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Making Sense of Mobile Applications) A Critical Note to Recent Approaches to Their Taxonomy and Classification

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Making Sense of Mobile Applications – A Critical Note to Recent Approaches to Their Taxonomy and Classification

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Abstract

Applications of Mobile Technology in business in the current environment are characterised by a critical reliance on a diversity of highly complex and often competing technology infrastructures and architectures. Classification models are often very descriptive and orient themselves more on the overt attributes than on the underlying qualities. Recent models, however, apply a wider set of concepts in an attempt to establish basic concepts. It is argued that the special character of mobile applications, their fluid environment and equally changeable technology foundations make qualitative research approaches more appropriate. A combination of Grounded Theory and Action Research met5hods is recommended for future research and a nascent research project with the objective of establishing fundamental conceptual frameworks for mobile applications is outlined.

1. Introduction

Applications of Mobile Technology in Business (further on referred to as *Mobile Applications*) in the current environment are characterised by a critical reliance on a diversity of highly complex and often competing technology infrastructures and architectures. The technical underpinning is thus often of less than desirable reliability and intra-compatibility between its components is nearly always an issue. It is no surprise that against this backdrop the technical aspects of Mobile Business have often appeared to dominate its assessment. However, the many failures of the 'dot.com' ventures showed that business models generated to support activities designed because they could be done technically – rather than support customer needs - are likely to achieve less than anticipated rates of success. Following these insights, a new set of classification and assessment approaches has appeared in the literature. This paper sets out

- Firstly to discuss, compare and critique a set of taxonomy models, predominantly from the German and other European literature;
- Secondly to look at an alternative, grounded approach for a classification schema.

2. Recent Approaches to Categorise Mobile Applications

Mobile Applications are a subset of Electronic Business (EB) applications. It seems therefore useful to look first at general models of EB to use as a backdrop against which to set specific categorisations of Mobile Applications.

Papakiriakopoulos et al. (2001) suggest a model for EB which seems to be appropriate for Mobile Applications. The model acknowledges the influences of technology and links them specifically with competitive and co-ordination capabilities. The latter, specifically, is of importance to Mobile Applications because of the larger number of actors required to deliver a product or service. Technology is then juxtaposed by market influences, focussing on core competencies and customer value respectively. In this respect the model clearly takes into account the lessons learned from many the failed 'dot.com' firms of the last few years. Figure 1 below illustrates the model.

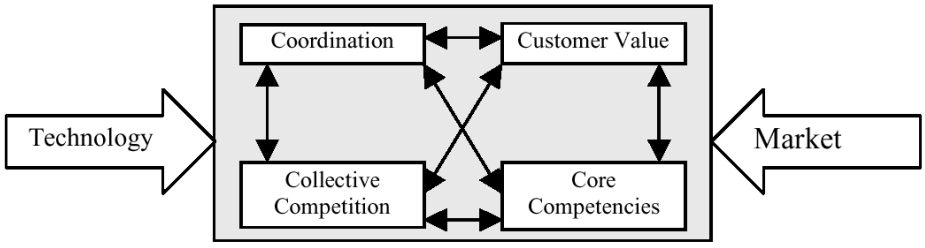


Figure 1: *Framework for Business Model Analysis (Papakiriakopoulos et al., 2001)*

Building on models developed by Lehner (2001) for the interactivity of the multiplicity of actors and platforms in the technology environment and Timmers' (1998) interaction dimensions of functionality and innovation, Nachtmann & Trinkel (2002) amalgamate these (and ideas first developed by Zerdick et al., 1999) into a model that recognises Technology Push and Market Pull as the two main (and mutually influential) dimensions for the creation and classification of Mobile Applications. Table 1 below sets out the main components of the model.

