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"Mobile Holistic Enterprise Transformation Framework"

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Abstract

Mobile shipments have surpassed those of PCs and tablets, and the demand for mobile services has never been higher. Although, many businesses believe mobile devices and services are beneficial to them, they have not actually taken steps to adopt mobile on a large scale. Other enterprises are limiting adoption to provision of a mobile friendly web page or including mobile elements within their existing electronic services. This paper proposes a holistic framework that highlights the goals of mobile adoption, presents a taxonomy of enterprise mobile services capabilities which if utilised should assist organisations to achieve the goals of mobile adoption and categorises the components of mobile solutions and mobile strategy. Developing a taxonomy of enterprise mobile services capabilities helps the transformation to a mobile enterprise by supporting the visualisation of a future state of the enterprise.

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Keywords: Mobile Enterprise; Mobile Framework; Mobile Transformation; Mobile Services; Mobile Applications.

1. Introduction

Mobile phone usage has grown rapidly and it is estimated that more than 86% of the world's population are mobile subscribers[1]. One of the main drivers has been demand from government and business[2] and increased mobile functionality has led to the emergence of new businesses[3]. The advantages of mobile include context aware applications[4] and a range of other features including personalised applications and information targeting[3]. Mobile technology has the potential to transform enterprises and provide significant opportunities for existing business to leverage mobility and reinvent operating models. It has been estimated that less than 50% of organizations have holistic strategies in place to take advantage of mobile technology and address the implementation challenges[5]. A 2013 survey found that 67% of respondents considered mobile technologies to be important or really important and 45% predicted an improvement in productivity by no less than 33% if traveling and non-traveling staff could connect to the back office. However less than 25% of respondents had made progress towards mobile-enabled business processes and 67% did not have mobile access to their Document Management systems (DM) and their Enterprise Content Management systems (ECM)[6]. It has been suggested that one factor delaying mobile adoption is lack of standardisation[7], while another factor is that companies have difficulty assessing how mobile technology could change their business[8]. This paper proposes an holistic framework to support the adoption of mobile technology. The paper is organised as follows: Section II introduces mobile enterprise; Section III reviews current frameworks for mobile adoption. Section IV proposes a new framework for mobile adoption and Section V presents the application of cases studies followed by Section VI which outlines the conclusion and suggestions for further work.

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2. Mobile Enterprise

Enterprises utilised mobility before the introduction of mobile phones[9]. It is estimated that 20% of all smartphone mobile usage is of a business nature[10] and that by 2016, employee-owned smartphones, tablets and PCs in the workplace will have increased to more than 5.25 billion from 2 billion[11]. Mobile support is a key technology in ubiquitous computing[12]. The benefits of mobile technology include increased productivity through reduction of delays[13]. Companies that implement a mobile strategy are able to stay in control of their end users' use of mobile devices, applications and company data[11]. The growth in mobile has evolved to the stage that strategic enterprise-wide implementations are required, to enable organizations to create new core competencies, gain and sustain competitive advantages, and define new markets[14]. Moving to a mobile enterprise culture creates benefits in terms of attracting customers, leveraging interactions, providing a consistent brand experience for customers using mobile applications and delivering innovation[15]. To have a transformative effect, mobile solutions need to meet the four targets of deepening the relationship with the customer/user, improving business processes, improving employees' productivity and providing the opportunity for new business solutions[4].Ubiquitous access to data, mobile support of business processes, unified communication, and employee satisfaction are suggested as added benefits[10]. The literature has identified the need for tools to guide the adoption and implementation of a mobile culture in enterprises[4,7,8.]

3. Current Frameworks

A number of frameworks have been developed to support the introduction of mobile into enterprises. The 'SAFE' framework proposes a methodology for mobile application development to ensure the separation between the application development and the enterprise, allowing for policy and features to be added or changed without affecting the application devices and operating systems[16]. The TANGO (Timeless Architecture for Next Generation mObility) Framework proposes a unified architecture for offline enterprise application and online Enterprise application, or a mixture of both[17]. Other approaches include Mobile Business Intelligence applications[18], a Mobile Security Framework[19] and a framework to facilitate the integration of mobile applications into existing infrastructure[20]. The different frameworks all contribute to the understanding of mobile computing but need to be understood in a strategic perspective.

