Usability as a driver of customer productivity in mobile business services

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Abstract

Purpose – This paper aims to clarify the value creation dynamics of mobile business services by exploring the linkage between customer productivity (i.e. productivity of an organisation using a service) and usability of a mobile business service.

Design/methodology/approach – The analysis made in this paper is conceptual. It is based on existing literature concerning the concepts of usability and service productivity and on frameworks that can be used to evaluate the performance of mobile business services and ICT services more generally. The analysis also exploits earlier case studies of mobile business services.

Originality/value – The main contribution of the paper is in the analysis that combines the concepts customer productivity and usability and creates better understanding of the interrelationships between them in the context of mobile business services. A conceptual framework: "Mobile Business Service Success Model" is presented as a conclusion.

Practical implications – The analysis can help to match viewpoints of business managers and users of mobile business services because it aims to shed light on the linkage between productivity and usability. For service providers this analysis is useful because it increases understanding of how the mobile business services are producing value for their customers. The analysis provides also implications for the performance evaluation of mobile business services which is relevant for the companies deploying the services.

Keywords – Customer productivity, Usability, Mobile business service, Conceptual analysis

Paper type – Academic Research Paper

1 Introduction

Productivity impacts of information and communications technology (ICT) are a focus of attention among both practitioners and academics. It is seen that ICT still has a great untapped potential to contribute to the productivity improvement of organisations (Pohjola, 2008; Jalava & Pohjola, 2007). Interest in deploying mobile services in business settings is also increasing (Tekes & Market-Visio, 2008; Scornavacca & Barnes, 2008). In this paper the concept of mobile business service refers to business-to-employee ICT-application that the user operates by using a portable and wireless device. Thus, mobile business services can be used independent of time and/or location. Such services include mobile office (e.g. e-mail and calendar) and mobile operations services (for field and sales force) that provide access to company's information systems and enable data collection, recording and transfer in the field. It is acknowledged that mobile business services have potential for contributing to the success of a company deploying the services. However, there exists a lack of knowledge about how they can enhance business processes and how to measure their impacts (Gebauer & Shaw, 2004; Rangone & Renga, 2006). Mobile business services can improve productivity in numerous ways, e.g., by speeding up processes and reducing idle time. Yet, it is not evident, what the factors are that influence on whether these possible productivity impacts are realised or not.

It has been recognised that the investments on complementary assets impact on how the value of ICT-investments realise. New ways of action (such as business process design, flattening of hierarchy levels, development of incentive schemes, distribution of responsibilities and authorities and investments in human capital) are needed to gain the

benefits from ICT-investments. (Mäkinen, 2007; Brynjolfsson et al., 2002; Davern & Kauffman, 2000) Usability problems can also prevent the potential value of ICT investment from realising. Poor usability of a mobile business service can mean, for instance, growth of interruptions and errors, slowing up of working or adoption of inefficient working methods to sidestep existing usability problems. Johansson et al. (2005) state that many services, intended to be mobile and intended to bring benefits because of mobile use, are used as a stationary because of usability limitations. Poor usability may also delay the adoption of the service. Thus, it can offer one explanation for the question why the potential value of mobile business service differs from the value realised in practice.

Because companies aim to improve their productivity by using mobile business services, it is important to recognise what productivity improvement calls for. How mobile business services are creating value? What is required in order that the mobile business service improves organisation's productivity? Usability of the service can be seen as one explanatory factor, i.e. a driver of productivity. However, Petter et al. (2008) state that even though there is a strong association between user satisfaction and net benefits at an individual level, there is not enough data to derive reliable conclusions about the relationship between user satisfaction and net benefits at an organisational level. This implies also that there is not enough empirical evidence to support the connection between usability and organisational productivity.

This paper aims to clarify the value creation dynamics of mobile business services by exploring the linkage between customer productivity (i.e. productivity of an organisation using a service) and usability of a mobile business service. Can usability be seen as a driver of customer productivity, and what is the relationship like? The paper proceeds as follows. In section 2 the concepts of usability and productivity are defined. Section 2 also brings out why both of these concepts are relevant in evaluating the success of mobile business services. Section 3 focuses on the interrelationship between usability and productivity. First, section 3.1 considers the interrelationship in the IT/IS evaluation frameworks and second, section 3.2 depicts the interrelationship based on empirical evidence gained from previous case studies. Section 4 draws conclusions.

2 Defining usability and customer productivity in mobile business services

2.1 Usability and user experience

Usability has been defined as *"the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use"* (ISO 9241-11, 1998). Another ISO standard defines usability as *"a set of attributes that bear on the effort needed for use, and on the individual assessment of such use, by a stated or implied set of users"* (ISO/IEC 9126, 1991).