Technology Push	**Market Pull**
Digitisation	Interactivity and Individualisation
Efficiency (increased automation, etc.)	Ubiquity and Access Immediacy
Miniaturisation	Cost leadership to increase market share
Standardisation	Customer Mobility
Localisation	Multimedia delivery

Table 1 *Technical Innovation and Market Development (Nachtmann & Trinkel, 2002)*

Roetger-Gerigk (2002) proposes a model that further dissects the market related issues affecting Mobile Applications, especially those in the M-Commerce arena. The model elements are segmented into firstly *Value –adding Factors*, namely

1. Personalisation
2. Localisation
   (both of which are considered to be not yet fully obtainable technically)
3. Ubiquity
4. Immediate Access

Secondly, there are *Hygiene-Factors* (i.e. they have to be present for initial uptake of the service, but do not in themselves add value). They are

1. Cost (lowest possible)
2. Security
3. Convenience

Meier (2002) takes this market focus further into looking at Mobile Applications as a Marketing entity, albeit one with strong customer related characteristics. He sets out a model that determines the elements of Mobile Applications as contributions to *Customer Value*[1]. There are three 'perspectives', namely

- Financial, to do with the long-term profitability of the customer relationship;
- Development, the ability to widen/deepen the relationship in future;
- Communications, notably also those occurring between customers on a peer-to-peer basis.

Looking at the specific environment of the banking and finance industry, Rausch (2001) moves even further into the concept of customer relationships. He uses Maslow's hierarchy of needs to classify Mobile Applications as to the extent that they can satisfy basic and higher needs. Interestingly, he sees close co-operation and/or alliances - of the technology partners (banks and telecommunications providers, in his specific case) as essential for guaranteeing the coverage of customers needs. The telecommunications firms would provide the 'basic needs' of security, reliability and familiarity whereas the banks then contribute the 'higher' needs of convenience, acceptance and prestige - a similarity to or precedent of the 'hygiene' versus 'value-adding' factors in the Roetger-Gerigk's (2002) model. Furthermore, the idea to allocate specific factors of user acceptance to identifiable 'actors' in the technology provider configuration and the resultant call for alliances to reflect these dependencies is probably the main contribution of the Rausch model.

In addition to these 'factor' models there are a number of classification schemes for applications by either their target user-community and/or by the industry of their supplier(s). Roetger-Gerigk (2002) (citing Riemer, 2001) separates two classes of applications. Together with typical application areas they are shown below:

Consumer M-Commerce	**Business M-Commerce**
Finance	Supply Chain Integration
Shopping	Telemetry
Dynamic Information Management	Fleet Management

[1] "Kundenwert"; this is used as an amalgamation of *Customer Life Time Value, Customer Equity, Customer ROI/Profitability* and *Customer Relationships Value*

Entertainment
Security Services
Localisation services
Information Push/Pull
Advertising
Sales Force Automation

Diederich et al. (2002) extend these classes and set out a classification matrix that maps applications by initiators and recipients. The matrix, together with examples of products/services for each combination of initiator and recipient is shown in Table 2.

>>>>>	Business	Consumer	Employee	Administration
Business	SCM, Alliances	Information, Products & Services	Sales Force Automation	N/A
Consumer	Purchasing, Payments	Peer-to-peer exchanges (e.g. products, information, payments)	N/A	Tax returns, other formal interactions
Employee	On-duty reports, sales reports, expense claims	N/A	Peer-to-peer-applications, e.g. Network-of-experts	Compliance applications;
Administration	'Personalised' due-date-reminders	Personalised interactions, e.g. reminders	Personalised interactions of a formal nature	Peer-to-peer-communication applications,

Table 2: *M-Commerce Application Matrix (after Diederich, 2002)*

In addition to the several types of generic types of mobile applications users, there are also a number of players involved in the creation and distribution of the technology applications. This adds more complexity to the mobile applications by introducing another dimension to their classification, as Martignoni & Stimmer (2002) discuss, in their case for the specific environment of financial services provision. Figure 2 shows the interaction between the key classes of participants in the creation of a mobile application.

