Mobile
Customer Relationship Management

by

Saw Myat Nwe

Submitted in Partial Fulfillment of the Requirement for the Degree of Master of Science in Telecommunication Management Assumption University

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St. Gabriel's Library, Au

Project Title: Mobile Customer Relationship Management
Name: Ms. Saw Myat Nwe
Project Advisor: Dr. Sudhiporn Patumtaewapibal
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The Faculty of Engineering, Assumption University had approved this final report of the six credit course, TM 6900 Master Project, submitted in partial fulfillment of the requirements for the degree of Master of Science in Telecommunications Management.

Approval Committee:

( Dr. Sudhiporn Patumtaewapibal )
Chairman / Advisor

( Asst. Prof. Dr. Kittiphan Techakittiroj )
Member

( Assoc. Prof. Dr. Kobchai Dejhan )
MUA Representative

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ABSTRACT

Customer relationship management, CRM, is at the core of any customer-focused business strategy and includes the people, processes, and technology questions associated with marketing, sales, and service. Mobile CRM is a solution that extends the reach customer relationship management applications to employees, channel partners and outsourced field professionals whenever and wherever needed. This study provides essential knowledge to management of the organization regarding CRM, pros and cons of mobile CRM over traditional CRM under various aspects, as well as investment criteria for mobile CRM. The study has a limitation that the project research works are done based on the case and research studies of the companies and industries in other countries that are fully deployed with mobile CRM solutions, due to the fact that currently in Thailand there is no such industry of the scope that is fully deployed with mobile CRM solutions and thus no practical management strategies or/and financial projections are available. The study recommended that future research can be extended to this paper on the technical and marketing aspects of the mobile CRM solutions throughout the third generation mobile network and the market trend.
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CHAPTER 1: INTRODUCTION

1.1 Project background

This study intends to provide information on the background of customer relationship management and extension of CRM applications to mobile connectivity. Customer relationship management is at the core of any customer-focused business strategy and includes the people, processes, and technology questions associated with marketing, sales, and service. CRM being an essential part of business operation processes in medium to large enterprises, the extension of CRM applications to mobile devices become a challenging role for most of the enterprise to increase the productivity of business operations.

Mobile CRM is a solution that extends the reach customer relationship management applications to employees, channel partners and outsourced filed professionals whenever and wherever needed. Due to market drives and increasing trends of mobile usage over existing 2.5 Generation (2.5G) mobile network throughout the population, the deployment of mobile CRM applications is highly feasible. However, the concern is not the feasibility but much on the investment cost and the measures of return on investment.

This study intends to analyze and compare the features and benefits between traditional CRM and mobile CRM under various aspects, along with supporting criteria for investment decision making on extension of mobile connectivity to the traditional CRM or electronic CRM. The study also includes the case study on the extension of mobile connectivity over existing electronic CRM system.
There are several criteria to be taken account prior to making an investment on mobile CRM solutions. The current situation of the organization should be carefully study with various aspects to analyze and foresee any possible consequences of deployment of mobile solutions. This study provides recommendations to the most common pitfalls of mobile CRM solutions in organizations, in order to prevent any foreseeing future mistakes in reaching an optimal stage of deployment.

Mobile CRM solutions are recommended to deploy in organizations which provide a wide range of services, thus in this study a model case of five star hospital in Thailand is studied for deployment of mobile solutions in part of their services in daily business operations. The pains and needs are studied for this industry, as well as proposed solutions, and initial investment projections are included in the study.

1.2 Project Objectives

Thailand market share is still way behind other countries in mobile CRM solutions. This project study is intended to educate management to realize the increment productivity and efficiency by usage of mobile solutions in the organization. The objective of this study is to provide essential knowledge to management of the organization regarding CRM and pros and cons of mobile CRM over traditional CRM under various aspects. This study intends to mainly focus on information supporting decision making for investment of mobile CRM in the organization, with supporting criteria for decision making. This study also intends to contribute the knowledge and understanding on the advantages of deployment of mobile CRM solutions over traditional CRM solutions, from management point of view.
1.3 Chapters Description

The first chapter explains an overview of CRM along with brief explanation of various types of CRM, steps of CRM value chain process. And further explanation on the overview of mobile CRM, and the market drivers for moving CRM towards mobility. The second chapter provides the reader with the knowledge of management perspective on mobile CRM regarding the strengths and weaknesses, the benefits of mobile CRM over traditional CRM, the pitfalls and recommendations on deployment, ROI measures and criteria for investments including cost consideration for mobile CRM deployment. The third chapter includes the study of mobile healthcare, which includes description of mobile healthcare applications, benefits, and the frame works. This chapter also includes the case study on a model top five hospital in Thailand, with the cost of deployment of mobile CRM along with ROI measurements, and the future trend of mobile CRM.
CHAPTER 2: CRM OVERVIEW

2.1 CRM overview

Customer Relationship Management (CRM) includes everything about attracting and retaining customers, prospects, business partners, and other constituents. CRM is at the core of any customer-focused business strategy and includes the people, processes, and technology questions associated with marketing, sales, and service. CRM simply is corporate activities to increasing the customer base by acquiring new customers and meeting the needs of the existing customers, and building partnerships with customers by the use of internal business processes from Sales, Customer Service and Marketing.