Both definitions emphasise the effort needed, or the efficiency – measured in the button presses or time needed per task, error rates, or experienced effort – to use the system for its purpose. ISO 9241-11 (1998) also includes the context of use as a central factor in the usability of the system. This means that the usability – including efficiency – will be affected by the user's tasks, his or her social usage context, the physical context, and the technical context in which the mobile service is used. Both definitions also emphasise individual user's perspective to usability. Thus, in these standards, even

though the organisational efficiency and effectiveness need to be taken into account, they are not in the main focus of measuring usability.

The concept of *usability* has different interpretations and it can refer to multiple attributes. Abran et al. (2003) bring out that usability has not been defined consistently. They classify standards related to usability into four categories: product effect, product attributes (interface and interaction), process quality and organisational capability. In addition, they identify two major categories, and see ISO/EIC 9126 as a product-oriented standard and ISO 9241-11 as a process-oriented standard. ISO/EIC 9126 focuses mainly on product attributes and distinguishes usability from functionality, reliability, efficiency, maintainability and portability. ISO 9241-11 focuses more on user performance and satisfaction considering also context characteristics. (Ibid.) Thus, ISO 9241-11 defines usability in more appropriate way in view of the approach taken in this paper (usability as a performance driver).

In this paper the usability – i.e. *"the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use"* (ISO 9241-11, 1998) – of the mobile business service is seen mainly from the individual user's point of view and not, e.g., from the perspective of software developers or terminal manufacturers. Thus, good usability appears to require also good reliability, functionality, security and learnability. Users cannot use the service efficiently, effectively and satisfactorily for performing work tasks if, e.g., it takes a lot of time to learn to use the service, network connections do not work or the service is for some other reason inoperative.

In the early 2000's, the shift in product development has taken place towards *user experience (UX)* (e.g. Hassenzahl & Tractinsky, 2006; Forlizzi & Battarbee, 2004). Aiming at good user experience means designing products and systems that, in addition to being usable, invoke positive emotions (Norman, 2003; Jordan, 2002). Products need to support users' *hedonic* needs such as stimulation and self-expression, in addition to the pragmatic ones (Hassenzahl, 2004) in using the product or service. Designing for UX aims at broader views of users' emotional, contextual and dynamically evolving needs, and the impact of users' previous experiences to the new experiences. Furthermore, positive user experience means that the users' interactions with every contact point in the life cycle of the system usage are satisfying, including taking it into use, active usage of the system, using the supporting services including maintenance, and upgrading the system (Väänänen-Vainio-Mattila & Väätäjä, 2008).

Roto (2006) has investigated the UX of mobile browsing and developed a synthesis model for components affecting user experience of mobile browsing. In Roto's model, the main components of mobile browsing are the user, the system and the context of use. Furthermore, the system consists of the mobile terminal, network connection, the browser and the actual web site. This implies that designing for high-quality user experience – including usability and efficiency – is a complex issue which is affected by many stakeholders, i.e. operators, terminal manufacturers, and browser and service designers. Väänänen-Vainio-Mattila et al. (2008) have further defined the specific elements of cross-platform service user experience, for example social interaction, mobile interaction, and context-awareness of the service. Thus, productivity of a worker using a mobile service is also affected by these manifold factors.

2.2 Customer productivity

In service context, there is a need to evaluate productivity both from the service provider's and from the customer's point of view (Parasuraman, 2002). In this paper the focus is on the productivity of the customer, i.e. the service user. Thus, the concept of customer productivity refers to the productivity of the organisation using the mobile business service. Productivity is commonly defined as a ratio between outputs produced and inputs needed to produce those outputs. Inputs consist of resources, such as raw materials, energy, labour and capital; outputs include products and services. (Sink, 1985; Hannula, 1999) Traditionally productivity is defined quantitatively and the quality of the input/output factors is assumed to remain unchanged (Grönroos & Ojasalo, 2004). Productivity has both efficiency and effectiveness dimensions: efficiency implies to the efficient use of resources and effectiveness to the ability to achieve desired outcomes. Thus, productivity improvement deals with both utilisation of resources and creation of value. (Tangen, 2005)

Productivity is not an unambiguous concept; its meaning can vary depending on the context within which it is used (Tangen, 2005). For example, the object of examination (e.g. certain working phase, process, unit or organisation) and the time period under review can vary. The period under review matters because productivity impacts can materialise either immediately or alternatively come with delay. It is also possible that impacts change from negative to positive – or vice versa – with time. Depending on perspective, inputs and outputs can be defined in different ways. Especially in services the productivity concept faces challenges. General characteristics attached to services (such as intangibility, heterogeneity, inseparability, perishability and customer participation) make the quantitative measurement of service outputs difficult.

Grönroos & Ojasalo (2004) state that in service context – as distinct from goods manufacturing – it is necessary to take quality aspects into account. Services are typically intangible, heterogeneous and experienced differently by different people. Also the customer can be personally involved in the service production process. Because of the intangible elements of the service output, it is difficult to objectively define it. In addition, the service experience needs to be taken into account. (Johnston & Jones, 2004) These observations imply that user experience and usability (representing aspects of service quality) should be taken into account when evaluating productivity in service context.