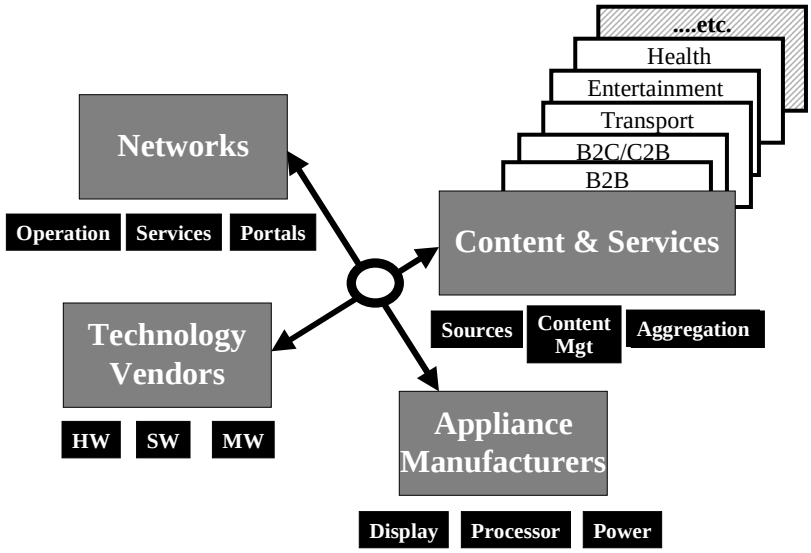


Figure 2: *Participants in Mobile Commerce Applications (after Lehner, 2001)*

Carlson et al. (2001) introduce another perspective, which brings together the actors either as 'customers', 'producers' or 'management' (a rather diffuse category, which unites all the various business and economics issues raised by mobile applications, such as cost/value ratios, logistics, etc.). In this model, customers and producers complement each other in their key concerns, as the following comparison shows:

Customers demand	**Producers supply**
Flexibility and ubiquity	Modularity and generic building blocks (in support of flexibility)
Value-adding functionality	Layers, to personalise products services to add maximal individual value
Quality-of-life enhancing features	Bundling of modular blocks into personalised/localised products/services

In consequence, Carlson et al. (2001) then dispute (as do a number of other researchers, e.g. Martignoni & Stimmer, 2002) the existence of any specific singular 'Killer Application'. Instead they point to a number of potentially 'lethal' bundles, which they characterise by whether the components can be distinguished

and by the amount of synergy the components generate[2]. They conclude that the synergy providing bundles will have a greater propensity to satisfy users' demands within the limits of technology as well as within sensible economic boundaries.

Building on a model that Straub & Watson (2000) developed for categorising and classifying E-Commerce along the interest of the six generic key stakeholders[3], Lehner & Watson (2001) propose an extended model by adding two more perspectives. They define the 'stakeholders' as the actors participating in any such bundles as in the resulting application. Further definition of the nature and context of such products and/or services together with the notion of an application-specific configuration of actors are the additional perspectives:

- Services and Applications are a conglomerate of three generic components, i.e. information provision/processing, transaction execution or communication processes; and
- Institutional market units, i.e. the actors (as defined in Lehner, 2001) in their particular configuration for a specific service or application. The 'institutional units' interact in a life-cycle, an idea first suggested by Varshney & Vetter (2001), as shown in Figure 3 below.