3.1. Strategic Frameworks

In an IBM survey, 81% of 600 individuals with knowledge of their organizations' mobile strategy stated that mobile capabilities are fundamentally changing the way their organizations do business[5]. Businesses are looking for wider, deeper and more strategic ways to develop their business[21], and this requires decision making and understanding at the strategic level. Early frameworks focused on showing how enterprises could benefit from mobile adoption[22,23]. More recent studies have looked at the introduction of mobile in different industries, such as health[24], tourism[25], or at specific technologies[26]. Mobile First, introduced by IBM calls for the adoption of mobile to be considered at a strategic level and gives guidance on a number of areas including recommendations to enhance productivity and the mobile experience[5]. However, the report does not provide guidance for the implementation of mobile or integration with business strategy. The Yankee group proposed a mobile enterprise maturity model[21]. Sørensen identified enterprise mobility capabilities which included connectivity, portability, intimacy, pervasiveness, memory (in the sense of devices remembering user choices) and priority (when the device maintains priority aspects of the process)[27]. Sørensen did not elaborate on how these capabilities could be converted into value and did not provide implementation guidance. Unhelkar and Murugesan proposed a mobile taxonomy, describing the different categories of Mobile Broadcast, Mobile Information, Mobile Transactions, Mobile Operations and Mobile Collaboration[28], however, they did not provide guidance as to how enterprises could utilise the taxonomy. Picoto categorised mobile added values into four categories, ubiquitous data access, support for business process, employee satisfaction and unified communication[29]. None of the frameworks reviewed consider all aspects of mobile enterprises holistically although mobile adoption is most beneficial when there is a clear mobile strategy in place[5].

3.2. Drivers for Mobile Adoption

Identifying the drivers and objectives of mobile adoption helps in transitioning to a mobile enabled enterprise and supports alignment with business strategies. Ortbach used the TOE (Technology Organisation Environment Framework) to investigate the impact of managing mobile devices and found a positive impact including cost and security benefits[30]. Studies on the drivers, impact and consequences of mobile adoption were carried out by several researchers[10,31,32]. Picoto investigated the impact of mobile on different elements of the enterprise and reported a number of benefits such as increased customer satisfaction and improved communication but did not find any cost reductions in inventory or procurement[29]. To avoid the productivity paradox, in which IT investment may produce benefits but may not lead to a gain in productivity, a holistic approach is needed to manage the transformation to a mobile enterprise, to provide measurable indicators and support for the development of a mobile strategy that aligns with the organisation's business strategy.

4. Proposed Framework

The proposed framework is a holistic framework that supports enterprises transformation to mobile enterprise. The framework supports the depiction of vision by suggesting a taxonomy of the mobile services capabilities which are of value to the enterprise. It allows for new opportunities to be explored, for existing and planned services. In addition, it enables the value of mobile to be measured, regardless of method and techniques, by relating the objectives of mobile adoption to the Balanced Scorecard (BSC) evaluation approach. The framework was developed from the literature using multiple case studies to ensure that the framework is sufficiently flexible to support the depiction of vision for different enterprises. As discussed in Section 6, future work, the Framework will be validated in a real world context. The elements of the framework were selected to facilitate the analysis of future state of transformation in either a top-down approach 'objectives to solutions' or a bottom-up approach 'solutions to objectives'. The framework has a strategic role but is not isolated from implementation; in each category, the framework supports the identification of issues and the development of recommendations for solutions

4.1. Mobile Services Capabilities

Mobile services capabilities are at the heart of the framework. Fig 1. shows the capabilities in relation to 'Goals' and 'Solutions' categories. We present a taxonomy of mobile services capabilities to enable enterprises to explore their options, and maximise utilisation of mobile applications. The capabilities are generic and are not industry specific; covering the inward facing applications (aimed for internal services) and outward facing applications (for customers and external users); and can drive or trigger interest in mobile technology. Capabilities can be combined to maximise utilisation. Enterprises can visualise a future state of their existing operational and planned services and applications for internal systems and business lines, in the light of the these capabilities. Capabilities are categorised to organise and streamline the analysis process, provide a unified language, to enable a comprehensive exploration of mobile benefits and to produce a clear set of requirements for the implementation and transformation process. The four categories identified are: Location Based Services; Personalised Services; Instant Access Communication and Collaboration and User Experience.