Many conceptualisations have been made about productivity in services (see e.g. Parasuraman, 2002; Anitsal & Schumann, 2007; Johnston & Jones, 2004; Grönroos & Ojasalo, 2004). Parasuraman (2002) suggests that when service provider also considers customer's own productivity, improving service quality and boosting service productivity are not in conflict. Parasuraman (2002) proposes that lower levels of customer inputs and higher levels of company's input lead to higher levels of service quality and also contribute higher levels of output for both company and customer. In this model usability can be seen as an element of service quality. It can be stated that good usability decreases the customer's inputs (e.g. time, effort and emotional energy) and thus enhances service quality and contributes to the productivity improvement as well. However, the framework is conceptual and the suggested relationship between service quality and productivity needs still to be verified empirically.

General characteristics attached to services have also been criticised not being applicable to every service (Lovelock & Gummesson, 2004; Sampson & Froehle 2006).

Sampson & Froehle (2006) state that the only common feature of service process is the presence of customer inputs. They characterise service processes as production processes in which customers provide significant inputs (physical or conscious presence, tangible property or information). The presence of customer inputs leads to challenges in managing service quality because customer-provided inputs can vary considerably. E.g., employees using services have different skills and their moods vary. (Ibid.) This applies to mobile business services also. E.g., in mobile context a user may need to focus attention also to the surroundings (input of conscious presence is distracted) and the mobile business service receives short shrift. Because the value of the service for the customer company is affected by users' inputs and opinions about how the service process and outcome should be, considering usability and user experience is important when evaluating the success of the service.

Vuolle (2008) states that the use of mobile business services can improve productivity in several ways, e.g. by reducing need for travel, improving use of downtime, eliminating futile paper work, increasing the availability of critical, real-time information, improving data accuracy, employee satisfaction or resource management or quicken the decision-making. In these ways the use of mobile business services make it possible to reduce inputs in terms of time, effort and costs and improve outputs in terms of quality and quantity (Ibid.). Gebauer & Shaw (2004) classifies the impacts of mobile business services in two groups: (1) automation of manual processes, and (2) improved access to information. The automation of manual processes implies to operational impacts from improved process efficiency whereas the improved access to information implies to organisational flexibility and ability to react to environmental changes and to handle emergency situations.

These identified impacts of mobile business services (such as improvement of employee satisfaction and organisational flexibility) show that productivity impacts can also be indirect. Also Gebauer (2008) emphasises this aspect by stating that mobile business services can impact on the personal lives of its users by creating convenience, timeliness and flexibility. Improved satisfaction, in turn, can lead to increase in productivity when performing work tasks. This implies that good usability and user experience can also contribute to customer productivity. Yet, presumably, the impacts of excellent user experience do not show in the productivity figures immediately. Due to this it is ideal to consider productivity impacts of mobile business services both in the short run and in the long run.

When evaluating mobile business services on an individual level of analysis, usability and productivity concepts do not seem to be far from each other. ISO 9241-11 (1998) definition of usability ("*…achieve specified goals with effectiveness, efficiency and satisfaction…*") bring usability definition quite close to the concept of productivity (i.e. transforming available inputs efficiently and effectively to desired outputs). Thus, both usability and productivity are about achieving goals in an efficient and effective manner. Definitions suggest that good usability indicates also good productivity – and vice versa.

However, it seems that when evaluating success of mobile business services from the perspective of usability, only the possible productivity impacts from an individual's point of view are taken into consideration. The aim of the usability in mobile business services is primarily at enhancing individual's job performance and satisfaction and it fails to fully connect usability to the success at the organisational level. In addition, aspects of usability and user experience emphasise user's subjective evaluations. However, these subjective evaluations are not always consistent with quantitative metrics. When

evaluating the success of mobile business services, it is necessary to use also quantitative metrics of success because user's can do faulty interpretations about their own or their organisation's productivity.

3 Usability as a productivity driver

3.1 Interrelationship between usability and customer productivity in conceptual frameworks

Many models have been presented to describe the success factors of information technology (IT) or information systems (IS), such as Technology Acceptance Model, TAM (Davis, 1989), Task-Technology Fit, TTF (Goodhue & Thompson, 1995), IS success model (DeLone & McLean, 1992) and balanced IS scorecard (Martinsons et al., 1999). It should be noted that the frameworks are generic, i.e. they can be applied to different IT/IS applications. So, they are not specifically designed for ICT services that are mobile (as distinct from stationary) and used by business users (as distinct from consumers). However, TAM, TTF and IS success as well as the concept of balanced scorecard are well established frameworks; they are widely used and cited. The generic nature of the frameworks allows them to be used also as success evaluation frameworks for mobile business services. Both productivity and usability aspects can be found in each model. Following paragraphs seek to explore how these conceptual frameworks depict the interrelationship between usability and productivity.