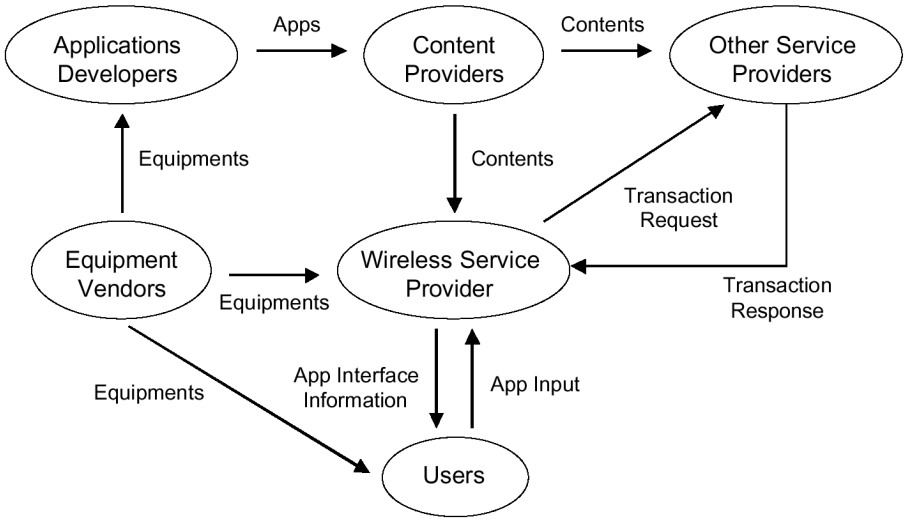


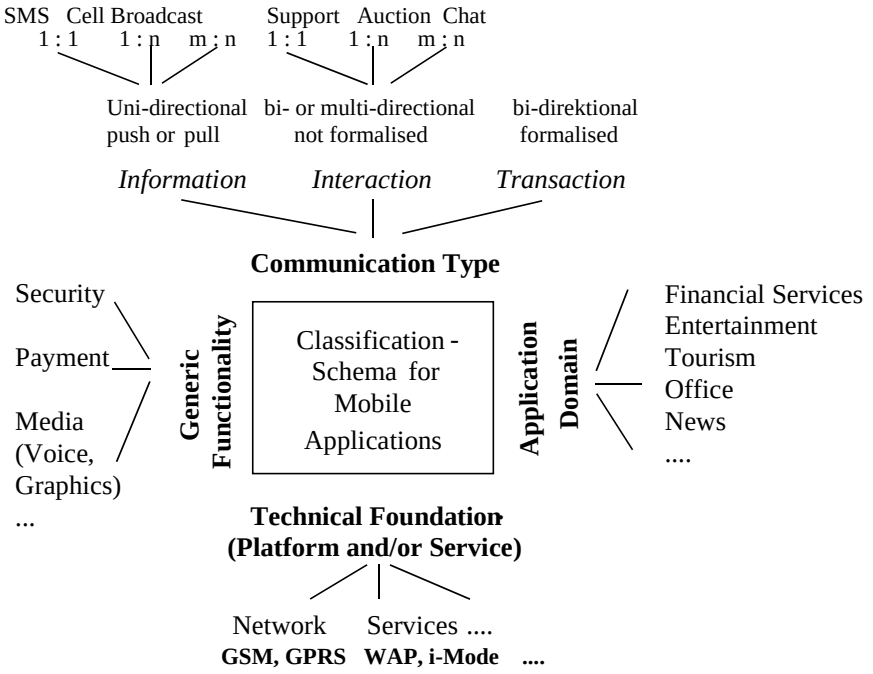
Figure 3: *Mobile Commerce Life-Cycle and Acitivity Flow (after Varney & Vetter, 2001)*

[2] They named the first group ***Killer Cocktails*** or ***Pizzas*** (recognise ingredients or not), ***Soups*** or ***Fondues*** (operator needed or not) and the second group ***Killer Bouquets***

[3] These are: (1) suppliers or (2)intermediaries, (3) customers (4) government, (5) employees, and (6) investors.

Lehner (2002) brings together these multidimensional approaches into a comprehensive taxonomy, which classifies mobile applications according to four key characteristics:

1. Type of communication (information, interaction, transaction, uni-or bidirectional, push/pull, etc)
2. Basic functions (e.g. which media application (voice, graphics, etc), payment, security, etc)
3. Technical platform or service (network (GSM, GPRS, etc.), technical service (WAP, i-Mode, etc.); and
4. The application's domain in industry terms.The basic schemata is demonstrated in



5.
6. Figure **4** below.

