Toward the Mobile Internet in a Geographic Setting: Context, Usability, Survey, Strategic Community-Based Steps, Social Process Models and Related Challenges

Manzur Ashraf , Md. Mahfuz Ashraf & Dr. Yousuf Mahbub Islam

Abstract— **Successful strategic decision of business organizations depends on the necessary steps taken in terms of (a) 'usability' and 'context' of the services (b) analyzing 'user behavior models' and 'social process models' associated with the services. Hence discovering challenges and direction of improvement associated the services of any business starters is an important task. Now-a-days mobile internet is booming as an emergent service all over the globe. Business organizations of mobile internet services should try to resolve the challenges or activities before taking efficient strategic decisions. The paper discovers four areas of challenges - 'context', 'usability', 'community-based steps' and 'social process models' in terms of strategic decision making of Mobile internet industries. With relevant literature surveys, this paper proposes research directions in corresponding areas. The overall motivation of this paper is to pinpointing the efficacy of strategic plans of mobile internet vendors in different geographic contexts.**

Keywords— **Mobile Internet, Strategic decision, User behavior model, Social process model, Information system.**

I. Introduction

The promise of ubiquitous computing is a future in which highly specialized, embedded computing devices operate seamlessly within the everyday environment and are transparent to users. Realizing this vision will require next-generation networks to support mobile multimedia devices with capabilities well beyond those of today's handsets. These networks will exploit wideband radio access technologies and IP based protocols to provide:

- IP transparency-all network elements support IP
- Mobility management for a globally networked environment
- Unique addressing for every user
- Personalization of information
- Positioning to enable location dependent services
- End-to-end security

Such functionality requires more than providing wireless Internet access and e-mail. However, the objective of this paper is to identify challenges or research contexts in emergent mobile internet arena - which is gaining wider prominence at present. Besides technical challenges, the mobile internet user behavior modeling is a must-to-do task in terms of vendors and researchers. Companies can take necessary strategic steps to help the mobile internet industry to flourish in any geographic context.

First two authors are with the University of South Australia, SA 5095, Australia, e-mail:{Manzur.Ashraf@postgrads.unisa.edu.au, ashmy002@students.unisa.edu.au}

Dr. Yousuf is the Research Director of BRAC University, Dhaka 1212, Bangladesh, e-mail: yislam@bracuniversity.net

A. Technical research / services in Mobile internet

In its market studies, the UMTS Forum (http://www.umts-forum.org/) has identified six 3G service categories for future research perspectives as well as services:

- Mobile Internet access
- Mobile intranet and extranet access
- Customized infotainment
- Multimedia messaging service (MMS)
- Location-based services
- Rich voice

Hence, technical challenges come across those six places. These are beyond the scope of this paper.

II. Organization of this paper

In this paper, we look for the barriers or challenges behind usability of Mobile Internet in different demographic contexts. Citing examples from different research works, we have elaborated the framework of Mobile Internet research in 'usability' context using four main parts. In Part one, surveys and approximation-based studies toward mobile internet in various geographic contexts are highlighted which will evidently depict the key process areas or parameters behind social influence in Mobile Internet perspectives. In Part two, analysis and finding the factors behind Mobile Internet market penetration is illustrated with possible research contents. In Part three, Adaptive Social Process Model with the penetration of Mobile Internet is highlighted. In Part four, 'Industry formation theory' is applied to 'Mobile Internet industry' to get new insight of Mobile Internet acceptability in society. All these four approaches are very important to pinpointing the economical, cultural, social, political influential factors behind usability of Mobile Internet in different geographic contexts. The key-process factors identified in all of those four parts can be applied in calibrating the influential factors of mobile internet flourishment in under-developing countries. The barriers behind usability of Mobile Internet will evidently be identified and be resolved accordingly.

III. Part 1- Survey of the mobile internet, usage, contexts

A. *Interim Survey and Study of New Services in Mobile EC, ECOM*

According to [1], survey of the users in mobile internet was conducted. Based on the user questionnaires conducted through the Internet, such as: purpose and place of access to the mobile Internet; the phone. Mail and Web usage patterns; current usage of E-commerce; willingness to use new types services were analyzed. Responses from various age groups were compiled and evaluated. The concerns of questionnaires were:

1. Attribute of respondents
2. Purpose of mobile phone use
3. Application patterns
4. Where to use web services
5. Correspondence between professions and places

Through the compilation of the questionnaire survey, they have analyzed and hypothesized about the difference in purposes of cellular users by gender and by age and about the characteristics of the profession groups regarding the main place of accessing the Web services. The survey also revealed much about the current usage of the mobile EC in Japan, and the users' readiness toward it.