Technology acceptance models aim at studying how individual perceptions affect the intentions to use information technology as well as actual usage (Venkatesh et al., 2003). In 1989 Fred Davis presented the initial Technology Acceptance Model (TAM) to explain the determinants of user acceptance of a wide range of end-user computing technologies (Davis, 1989). The model is based on the Theory of Reasoned Action by Ajzen and Fishbein (1980). TAM points out that perceived ease of use and perceived usefulness affect the intention to use. Davis (1989) defines perceived ease of use as "*the degree to which a person believes that using a particular system would be free from effort*" and perceived usefulness as "*the degree to which a person believes that using a particular system would enhance his or her job performance*". Perceived ease of use also affects the perceived usefulness (Figure 1). The intention to use affects the real usage behavior. TAM was designed to study information systems at work to predict whether the users will actually take a certain system into use in their jobs. The model provides a framework to study the impact of external variables on internal beliefs, attitudes and intentions.

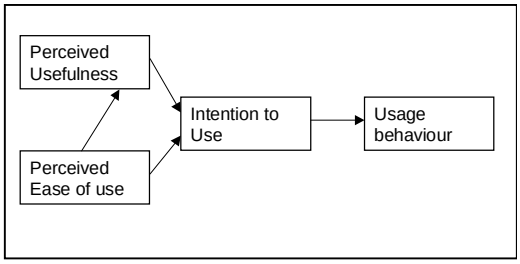

Figure 1. Technology Acceptance Model. (Davis, 1989)

TAM deals with perceptions; it is not based on observing real usage but on users reporting their conceptions. The instruments used in connection with TAM are surveys, where the questions are constructed in such a way that they reflect the different aspects of TAM.

Venkatesh and Davis (2000) have enhanced the original TAM to TAM2 that provides a detailed account of the key forces underlying judgments of perceived usefulness. TAM2 showed that both social influence processes (subjective norm, voluntariness and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability and perceived ease of use) significantly influence user acceptance.

The Technology Acceptance Models constitutes a solid framework to identify issues that may affect user acceptance of technical solutions. TAM has proven to be a useful theoretical model in helping to understand and explain use behaviour in information systems implementation. It has been tested in many empirical studies and the tools used with the model have proven to be of good quality and to yield statistically reliable results (Legris et al., 2003). However, based on analysis of empirical research using TAM and extensions of the model, Legris et al. (2003) claim that significant factors are not included in the models. They suggest that TAM is a useful model, but has to be integrated into a broader one which would include variables related to both human and social change processes, and to the adoption of the innovation model.

Davis and Venkatesh (2004) have proved that the model can be enhanced from the original purpose of studying user acceptance of existing products to study planned product concepts, e.g. in the form of mock-ups. This suggests that TAM could also be used in connection with technology development projects and processes to assess the usefulness of proposed solutions.

The reason for many commercial failures of mobile services can be traced back to the wrongly assessed value of the services to the users (Kaasinen, 2009). In long-term field trials with users, it is possible to gather feedback on the adoption of the service. Such studies gather usage data beyond mere usability and pre-defined test tasks. Field trials help in studying which features the users start using, how they use them and how often, and which factors affect user acceptance of the service. Kaasinen (2009) has extended the original TAM model for mobile services based on several long-term field trials (Figure 2).

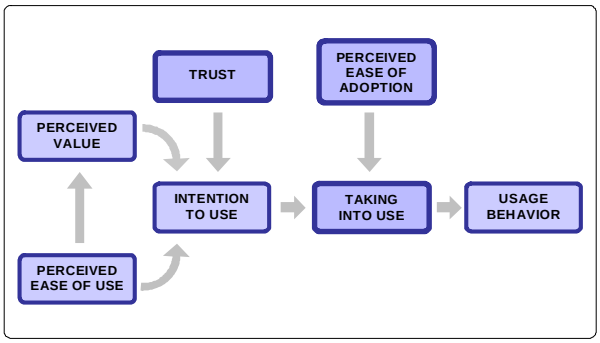

Figure 2. Technology Acceptance Model for Mobile Services. (Kaasinen, 2009)

Technology Acceptance Model for Mobile services (TAMM) extends the original core model by Davis (1989) by identifying two new perceived product characteristics that affect the intention to use, i.e. trust and ease of adoption, and by redefining the theme of usefulness as value to the user. Taking the mobile service into use is seen as an important and separate step after the usage intention and before actual usage.

TAM represents that both perceptions of productivity gains (perceived usefulness or perceived value) and perceptions of usability (perceived ease of use and ease of adoption) affect intention to use. TAM also illustrates that perceptions of usability have influence on perceptions of productivity gains. Thus, TAM presents usability as a factor that affects acceptability of the service. Acceptability of the service can have a significant effect also on productivity in some situations. It is possible that the realisation of productivity benefits requires that everybody in the organisation take the technology in use. E.g. digital calendar (to arrange appointments and meetings among colleagues) does not bring benefits in the organisational level (possibly only increases individual's own job satisfaction) if part of the employees is not using the calendar. Slow adoption can also delay the realisation of productivity impacts.