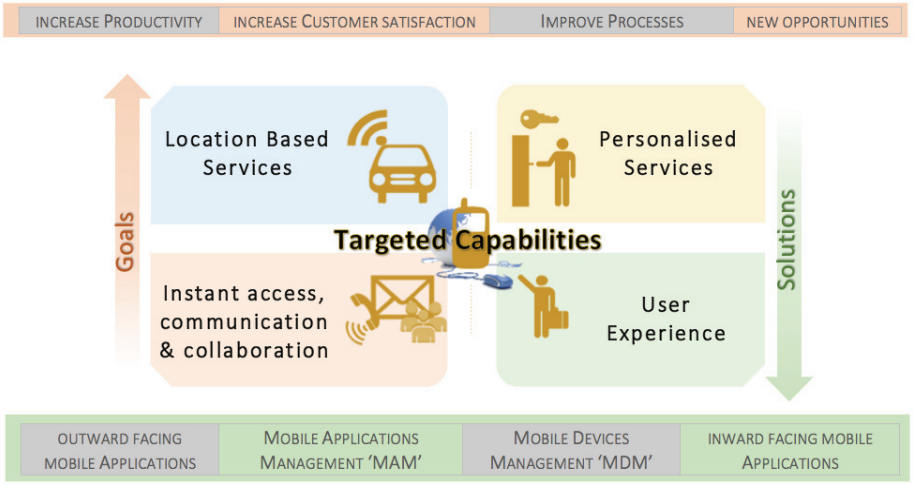

Fig 1. The Elements of a Mobile Enterprise Strategic Framework

- *Location Based Services*

The availability of information through mobile devices has led to an increase in employees' independence from fixed workplaces[10]. Location based services enable user mobility, allowing users to conduct business anywhere, with the ability to get the user location or tracking the mobile devices. The advantages of this include geo tagging of files, providing advantages such as enhanced filing and document management systems. Business and service providers' benefits include user tracking and monitoring, assigning or triggering tasks based on location and gathering information whether provided by the user or an automated process that gathers the information from the mobile device applications, built in sensors, or external customised sensors.

- *Personalised Services*

Mobile phones are personal devices, which are designed to be used by a single user. This enables use as a personal identifier, supporting customisation by users and the provision of customised services. Additionally, the data collected from

the user through the various sensors are assumed to be the context of a single user. This made smartphones the preferable devices for many applications such as health applications, recording user movement and location in fleet management, mobile employees tracking, and many other applications.

- *Instant Access Communication and Collaboration*

In the mobile enterprise, employees can access and update enterprise databases from any location and at any time[10]. Mobile has facilitated instant communication, and easier collaboration. Ubiquitous real-time access to critical business information supports decision making in shorter time frames, increases worker productivity and reduces business operating costs[19]. It has been argued that frequently interrupted and fast-paced work style business applications are most successful on mobile[33]. Employees use mobile devices to interact with colleagues or customers to access and share information. Mobile access and activities might include managing documents, connecting to the Customer Relationship Management system (CRM), email and social business software, and steps in workflows via Internet-based data transmission[10]. Mobile is playing an important role in driving real-time active usage of social platforms in all markets. The most popular consumer mobile devices operating systems are iOS and Android, and their users are significantly more likely to use social networks than the average internet user from any other platforms around the world[34].

- *User Experience*

Developments in mobile hardware and software have made the mobile smartphone an acceptable platform for electronic services, and created a demand for mobile services. The latest statistics from YouTube show that 40% of YouTube's global watch time is on mobile devices[35]. Mobile is the main driver for the growth of social networks, and since the beginning of 2011, the number of users accessing the internet via a mobile phone has increased by 60.3% to 818.4 million across the 31 GWI markets[34]. Mobile supports the use of device preferences and data gathered from sensors, to be aware of the user context and enhance the user experience accordingly. For example, it could decrease the amount of manual work required from the user, and increase the volume of data gathered in an automated and more accurate manner.

