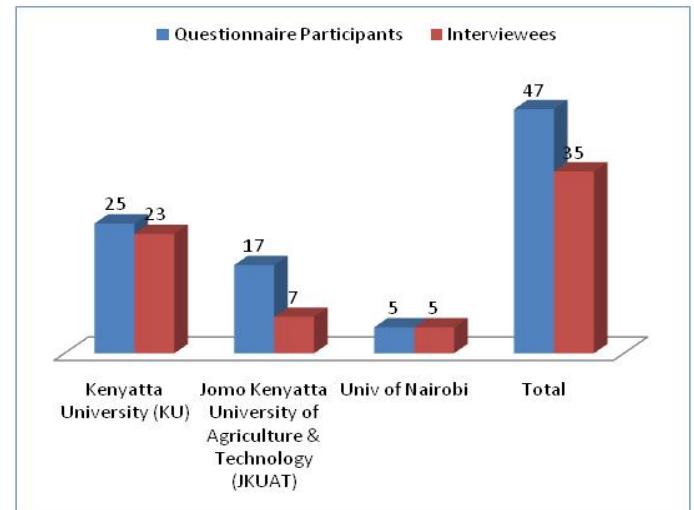


Figure 3 Participants from university students

Another group of samples comprised 7 entrepreneurs from informal settlement areas (Figure 4). Five of them joined Mobile Movement, which is a social enterprise providing integrated and interactive technology-enabled solutions in economic development [19]. Due to less access to the community and difficulties to gather them, researchers could only spend 2 days with these entrepreneurs. This short time was used for semi structured interviews and observation on how they use their mobiles.

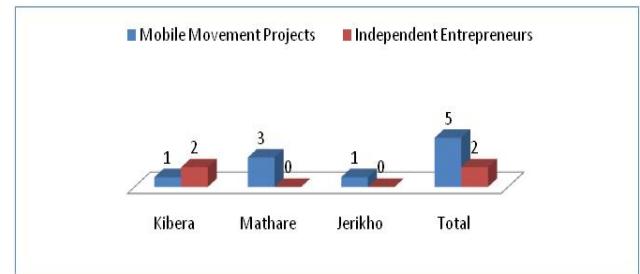


Figure 4 Participants from entrepreneurs from informal settlement areas

The questionnaires, which were filled in by university students, did not specifically measure Mobile Web impact. However, they assessed impact of Web applications as level of dependency. The more highly dependent a participant on a Web application is interpreted as the higher its impact on participant's life. Figure 5 shows that search engines were the only Web applications with remarkably high number of participants felt very dependent on (23 participants). Then Web mails and social networking sites were two Web applications, which had significantly high number of respondents feeling dependent on. They were 24 and 21 participants respectively. On the other hand, microblogs like

Twitter were extremely not popular, because it had the highest number of participants who did not dependent on (21 participants). In addition, microblogs had the second highest number of respondents who did know what they were (8 participants).

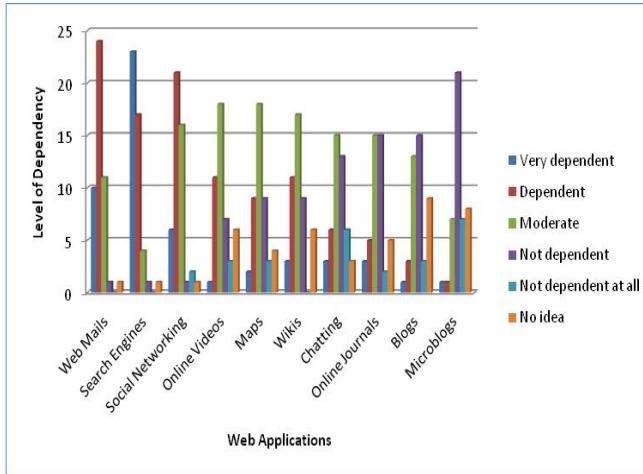


Figure 5 Web impact as level of dependency on Web applications

In informal settlement areas, Victorious Youth Group had the most significant direct impact of the Mobile Web. The group used a mobile phone provided by Mobile Movement to capture pictures of their products, which were then uploaded to the Mobile Movement's web site [20]. Later a gift shop owner in Germany saw the products advertised on the Web site. She visited their workshop and made a 200,000KSH (US\$2,400) order. The group also harnessed the Mobile Web to collaborate with a jewelry designer in the USA to create new designs of jewelries.