If the mobile business service is taking into use in voluntary basis, it is possible that users do not want to take it into use because of psychological and social factors (e.g. resistance to learn and use a new service) even though it would improve the existing work processes and bring productivity benefits for the organisation. In these situations perceptions of usability may play a significant role for taking the service into use and furthermore for achieving the desired impacts on productivity. User experience, as well, affects acceptability of the service; perceptions of the ease of adoption can either encourage or hinder the usage of the service at the beginning.

Task-and-Technology Fit (TTF) and an extended model of TTF – Technology-to-Performance-Chain (Figure 3) – emphasise that usage of a mobile business service does not guarantee productivity benefits. Goodhue & Thompson (1995) present that productivity impacts require both utilisation and task-technology fit. Gebauer & Tang (2008) applied the theory of TTF to mobile technology and highlight the importance to take into account the mobile use context and user mobility when considering the aspects of fit.

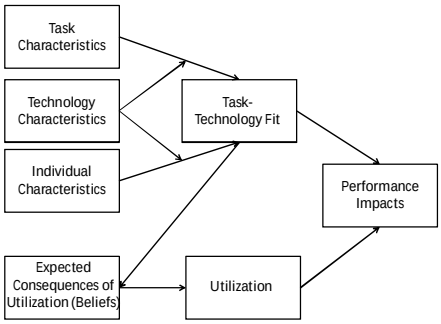

Figure 3. Technology-to-Performance-Chain. (Goodhue & Thompson, 1995)

The idea of TTF is that task characteristics require some functions and features from technology. Fit concerns how well the technology corresponds with these requirements. In the model usability can be seen as one factor that affects utilisation. When utilisation is

not voluntary, performance impacts will depend more on task-technology fit than usability. More utilisation does not inevitably lead to productivity gains if IT/IS-system is unfit for the tasks it is meant to support. However, without utilisation no performance impacts will realise. In this model performance impacts imply to improved efficiency, improved effectiveness and/or higher quality on an individual level. (Goodhue & Thompson, 1995)

Both TAM and TTF identify a connection between usability and performance impacts on an individual level. However, productivity impacts can be different on the individual level compared to the organisational level. For example, time savings do not bring value for the organisation if the saved time is not used for value-added activities (Rangone & Renga, 2006). It is possible that IS/IT-system has negative impacts on individual's work productivity but still it affects positively the whole organisation, or vice versa. Also, sometimes the individual level of analysis does not bring out all the productivity impacts. For instance, Rangone & Renga (2006) describe a case where the mobile business service made possible for company's sales agents to transmit orders directly in the field. Besides that it saved individual sales agents' time (no duplication because there was no need for data entry at the end of the day anymore), it also made possible to improve the order fulfillment time which was a critical competitive factor.

In addition, Gebauer & Shaw (2004) emphasise that when analysing the impacts of the use of mobile business services on organisational productivity there is a need to consider both direct effects on the user and indirect effects on the employees interacting with the user. For instance, in a case where the field-force transmits the data directly from the field to the corporate information system, there is no longer need for an employee who previously did the actual data entry after the field-force had sent the information by fax to administration (Rangone & Renga, 2006).

As distinct from TAM and TTF, IS success model brings out also organisational level benefits to the focus evaluation (Figure 4). The concept 'Net benefits' captures that impacts can take place in different levels (such as individual, group, organisation, industry and society). (DeLone & McLean, 2003)

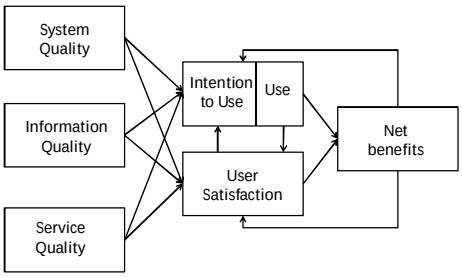

Figure 4. IS success model. (DeLone & McLean, 2003)

IS success model consists of six dimensions: system quality (ease of use, system flexibility and reliability, response times etc.), information quality (the desirable characteristics of system output, such as relevance, timeliness and usability), service quality (the quality of the support that system users receive), system use (e.g. amount,

frequency, nature, appropriateness and purpose of use), user satisfaction and net benefits (such as improved decision-making, improved productivity or increased sales). (DeLone & McLean, 2003) The model takes into consideration multiple dimensions of success, and usability can be seen as a factor that affects intention to use and actual use which consequently influence on the realisation of net benefits.