4.2. Mobile Transformation Goals

Transformation to a mobile enterprise offers competitive advantage. Companies recognize the need for a mobile strategy to effectively compete in the future[5]. The strategic goals of embracing mobile also need to be measured and monitored by using them in conjunction with performance management systems such as the Balanced Score Card. The strategic goals described in the Framework are based on Nicol's transformative mobile solutions attributes[4] and the benefits of mobile transformation solutions listed by Seidel[15]. Goals are to be considered in the planning phase, and can be used for control, continuous improvement and operations audit. The framework identifies the following four mobile goals: Increase Productivity; Increase Customer Satisfaction; Improve Process and Create New Opportunities.

- *Increase Productivity*

The most important motivation for mobile initiatives has been identified as increasing efficiency and effectiveness[36]. Knowing how 'business value' can maximise the IT investments addresses the efficiency and the effectiveness of IT, where IT contributes to the business strategy and objectives[37]. The enhanced communication and greater timeliness of information which is made possible by mobile technology can increase organizational productivity and profitability[31]. Productivity is the ratio between output and input. It is the product of efficiency and effectiveness where efficiency expresses the utilization of resources[38]. Adopting 'Targeted Capabilities' changes the inputs, and the expected output. For this goal enterprises have to compare their current input/output ratio to the planned input, and expected output.

- *Increase Customer Satisfaction*

There is a huge demand for mobile services, and fulfilling that demand will increase the customers and employees' satisfaction. Enhancing customer experience and increasing satisfaction was listed as a third driver for adopting mobile[36].

- *Improve Processes*

Mobile can speed up processes, especially where making and communicating decisions is required[10]. When new capabilities are added, businesses should consider reengineering their processes in the light of these capabilities. A process improvement is a tangible value, and if processes are improved, businesses could see improvement in other goals, such as productivity and decision-making, operational costs and customer satisfaction[29].

- *Create New Opportunities*

Mobile capabilities offer new opportunities; new sources of revenues can be introduced since businesses are closer to the

customers and are able collect more information. The emergence of mobile applications in particular creates new opportunities for using the mobile devices and networks[10]. Current applications such as social networks are better utilised with mobile and this has led to 'IT consumerisation with individuals demanding more from their devices, applications and technologies'[39].

4.3. Solution Categories

Current solutions and practices of mobile enterprise include the following four components: Outward Facing Mobile Services and Applications, Inward Facing Mobile Services and Applications, Mobile Device Management (MDM), and Mobile Application Management (MAM). Each of these components may require a different set of skills, involve different stakeholders, and are usually provided by different vendors. In mobile strategy, these subcategories can streamline discussions around the mobile adoption; policies and guidelines can be set separately for each category to mitigate risk and increase profit.

- *Outward facing Mobile Services and Applications*

This category relates to Business to Customer (B2C) applications and services, including marketing, service portals and mobile commerce and job specific applications. They are typically distributed over application market stores of smartphones and managed and updated through the software development kit offered by the app store provider.

- *Mobile Application Management- MAM*

MAM focuses more on the application and less on the device. It is used to develop custom applications that enable the deployment, provision, updating, and management of mobile applications[40]. MAM offers functions including policy enforcement and security settings, distribution of software, secure areas for application version management and security services such as VPN connections for specific applications, authorization, encryption and remote control[10].

- *Mobile Device Management - MDM*

The use of mobile technologies and applications has also brought new security challenges and risks, particularly on mobile devices[19]. Mobile Device Management is concerned with managing user mobile devices that are being used to conduct the business. MDM systems offer functions such as remote device administration and configuration, inventory and asset management, remote-wipe or device lockout, installation of updates on operating system or application level, geolocation of devices, or cost management[30]. MDM is not a desirable add-on; it is a prerequisite, it should go hand in hand with trend of Bring Your Own Device (BYOD)[39] discussed in the next paragraph.

- *Inward Facing Mobile Services and Applications*

Mobile enterprise applications are becoming one of the most discussed topics in enterprises[17]. This category is concerned with applications intended for internal use. The trend known as Bring your Own Device is gaining momentum since although many employees are using their own tablet or smartphone for work purposes, few are willing to use their own PC as the primary device for work[39]. Solutions for this category include building client applications on current advanced smart phones for existing enterprise systems, such as Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and Supply Chain Management (SCM). This area is focused on the development of those applications. This introduces security concerns although implementing effective MDM and MAM solutions should mitigate these.