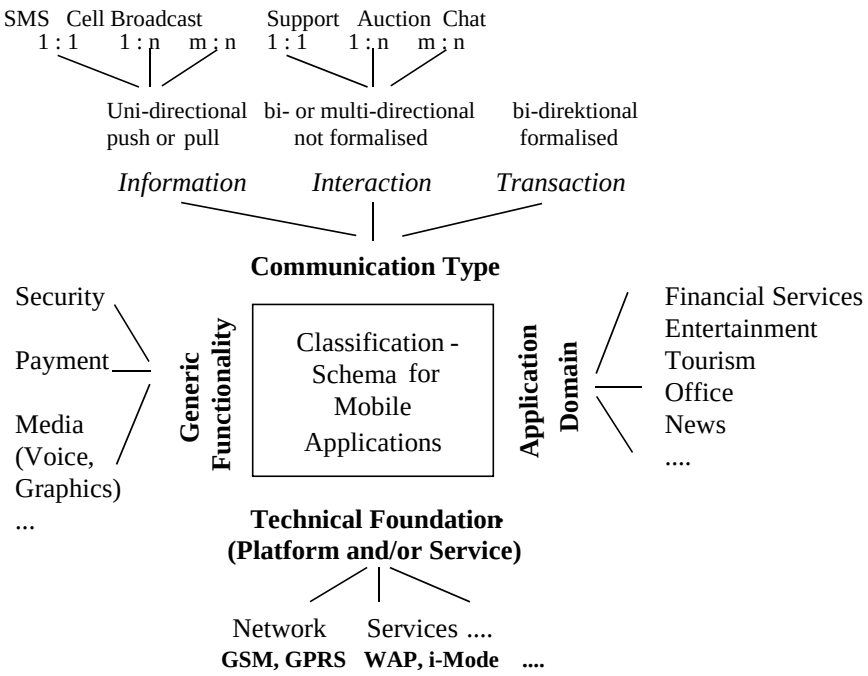


Figure 4: *Classification Schema for Mobile Applications (Lehner, 2002)*

3. Critique of the Classifications Models and Schemas

A majority of the earlier models and taxonomies are in the first instance descriptive. They order mobile applications by a number of 'surface qualities' such as by industry, by type of process, nature of the application and so on. This hold also true for a large section of practitioner-oriented research, mostly done by professional research companies such as Gartner, Forrester, Ovum and Durlacher, etc. They produce useful statistics on technology penetration (e.g. number of WAP handsets), application usage (e.g. SMS), mobile internet access parameters and similar topics. Many of the remaining publications, sometimes originating from academic sources, are similarly technically oriented or just surveys (for an overview see e.g. Prasad et al. 2000, Muller-Veerse 2000, Webb 1999, Leong et al. 1999, Hansmann et al. 2001). These studies are not very conducive to developing a conceptual understanding of the application of mobile technology, or to fathom why some applications are accepted and used by more people than others, why some applications can command a price whilst others struggle to be given away.

Some of the more recent attempts at classification, however, are beginning to address this concern. Using approaches like Maslow's need hierarchy as Rausch

(2002) did, or distilling the concepts of Hygiene *versus* Value-adding factors in the analysis of mobile applications (Roetger-Gerigk, 2002) are attempts at using some deeper seated characteristics to gain a wider-reaching understanding of mobile applications. Similarly, Meier (2002) and Diederich et al.(2002) apply perspectives which are aimed at developing insights into the dynamics of user acceptance and market interaction of mobile applications. Carlson et al.(2001) try to bring together the variety of elements, actors and environments in the "attempt to form an embryo of a conceptual framework for m-commerce products and services". Lehner and Watson (2001) actually present such a framework, which encompasses and links markets, actors and applications. Lehner (2002) developed this further into a four-dimensional framework, further refining applications by type and content.

Is there a need to go further? If what we are on about were traditional IS, the answer would be in the negative: there is little need to further the understanding of technology applications in a field that has been well researched for many years and is by now reasonably well understood.

Mobile applications are different and it has been argued that the whole of Mobile Business is an emergent field with it its own sets of concepts, rules and relationships. This claim is often made by nascent fields of research and the reasons are often the lack of knowledge and understanding, the inability of making sense of what is going on. Some of the view that mobile applications are different stems no doubt from that corner. On the other hand, for example, cell phones are used by poorly educated and even illiterate people, a segment significantly different from the well-educated white-collar workers that are so often the subjects of traditional IS investigations. Cell phones have an aural, tactile, and visual interface, whereas the bulk of IS research has focused on visual interfaces. Mobility and ubiquity are another set of issues that have not traditionally concerned IS researchers, whose investigations have predominantly occurred within the office. When an information technology affects new populations with a new interface in new places, IS researchers are venturing into terra incognita. Whilst there is no doubt that there will be some revisiting of old issues, the study of mobile applications will force researchers to confront some significant new IS issues.

4. A Grounded Approach to Concept Development?

Where a new situation does not allow the carry-over of theoretical frameworks from which to form conceptual ideas from, methods that attempt the derivation of insights from quantitative data are often less than satisfactory. Methods are needed that develop interpretations of the data from the data itself and go on to build coherent and comprehensive mental pictures of what is happening inside the phenomena studied. By the nature of the problem, these methods will be qualitative in approach and aim to create conceptual frameworks that can both explain and predict the occurrences under observation.

There is a wide variety of qualitative research methods in use in the social sciences and their use is becoming firmly accepted no in information systems research. Two of the methods specifically useful for the investigation of mobile applications would be the discovery of 'Grounded Theory' and the concept of 'Action Research'. Both are briefly introduced in the following paragraphs.