Martinson et al. (1999) have presented a balanced scorecard for information systems which consists of four dimensions: business value perspective, user orientation perspective, internal process perspective and future readiness perspective (To read more about the original concept of balanced scorecard see Kaplan & Norton, 1992, 1996). In business services – as distinct from consumer services – the value of the service is often evaluated based on business profit criteria; e.g. does the service offer cost savings or an opportunity for process innovations. Thus, in evaluating the success of business services it is necessary to take into account business impacts (such as productivity, quality, costs and speed of the processes) alongside with the aspect of user satisfaction. In addition, when considering mobile business services, the use is often mandatory so perceptions of users do not have an effect on adoption and acceptability of the service the same way as in voluntary consumer services. In this respect, balanced IS scorecard offers a suitable framework to evaluate impacts of mobile business services from different business perspectives taking into consideration also long-term objectives of the business and non-financial success factors. On the other hand, it leaves the aspect of usability aside. It can only be indirectly found in the user orientation perspective. However, Martinson et al. (1999) state that balanced scorecard should include both outcome measures and performance drivers. Thus, although this framework is about impacts, it suggests that – alongside with productivity – also usability aspects (users' perspective) are relevant in evaluating the success of mobile business services.

TAM, TTF and IS success models imply that there exists a connection between usability and productivity impacts (although TAM and TTF illustrate the connection only at an individual level). In the light of these models it seems expedient to measure both usability/user experience and productivity effects to capture the success of mobile business service. Petter et al. (2008) criticises the proclivity to use only user satisfaction as a surrogate measure of success and highlights the importance to get a comprehensive picture of the multidimensional and complex nature of IS success. Similarly Paavilainen (2001) argues that success of mobile business services should be measured both in terms of value analysis (such as user satisfaction and changes in organisational behavior, in terms of e.g. productivity and decision making) and in terms of technical analysis (such as number of active users and speed of the service).

3.2 Evidence of the interrelationship between usability and customer productivity from case studies

Mobile business services can be used by various users in different use contexts and for completing different kind of work tasks. Some mobile business services are applied to complete more complex tasks whereas other services are used for repetitive and more routine tasks. Also, some services are generic and can be applied in different business fields whereas others are more tailor-made and designed to complete certain business specific work processes. In addition, the role of mobile business service in the performance of work varies. It may work more like a supporting tool, or alternatively, as a main tool that is in constant use and essential for the completion of work tasks.

Presumably the connection between usability and productivity is not the same in every context but depends on the manner how users are utilising the mobile business service (e.g. nature, purpose and extent of use).

Case descriptions of mobile business services in practice are valuable in shedding light on the interrelationship between usability and productivity in different use contexts. However, the research of mobile services is seen skewed towards consumer applications – as distinct from business and enterprise applications (Scornavacca & Barnes, 2008). In addition, it is not very easy to find a study that includes both perspectives, i.e. considers in detail both usability and productivity. The empirical evidence of the interrelationship between usability and productivity in mobile business services is limited. Following paragraphs seek to analyse the interrelationship in the light of some case studies which have taken both of these perspectives into account.

Vuolle et al. (2008a) studied the success factors of mobile business services in two case studies: in passenger transport and at construction sites. In the case study with construction workers the mobile business service was used for weekly safety measurements at construction sites. The mobile business service was used on a mobile phone for documenting the observations related to safety issues that the safety delegate made while walking around the construction site. So, the mobile business service was used in a structured business process which was repeated similarly every time. Some usability problems were observed: lost connections distracted the safety measurement process and the use of a mobile phone's small keys was difficult. (Ibid.)

In the case with taxi drivers the mobile business service was used for accepting incoming requests, searching locations on the map and messaging to a dispatching centre and other taxis. Taxi drivers used the service constantly while driving. Usability problems were identified also in this case: connections were lost from time to time when changing location, cold weather slowed down the service and sunshine made it difficult to read the screen. (Ibid.) Thus, usability problems distracted the efficient use of the mobile business service in both cases. Because service supported the main work task in both cases, usability problems affected directly how the work task was completed.

Mobility of the service can make usability an even more important factor of success (and a driver of productivity). In the both case studies (one with the taxi drivers and the other with construction workers) safety was identified as the most important aspect of success when using the mobile business service. Because taxi drivers are driving and construction workers walking around the construction sites, observing the environment closely is important to avoid accidents. For this reason users are not able to give full attention to the mobile business service and there is a need to minimize the interaction with the service. (Ibid.) In this respect, usability of the service becomes exceptionally important for the productivity benefits to realise because it is essential for the safety to use the service with minimum effort.

Vuolle et al. (2008a) also suggest that learnability is important for the success of the services. Learning phase can be costly for the company deploying the service if users experience severe errors that harm their job performance or learning phase takes a lot of time and requires lots of support from the company. In business context, problems in the learning phase influence directly on the business performance. Thus, the business context makes learnability a critical element of usability and emphasises the importance of learnability for achieving the intended business benefits. This implies that usability of the business services is important already at the beginning when users are taking the service into use.