5. Application of Framework to Case Studies

The framework provides a holistic view of the transition to a mobile enterprise, illustrating the ways in which mobile could add value to the enterprise, increase visibility of the future state of transformation, and facilitate the transformation to maximise the benefits of mobile technology.

Enterprises should evaluate their current and planned services through the framework, by assessing every service individually against mobile services capabilities, documenting how the service could benefit from these capabilities, making sure those changes are of value by documenting objectives for every service, and listing any concerns and requirements related the four categories of mobile enterprise solutions. Existing 'off the shelf' solutions can be mapped to the framework to be assessed in term of value, applicability, and if further customisation is needed.

The framework was validated by evaluation against multiple case studies from different industry sectors such as education, health, tourism and banking. The framework underwent several iterations and refinements to determine the correct combination of elements. In this paper, for reasons of space, we discuss in detail only two case studies. The examples given here were selected because the cases vary in nature, between profit and nonprofit, simple and complex, and novice and professional level implementation. For the Solutions section, discussion on concerns and recommendations are

not documented in the literature for both cases studies and therefore assumptions were made to show examples of some of the relevant issues.

The case studies were mapped to the framework outlined in Fig. 1, the objectives achieved in both cases supported the categories, and the mobile adoption can be investigated clearly through the identified capabilities and components. The framework works as a template to provide a holistic view of the mobile initiatives as shown in case studies [Fig. 2 and 3].

The first case study is for a computer systems company with many field agents[41]. The company is one of the largest providers of business outsourcing solutions to about 25,000 automobile, truck, motorcycle, marine and recreational vehicle dealers, in Asia, America, Europe and the Middle East. The front line engineers were accustomed to a hard-wired solution that prevented them from responding quickly to fluctuating service demands. The new solution allowed them to take real time actions, improving many measures including the accuracy of Estimated Time of Arrival (ETAs) to customers, which increased from 10% to 90%. The objectives achieved and capabilities adopted are outlined in in the Goals and Targeted Capabilities sections in Fig. 2.

Case Study:	Description:
ADP Dealer Services	*For field engineers to take real-time action from the frontlines with mobile solution.*

Goals	Increase Productivity	Increase Customer Satisfaction	Improve Processes	New Opportunities
	Objectives:	Objectives:	Objectives:	Objectives:
	- *Reduced call centre costs* - *Lowered customer service costs.*	- *Improved customer service quality with accurate arrival times (ETAs) to customers.* - *Improved customer responsiveness.*	- *Improved inventory and parts management*	- *Easily and economically to adapt to future requirements, such as time and expense management, preventative maintenance processing and Signature Capturing.*

Targeted Capabilities	Location Based Services	Personalised Services
	- *Communication and files can be geo tagged.*	
	- *Engineers to be able to access the back end system and update them on the move.* - *Receive work orders via real-time notification with customers' information.* - *Using mobile to track bar-coded parts to manage and report on service inventory in real time.*	- *Information to be stored on mobile devices if for any reason the device cannot connect to the back end system, and update all at once when it connects.* - *Mobile Phones can be triggered to notify engineers in real time notification.*
	Instant Access, Communication and Collaboration	User Experience

Solutions	Outward Facing Mobile Applications	Mobile Applications Management 'MAM'	Mobile Devices Management 'MDM'	Inward Facing Mobile Applications
		- *Concerns and recommendations about future updates.*	- *Concerns and recommendations about engineers' mobile devices.*	- *Concerns and recommendation about usability.*

Fig. 2. The Vision of Mobile Adoption for Computer Systems' Company.

The second case study is for a Primary School in India, which uses mobile video games to support students in rural areas in learning English[42]. 31 children participated in the pilot study, and 4 left during the programme. In spite of poverty, and the fact that most of these families had one cell phone per household, and some did not entrust their children with costly devices, the results were encouraging. Students were loaned cellphones for the period of the programme.