A.1 Some findings

1. Purposes of using cellular phones differ distinctively from one age / sex group to another, and places of using from one profession group to another.
2. The purposes fall into two categories. One is common to both sexes, and the other is gender-specific. The most popular services are those centered on the former category.
3. Purposes change with age. Older users show wider difference between sexes than younger ones.
4. The mobile-based usage, where users are in transit (in vehicles or on foot) or on a brief visit, are common across the profession groups.

A.2 Research / Future direction

Further investigations can be conducted to confirm the above hypotheses, through the evaluation of the user survey on the current mobile EC user behavior and the readiness of prospective users in different geographic context.

B. *Survey conducted by Korea Research Foundation (KRF-2000-C00323)*

The survey [2] proposes a framework for studying the use context relevant to Mobile Internet. It then presents the results of an empirical study of the use context and service usability for Mobile Internet by using monitoring methods.

Mobile Internet is considered significantly different from the stationary Internet in two important aspects [4]. First, Mobile Internet can be used in various contexts, whereas stationary Internet is mostly used in predetermined environments. For example, because of its portability and intimate connectivity, Mobile Internet can be readily used on the road while in one's car. In contrast, the stationary Internet has been used mostly in limited contexts such as in an office or home [3,5]. Therefore, it is important to study the contexts in which people use Mobile Internet and also how often people use Mobile Internet in each specific context [6]. However, not much research has been conducted to define the numerous contexts relevant to Mobile Internet or to identify the key contexts in which people use Mobile Internet most frequently. Second, Mobile Internet usually comes with more limited system resources than the stationary Internet [3]. For example, Mobile Internet has much smaller screens, less convenient input devices, and much slower networks. The limited resources tend to make Mobile Internet more difficult to use, and, therefore, it is commonly stated that Mobile Internet will only become successful after these usability problems have been overcome . However, little is known about the major types of usability problems in mobile contexts and about the impact of the user's context on the major usability problems.

B.1 Mobile Contexts and Usability Problems

The study [2] attempted to identify usability problems that people often experience while using Mobile Internet. This definition is consistent with prior studies on contexts, in which contextual information focuses on what is important to the target users, such as user tasks, user action, and the specific situations of the users [7, 8].

Mobile Internet can be used in various contexts in terms of eight elements of the 'context structure' (Goal, Emotion, Hand, Leg, Visual, Auditory, Co-location, and Interaction), and different contexts may cause different kinds of 'usability problems' that can be classified into four groups based on Mobile Information Architecture (Representation, Structure, Navigation, and Content)[2]. Below in the list, we classify usage-scenarios of mobile internet while traveling in the car (typical example). Relevant 'context structures' and 'usability problems' can be identified using surveys.

- Interests while traveling in the car
  - Preparing for the day
    - Scheduling
      - Company
      - Individual
    - Reminders
      - Birthday
      - Appointment
      - Lists of work
    - Booking facilities
    - Confirming appointments
    - Emails
    - Stocks
    - Banking
    - Bills
    - Ordering
  - News
    - Financial news
    - Breaking news
  - Infotainment

∗ Ring tones
· Pop, top, tunes
· Oldies
· Add-on names
∗ Music, Videos (MMS based)

B.2 Research / Future directions

First, participants in that study were asked to describe their user contexts in a bipolar method. However, in order to provide more concrete suggestions to the developers of Mobile Internet services, future studies should be followed to focus on a few context factors with more refined numeric measures and more specific usability problems of Mobile Internet.

The second limitation of this study comes from the characteristics of the study method. Even though we could infer relations between context and usability problems, we cannot explain why certain usability problems occurred more frequently in certain contexts. In order to provide causal explanations, more controlled experimental studies focusing on key usability problems should be conducted in the future.

Finally, the study's results cannot be applied directly to other countries because all participants in the study were resident in Korea. A future study may be conducted with more people in different cultures for a longer time to verify the external validity of the study's results.

B.3 Significance of this research-pattern

The results of this study [2] have several implications both from a theoretical and practical perspective. From the theoretical perspective, this study provides a framework of use contexts and usability problems in Mobile Internet. It also presents a data collection method that can collect reliable data about contexts and usability problems in Mobile Internet. From the practical perspective, the study's results indicate that Mobile Internet is used heavily in a few contexts. The result implies that Mobile Internet service providers do not have to take into account all possible contexts, but should focus on the key contexts through developing specialized applications. Moreover, people turn out to experience different usability problems in different contexts. Therefore, Mobile Internet services that are developed specifically for a specific context should pay extra attention to those factors that are closely related to the usability problems experienced by users in that context.