Studies have also given support for the use of both usability and productivity measures when evaluating the success of mobile business services. Vuolle et al. (2008b) created a mobile business service questionnaire for measuring mobile business service experience (consisting of three aspects: usability, mobile working context and mobile work productivity) and used it in three tests: one with taxi drivers using a taxi booking and order dispatching service and two others with knowledge workers in two different companies who used mobile office services. Results show that there exist differences how knowledge workers vis-à-vis taxi drivers considered the importance of different usability aspects. E.g. simplicity of use and reliability of a service were more critical factors to taxi drivers than for knowledge workers. (Ibid.) This shows that usability can be a productivity driver in various ways. Different aspects of usability contribute to productivity improvement depending on the nature of service in use.

Verbung et al. (2005) describe that in home care the usability problem of the service (system's long network connection time) led to situation where home care workers did not use the service as planned. The mobile device was only used for mobile communication but not for, e.g., reading and writing care notes or getting information about clients and their individual care plans in the field. As a result of this, intended efficiency was not reached; i.e. benefits from frequently updated system, of elimination of paper notes, of information written in the system while it is still fresh in mind and of secure storage of information were not realised. (Ibid.) In this case the usability problem was quite remarkable. It increased unproductive waiting time a lot because to start-up and log into the system took almost three minutes, and this login had to be repeated in every visit (home care nurse visited typically 10-15 clients per day) (Ibid.).

Verbung et al. (2005) describe also another case with customs control where mobile business service was used for allocation of assignments, filling digital forms in the field during control, allowing access to central databases and returning filled-in forms. The use of the mobile business service generated a positive value impact; benefits in the area of operational efficiency and in terms of employee satisfaction were achieved. In this case usability problems concerned data transfer speed, battery duration and certain ergonomic conditions. However, these problems were minor and the service was considered to be user-friendly. Negative experiences with the service were limited and it was a success in the eyes of the employees and the organisation. (Ibid.)

It is probable that serious problems in usability have a direct effect on customer productivity (preventing potential productivity impacts from realising) whereas minor usability problems impact on customer productivity only slightly. There exist also other factors – such as how investments in complementary assets (e.g. in business process design and human capital) are handled – that affect whether mobile business services are succeeding in value creation. Thus, e.g., leadership practices, organisational structures, working methods and changes in the business environment could be more decisive factors affecting productivity impacts of mobile business services. Probably, in relation to these factors minor usability problems do not play a considerable role. Also for this reason the effects of minor usability problems to productivity are not easily detectable.

Productivity impacts of usability are presumably easier to identify when the mobile business service is used as a tool to perform the main work tasks. E.g. in the case of taxi booking and order dispatching the service was in constant use and applied to complete the main work tasks. Similarly, in the safety measurement the service worked as a main tool in a structured process. On the contrary, knowledge workers who used the mobile office (e.g. e-mail and calendar) the service worked more like a supportive tool and was

used irregularly (e.g. when having idle time between meetings). When the service is not essential for the completion of main work tasks, not used routinely and not used in a structured process, productivity impacts of usability are not so easy to identify. In addition, it can be proposed that when the role of mobile business service is fundamental to the performance of the work task, the productivity impacts of usability are not only easier to detect but the usability also contributes to the productivity in larger extent than for example in a case of a service that only supports some work tasks and is used occasionally.

4 Conclusions

Conceptualisations and evidence from the case studies suggest that there is a need to assess both usability and productivity when evaluating the success of mobile business services. Good usability itself does not tell whether a service is bringing productivity benefits to the employees and organisation using the service because potential impacts of different services vary. The value propositions of different services are diverse and possible impacts depend also on the context of use, i.e. on the business processes in which the service is applied. Mobility of the service brings more advantages to some processes than to others. In addition, there are also other factors that affect the realisation of potential productivity impacts, such as problems in implementation. On the other hand, if the usability is not evaluated, it is possible that part of the productivity benefits do not materialise because of usability problems. Usability problems may slow down or even prevent the adoption of the service or lead to inefficient use. For example, in business context the use is often mandatory and users have to accept a service even though it would be inefficient to use it due to usability problems. Thus, if the usability is not evaluated, the reasons why the potential productivity impacts do not realise will not come out.

The value creation dynamics of mobile business services deserves attention because it is important for the organisations using the mobile business services to understand how different factors affect to the realisation of potential benefits in practice. For this reason, it is also recommended to pay attention to this interrelationship between usability and productivity in the future research. Many open questions still exist. Neither conceptual frameworks nor case studies make any suggestions on what the exact causal relationship between usability and productivity is like. Is there some critical turning point, when usability is good enough and it does not contribute to the productivity improvement anymore? What are the productivity impacts when good usability is being improved further? It is possible that when a certain level of usability is achieved, usability enhancements do not contribute significantly to the productivity improvement anymore. Or maybe the impacts on productivity are still noteworthy but they are just indirect, intangible and realise within a longer time period. E.g., because of even better usability, the use invokes positive emotions and user's satisfaction, motivation and job engagement improve. This, in turn, may lead to creative behavior and creation of innovations.

Research is needed to empirically test the connection between usability and productivity. Researchers could, e.g., make longitudinal studies where the productivity impacts of mobile business services are being evaluated in different phases of the life-cycle of the service (where the level of usability varies). It would be important to take into account the characteristics of the service and the use context because services

enhance business processes in diverging ways. The same level of usability in different kind of services leads to different productivity impacts because the service itself and its use context are different.