4. THE FRAMEWORK OF MOBILE WEB UPTAKE (FMWU) AND MODEL OF MOBILE WEB UPTAKE (MMWU)

The pilot study helps developing the Framework of Mobile Web Uptake (FMWU). It lists possible indicators to be measured, as well as stakeholders associated with each indicator. Whilst the pilot study focused on Mobile Web users, the FMWU covers other Mobile Web stakeholders as shown in Figure 2. In addition, the FMWU is also refined by intensive literature review.

Indicators reflecting Mobile Web challenges are grouped into sub components and components of Mobile Web Readiness, Mobile Web Supporting Enablers, Mobile Web Use (Intensity), Mobile Web Capacity (Skills) and Mobile Web Impact (Outcomes). Table 1 records sub components, indicators and stakeholders related to Mobile Web Impact (Outcomes). There are also sources referred to build the table.

Table 1 FMWU: Sub components, indicators and stakeholders for Mobile Web Impact (Outcomes)

Sub Components	Indicators	Stakeholders	Sources
Direct benefits	GDP growth Job creation	Mobile Web users,	[4]

Sub Components	Indicators	Stakeholders	Sources
Indirect benefits	Productivity	Capacity builders, People	[5]
	Tax revenue	lowering barriers for	[16]
	Value-add from mobile operators	Mobile Web access,	[8]
	Being connected	Policy	[3]
	Being entertained	makers/ regulatory bodies/ governments,	[7]
	Entrepreneurship enhancement	Mobile phone industry,	[9]
	Reduction of information asymmetry	Mobile service developers	[11]
	Market efficiencies		[17]
	Transport substitution		[18]
	Creation of new business models		[21]
Intangible benefits	Disaster relief		[22]
	Locally-relevant and locally-generated Mobile Web content and applications		[24]
	Social capital and cohesion		[25]
Web technologies	Protocol improvement	Mobile service developers, Capacity builders,	[4]
	Browser advancement	Mobile phone industry	[5]
	Standard development		[10]
Mobile technologies	Wider, better, cheaper mobile networks	Mobile phone industry, Capacity builders	
	Handset advancement		

Relationships among components of the FMWU are illustrated in Figure 6 as the Model of Mobile Web Uptake (MMWU).

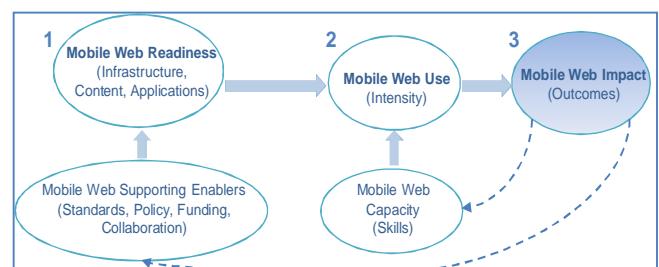


Figure 6 The Model of Mobile Web Uptake (MMWU)

It is adopted from ITU three-stage model [14] [16], value chain of m-development Impact Assessment [8], Mobile Web Challenges from [4], and previous model presented in [23]. The FMWU will be validated using expert reviews, whilst the MMWU will be tested with Structural Equation Modeling (SEM).

5. CONCLUSIONS

Despite rapid adoptions of mobile phones and the Mobile Web in the developing world, there has been no comprehensive research methodology to measure the impact of Mobile Web on society and Web technology. In order to address this problem, an impact analysis methodology is proposed as part of Web Science research.

A pilot study in Nairobi, Kenya was carried out on 11-25 May 2010. It aimed to test some parts of proposed methodology. It dealt with Mobile Web users, which is one component of Mobile Web stakeholders.

The pilot study helps developing the Framework of Mobile Web Uptake (FMWU). It lists possible indicators to be measured, which are grouped into Mobile Web Readiness, Enablers, Use (Intensity), Capacity (Skills) and Impact (Outcomes). Associations among these components are illustrated in the Model of Mobile Web Uptake (MMWU). The FMWU and MMWU will be validated to better measure Mobile Web impact.

6. ACKNOWLEDGMENTS

We express our gratitude to Prof Henrietta Moore, Dr Nicholas Long, Miss Connie Smith, Mr. Gordon Omeya, and the British Institute in Eastern Africa (BIEA) for organizing the pilot study. We also thank all participants in Nairobi, as well as the Schlumberger Foundation that financially supported the pilot study.

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