The curriculum was broken into 6 levels in the game, and the children were able to move from one level to another at their own pace. For the pilot study the material were preloaded to the cellphone because of the cost of cellular networks to the families, which explains not utilizing the other capabilities of mobile devices at this stage. Significant post-test gains that could be reasonably attributed to the cellphone-based English learning games were achieved [Fig. 3].

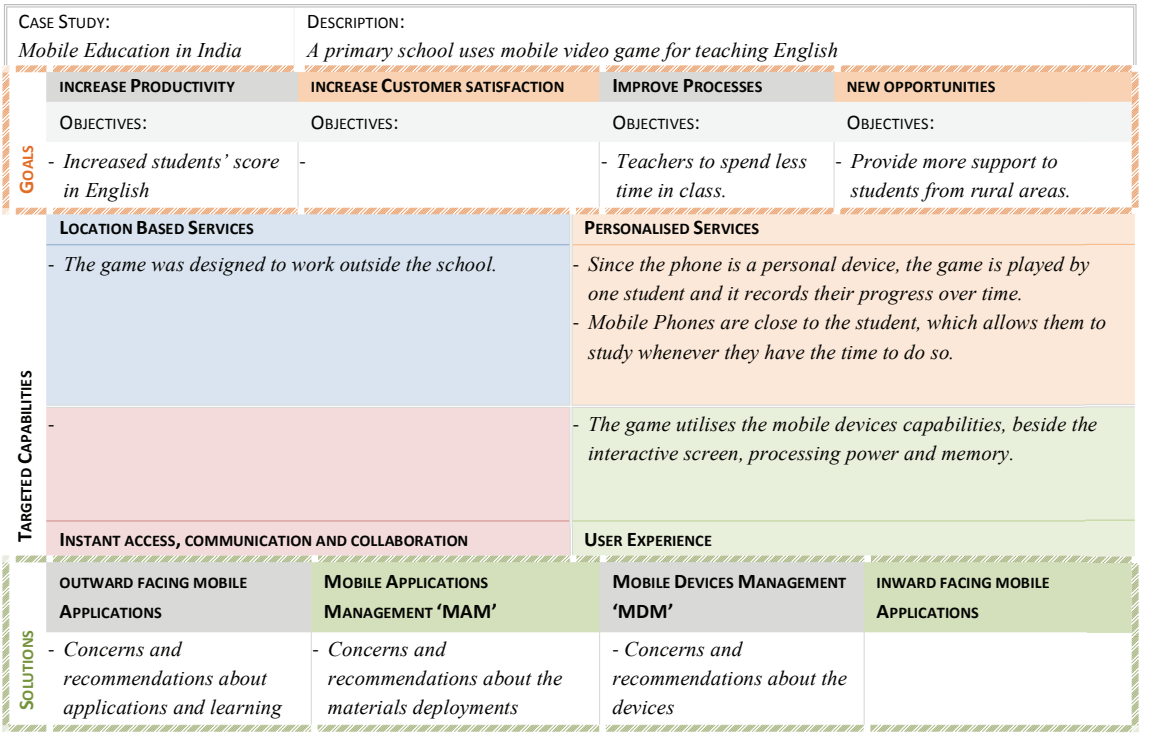

Fig. 3. The Vision of Mobile Adoption of a Primary School in India.

6. Conclusion

Smartphones are the new face of engagement, the demand for mobile services is higher than ever, and organisations need to consider adopting mobile technology for internal operations, Mobile Enterprise and in the services extended to customers. There are several existing frameworks addressing technical changes or different aspects of the mobile business strategy. However, there is a need to have a holistic mobile enterprise framework approach that guides the transformation process and provides a clear mobile strategy for an enterprise. In this paper, we attempted to design a taxonomy of mobile capabilities, using categories for easier evaluation and application, consideration of benefits and cost of development requirements. The taxonomy will help organisations create a vision for mobile transformation since the future state of the enterprise is clearer, in terms of goals and targeted capabilities and this would support the creation of a comprehensive mobile strategy.

Our future work is to evaluate the proposed framework using actual case studies from commercial companies in Saudi Arabia. The evaluation will use focus groups drawn from industry and will make use of the Balanced Scorecard to measure the effectiveness and contribution of mobile applications to enterprises.

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