Mobile work context (environmental variations, e.g., in terms of temperature, lightning, precipitation and noisiness, moving from place to place, engagement in other task while using a service, etc.) brings specific challenges for usability in mobile business services. There exists conflicts between interface aspects that support usability and what is useful and essential from information retrieval point of view. (Johansson et al., 2005) Thus, it is possible that some functional features that would bring productivity benefits must be eliminated because of hardware limitations (they are not usable enough). In this respect, it would be valuable to know the optimal level of usability with respect to productivity impacts. Modeling the interrelationship would aid service developers in designing mobile business service offerings.

This paper has shed some light on the interrelationship between usability and customer productivity in mobile business services. Conclusions can be summarised in a conceptual framework: "Mobile Business Service Success Model" or "MBS Success Model" (Figure 5). The framework describes the interrelationship between usability and productivity in mobile business services and helps to understand why the perspectives should be combined; how usability considerations can bring value to productivity considerations, and vice versa.

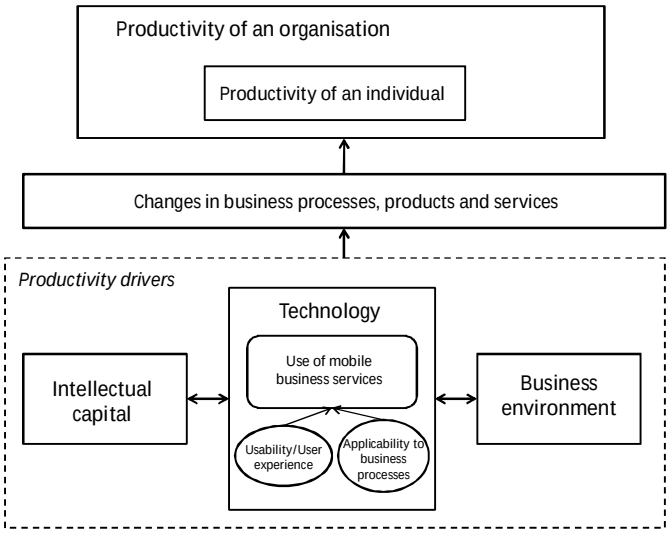

Figure 5. Mobile Business Service Success Model.

In the framework productivity drivers are categorised into three dimensions: intellectual capital, technology and business environment. Each of the dimensions consists of different factors. Intellectual capital includes, e.g., organisational structures and practices, employee motivation and engagement, competencies and management. Business environment includes external factors such as markets, regulations and society. Technology is related to the exploitation of different technologies. The use of mobile

business services is one aspect of this dimension and it is affected by usability/user experience and applicability to business processes.

The established conceptual frameworks – TAM, TTF and IS success – of IT/IS-success (presented in section 3.1) are successful in describing how different factors affect the use of mobile business services. However, these frameworks are more focused on the aspects of usability, and they appear incomplete from productivity point of view. TAM and TTF recognise impacts on an individual's job performance only. IS success also pays attention to impacts on an organisational level but fails to describe how benefits from the use of mobile business service realise. The realisation of benefits requires that other factors in the organisation support the use and that changes in business processes, products or/and services happen. The new framework expands these existing frameworks by taking into account impacts and how they emerge in the organisational context. It does not focus only on characteristics of a mobile business service and its usage. The new framework brings out that it is also significant to consider how the use of mobile business services affects productivity on an organisational level. In addition, it highlights that exploitation of technology (such as the use of mobile business services) is also connected to other productivity drivers. So, the realisation of benefits from the use of mobile business services depends also on other factors (i.e., on the exploitation of other technologies, the utilisation of intellectual capital and the development of business environment) and not only on a mobile business service itself.

Thus, productivity considerations increase the understanding offered by usability theories of how mobile business services are creating value. However, it works also other way around. It is important to identify the underlying factors supporting the realisation of productivity impacts. The frameworks (presented in section 3.1) suggest that usability/user experience and applicability to business processes are the main contributors affecting how the exploitation of a mobile business service succeeds. By taking into account the perspective of usability/user experience (as an essential productivity driver) the new framework expands traditional productivity evaluations which focus on outcomes. In this paper the focus has been in the interrelationship between usability and productivity. In future work, the focus could be extended to user experience, user acceptance as well as task and technology fit. Perhaps a totally new research framework would be needed to combine these viewpoints. User experience framework brings in the focus of how it feels using a mobile service, user acceptance framework brings in the focus of mobile workers accepting and adopting the service into use and task and technology fit brings in the viewpoint of fluent execution of work tasks. All these viewpoints are important for understanding the consequences of mobile business services from the point of view of mobile workers. In conclusion, usability and productivity considerations complement each other. Combining the perspectives is important for the comprehensive evaluation of mobile business services.

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