IV. Part 2- Analysis of Mobile Commerce market penetration in different regions

A. Regional context

A.1 Case study of Hong Kong

According to [9], the status of m-commerce in Hong Kong had been discussed. The six mobile network operators moved into the fatter-margin wireless data business. The interoperable SMS and infotainment applications were developed quickly to attract mobile phone users to use and enjoy m-commerce activities. In addition, the Public Key Infrastructure (PKI) that covers the use of public key cryptography and digital certificates was developed. The Hong Kong Post launched the mobile digital certificates and brought Hong Kong to the forefront in mobile commerce security with the creation of the world's first public mobile Certification Authority. It was the first economy in the world to issue mobile e-Certs for community-wide adoption. Although there are fundamental m-commerce services in Hong Kong, it is still the early phase of m-commerce market development. The initial consumers are fundamentally committed to new technology and like getting their hands on the latest innovations. They are typically the innovative adopters. The objective of serving the needs of the niche market is to customize the product to the needs of that segment. The products or services should be saving customers a lot of time because convenience is a unique feature of m-commerce. The information and news market in Hong Kong provides an ideal environment for m-commerce to grow. Hong Kong is an international financial center. There have been some benefits for mobile devices users. News, particularly financial news, can be easier to access throughout the day. Technically, mobile news articles can be considered a distinct medium. Mobile news can offer readers additional depth, background information, graphics and references to previous news, and it can offer more breaking news from time to time.

A.2 Case study of Japan

According to [10], after reviewing mobile Internet services in Japan, this article examines key social and cultural factors of mobile Internet use based on nationally representative surveys focusing on differences between PC and mobile Internet. The results demonstrate that mobile Internet is a more time-enhancing activity while PC Internet is a more time-displacing activity. Additionally, this article discusses unique Japanese cultural factors affecting communication patterns characterized by the high disclosure of subjective self and low disclosure of objective self, which may explain the unique usage patterns of the mobile Internet in Japan.

B. Impact of Innovation, emergent and entrepreneurial strategies of organizations (like NTT DoCoMo) in flourishing Mobile internet usage

Through a case study [11], we find the factors for success in the course of achieving strategic innovation in the mobile internet business field, i.e. the creation of a new market through intentionally and strategically having and furthermore integrating paradoxical organizations and strategies under a single corporate umbrella.

B.1 Future research themes/directions

The topic includes whether or not the practical aspect of discontinuous transformation of this case can be applied to other large corporations. It is understood that the actual discontinuous transformation method used by a specific large corporation depends on the environment, business type/form and the existing organizational culture, as

well as the sense of the values exhibited by top management, and the leadership style, etc. In that paper [11], the introduction of paradoxes is constructively understood to be the motive power behind organizational change and indicates one practical method for discontinuous transformation that uses paradoxes. Top management members intentionally introduced paradoxes within the corporation in terms of strategies, organization, culture and competencies, etc. and achieved strategic innovation by using knowledge management across the entire organization to control these paradoxes.

V. Part 3- Building up a social process model in Mobile Internet

The fast penetration of the internet-enabled mobile handsets influences the social interactions. This is witnessed as a new social relation building process. It is a new research opportunity to consider the mutual influence between technologies and societies. It raises the question about what is the fundamental social building process when the real world interactions and strict personal identification are not available. The emerging social relation formation is an attempt to change the mobile internet perspective from the poor alternative to the PC internet to a rich set of cues to understand the human interactions and social aspects. The mobile cyber mind can be defined with the comparison to the common real world interactions. An AIMS model [12] was proposed to provide a basic measure to analyze the mobile cyber mind in the assumption that emerged mobile technologies compensate for the traditional real world interactions. This model focuses on two things: the successful communication experience and development of social bindings during interactions. The mobile internet characteristics of personal identification trace capability can improve the traffic analysis to understand the former part. The latter part is based on cognitive factor; however, the development of making social promises using technologies can be used as a universal measure for this binding analysis.

This research is still in its early stages. Mobile social studies literature comprises empirical studies to indicate in-depth understanding of social contexts in mobile services. Luff et al [13] presented mobility in collaboration, examining micro-mobility, remote-mobility and social impacts. Palen [14] mentioned: "Mobile telephony is rapidly becoming a feature of our culture, yet we do not understand its effects on communicative practice and behavior, especially with respect to the interaction and convolution of the technology and human activity". Hofstede's work [15] describes the cultural dimensions based on the strict studies over decades. The drastic mobile internet penetration in Japan is culture-specific.