Grounded theory is a qualitative research method that seeks to develop theory that is grounded in data systematically gathered and analyzed. According to Martin and Turner (1986), grounded theory is

> *"an inductive, theory discovery methodology that allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or data."*

The major difference between grounded theory and other qualitative research methods is its specific approach to theory development - grounded theory suggests that there should be a continuous interplay between data collection and analysis.

Grounded theory approaches are becoming increasingly common in the IS research literature because the method is extremely useful in developing context-based, process-oriented descriptions and explanations of the phenomenon studied (Myers 1997). One reason that researchers are attracted to grounded theory approaches is that it offers relatively well signposted procedures for data analysis, and it gives original and rich findings that are closely tied to the data (Orlikowski 1993). It is this last point can provide the researcher with a great deal of confidence, as for each concept produced, the researcher can point to dozens of instances in the data which relate to it.

Action research is an established research method in use in the social and medical sciences since the mid-twentieth century, and has increased in importance for information systems toward the end of the 1990s. Its particular philosophic context is couched in strongly post-positivist assumptions such as idiographic and interpretive research ideals. Action research varies in form, and responds to particular problem domains. The most typical form is a participatory method based on a five-step model, which is exemplified by published information systems research

There are numerous definitions of action research, however one of the most widely cited is that of Rapoport's (1970, p. 499), who defines action research in the following way:

> *"Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework"*

This definition draws attention to the collaborative aspect of action research and to possible ethical dilemmas which arise from its use. It also makes clear, as Clark (1972) emphasizes, that action research is concerned to enlarge the stock of knowledge of the social science community. It is this aspect of action research that distinguishes it from applied social science, where the goal is simply to apply social scientific knowledge but not to add to the body of knowledge.

Action research has been accepted as a valid research method in applied fields such as organization development and education. In information systems, however, action research was for a long time largely ignored, apart from one or two notable exceptions (e.g. Checkland, 1991). More recently, there seems to be increasing interest in action research, especially in rapidly changing fields such as electronic commerce.

In combination the methods work well in tandem:

Grounded theory will provide a groundwork of concepts which can then be verified, added to and complemented in studying a real-life situations, cases and developments. Because of the close proximity not only to the data gathered but also to the dynamics and developments in the environment the data comes from, this combination of methods should work very well for the field of mobile applications which is characterised by

- Uncertain technology, often changing unpredictably (e.g. as forecasts of vendors are 'updated');
- High complexity of the applications themselves, which often involve several, not always fully compatible, technologies;
- Multiplicity of actors involved in mobile applications, of different size and stability, often with uncertainty about their ability to deliver or perform to specification/expectations.

Any research model based on the traditional paradigm of investigating, observing, analysing and finally concluding - and subsequently deriving implications for future developments and research – will be too cumbersome and too slow to be of much use in the emerginent, 'sense-making', phase of a new technology life-cycle. In contrast, the closeness to the data provided by the grounded theory approach and the involvement in the developments under study that is at the heart of the action research approach should shield very effectively against the 'limping-behind-the-times' syndrome IS researchers are often accused of.

5. Conclusions and Future Research

Classification schemata and models available to assist a deeper understanding of what is happening with the applications of mobile technology are often too descriptive and merely taxonomic to really fulfil their purpose. Later models are beginning to use a wider set of concepts and ideas to facilitate a more penetrating comprehension of mobile phenomena. It is argued, however, that models based on quantitative and deductive approaches will not perform as well in the process of 'sense making' as will qualitative, grounded methods that apply an action research paradigm.

Following these considerations, a research project has been started that sets out to establish a base of fundamental conceptual models about the nature and relationships between the elements of mobile technology applications. A set of over 100 mini cases has been gathered (predominantly from the German-speaking countries of Europe) for a first analysis and coding in the Grounded Theory tradition. This will highlight where additional knowledge is necessary and more cases will be collected and approached for co-operation in an action research mode. It is expected that this approach will yield a large amount of conceptual insight and will lead to findings that are immediately useful not only for 'sense making' in academic terms but will also assist the practitioners of Mobile Business to take some of the risk out of their endeavours.

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