A. Future Work

The applicability, limitations, implications of the past collaboration studies, and comparisons to other frameworks and models (from social science and psychological context) are yet to be explored in exploration of technology-oriented society.

VI. Part 4- Applying Industry formation theories to Mobile Internet

The flourishing of the new network industry is the result of interaction between multiple technological trajectories that are specific to a particular technology or broadly defined as the technological regime. The initial applications emerge through interactions between product designs and user needs where the social construction of technology takes place. Growth in the initial applications causes sub-trajectories or regimes, where competition in the market initially occurs, to emerge from the main trajectories.

There are a number of economic and managerial questions that cannot be addressed with existing models like product life cycles. One set of relevant questions are: 1) why did industry A evolve faster that industry B? 2) Why did industry A first start in region C while industry B start in region D? We can address the questions by analyzing the relevant trajectories and determining both the rates and reasons for the rates at which initial applications emerged and grew in various regions and industries. While it is possible that macro-economic factors influence the main technological trajectories, it is very likely that the effective integration to form new industries is a function of factors that are stressed in evolutionary theories of economics and the social construction of technology.

Funk [16] uses the mobile internet to demonstrate the role of the main technological trajectories, the interaction between product designs and user needs and sub trajectories. Industry formation occurs through the interaction between entertainment contents and young users in Japan while the lack of such contents in Europe and the US prevented industry formation. NTT DoCoMo's introduction of a micro-payment service facilated the emergence of these entertainment contents while European and US service providers focused on business users and thus other forms of content and business models for the content. The success of these entertainment contents in Japan caused positive feedback to ensue between content providers, handset manufacturers, and users while coordination problems made it difficult for such positive feedback to emerge in Europe and the US.

A. Future direction

The success of the entertainment contents has caused sub-trajectories like number of ringing tones, color, resolution, camera resolution, processor speeds, memory and network speeds to emerge. Similarly, 1) content-design is another trajectory, which also requires further research. These trajectories are now expanding the number and sophistication of the applications and provide additional stimulus to these sub-trajectories. 2) Although it is still too early to understand the results, it is also likely that these sub-trajectories will influence the emergence of a dominant design in the mobile market. Those influences can be approximated or measured using BBN or Neuro-fuzzy techniques of Artificial Intelligence. It is also our future direc-

tion.

Perimeter of the four research contexts is listed below:

- Usability & context identification (based on survey) of Mobile Internet in different geographic settings
  - Purposes of cellular context
  - Usage pattern of various age groups, profession groups, sex etc.
  - High usage-frequency in ad-hoc environments (contrast to predetermined environments). Defining numerous contexts of mobile internet usage.
  - Usability problems (less convenient input devices, slower networks, smaller screens, etc). Finding major types of usability problems.
- Mobile internet market penetration
  - Infotainment (including financial news, breaking news, etc) & SMS applications attract users.
  - Security features (PKI & digital certificates) are enriched.
  - Social & cultural factors (e.g., inclination towards time-enhancing activities of mobile internet), communication patterns of technology effect user attraction toward mobile internet.
  - Impact of innovation, emergent and entrepreneurial strategies of organizations & competencies to create markets (e.g., achieved strategic innovation by using knowledge management across communities)
- Creation of 'Social Process Model
  - Interlinking mobile cyber mind to real world interactions. The mobile internet characteristics of personal identification trace capability can improve the traffic analysis to understand it.
  - Development of social bindings during interaction. It is based on cognitive factor; however the development of technology dependant social promises is used as a metric for binding analysis mainly.
- Formation of mobile internet industries
  - Growth in the initial applications results sub- trajectories. Evidently forming new industry is a function of sub- trajectories that are influenced in evaluation theories of economics & social construction of technology.
  - Factors of context & usability analysis, market penetration & social process model cause variation to growth of mobile internet in different geographic settings

VII. Conclusion

In this paper we have identified some of the research possibilities and challenges in Mobile Internet in terms of 'context','usability','strategic community based steps', 'social process model', 'user behavior modeling' and 'new industry formation theories'. We summarize their research contexts in above list. Information system analysts and researchers can conduct those researches. It is a good starting point for strategic decision makers of mobile internet vendors where it is just considering onto the start-up phase in the South Asia. In middle east, for example in Saudi Arabia, where only 3 companies have been running mobile internet business for one year - also in preliminary stages. However, the acceptability, rapidity and reliability of mobile internet across wide community will depend on overcoming major strategic challenges associated with the mobile internet in geographic setting.

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