The philosophy of CRM is that long-term relationships with customers can be one of the most important assets of an organization, providing competitive advantage and improved profitability. The most important part of CRM is the "R", meaning "Relationship". "C" of course is important for keeping customer focused. If there is no Relationship between customer and the corporate, there will be no customer, "C", to manage. Therefore, keeping and managing the overall interaction relationship throughout the entire customer life cycle is a critical success factor to maximize lifetime customer profitability.

CRM is necessary for every single corporate to achieve the business especially for those do not have strategic advantage towards competition CRM is a must to support operational excellence or customer intimacy. Part of the strategic direction serious consideration, it is necessary to put customer at the center of consideration, and this can also be achieve by combining customer life cycle and organization value chain.
Managing both is necessary to maximize lifetime customer profitability. CRM technologies can be categorized into the following six types.

Collaborative CRM, is the infrastructure providing access to people to ensure the connectivity between corporate and employees and value partners across all contact channels such as telephone, Internet, or wireless devices.

Operational CRM, is the back office features and applications which provide a range of services across all the key areas from product development to customer retention.

Analytical CRM, is a mean of creating relationship of data through out the enterprise and put together in a form that can be used for decision making and to add proactive values. It consists of applications that enable businesses to analyze relevant data in order to achieve a more meaningful and profitable interaction with customers.

Interactive CRM, is a solution that delivers customized content to individual customers, creating a unique experience for each customer.

Electronic CRM, is a solution that supports electronic transactions/purchases and provides customers and management a greater amount of data at a faster speed and in a more attractive format.

Mobile CRM, is a solution that enable the customer relationship management applications to be accessible by corporate employees, partners and field professionals through wireless mobile devices.
2.2 CRM value chain

The purpose of CRM Value Chain process is to ensure that the corporate builds long-term profitable and beneficial relationship with customers. The following CRM Value Chain chart describes the detail five steps to profitable customer relationship management.

Customer Portfolio Analysis sorts out the actual or potential customer base into different groups, different target, and different value proposition. Not every customer is profitable to the corporate. It is essential for the corporate to analyze and sort the customers into four main different groups: sack, re-engineer, nurture, and invest. Customers in the sack group are those who do not have any potential profit or benefit to the corporate. Those in the re-engineer group are those who are not currently valuable or profitable to the corporate, however their potential may increase and...
become profitable if the relationship between the corporate and this group of customer is re-engineered. Customers in *nurture* group are those who are currently valuable and profitable but have little future potential. Those in *invest* group are who already have value and a great potential and will provide significant profit to the corporate in the future.

Customer Intimacy is one of the most critical success factors for developing a good customer relationship. It is not all about serving the customer alone. It is more important to know the behavior and what, when, how, why about the customers, to better develop a close relationship. It is important to understand customer life cycle. Putting CRM into a serious consideration, customer life cycle should be combined with organization value chain.

![Customer Life Cycle](image)

**Figure 2-2: Customer Life Cycle**

Network Development is process of building a network between corporate employees, partners, suppliers, and owners/investors. Every ones in this network must be properly
coordinative and managed to meet the needs of customers, and they must be heading towards the same direction to implement CRM strategies.

Value Proposition Development is creating and delivering particular values to target selected customers. The value of the corporate is not only focused on the product alone, but also on employees, processes, and services delivered to customers. Value can be created by how things are done with customers in such a way that, how customers feedbacks, comments and complaints are handled, how customers are involved in new product development, and to how much extent the services are provided to customers.

Relationship Management is a process of managing relationship with strategically significant and profitable customers, by the corporate re-engineering the internal processes and structures. Corporate marketing strategy should be customer centric, which includes and measures customer acquisition, retention, and satisfaction. These measures can be taken account for developing marketing strategies, which will in turn manage the relationship between customers and the corporate. In addition to these measures, performance of network members should also be measure in order to evaluate whether they are performing in accordance with CRM strategies.

On top of five main steps to successful customer relationship management, there are many other internal organizational conditions supporting those steps to be achievable. Organizational design, Culture and leadership, People, IT and data, and Functional processes are those internal conditions influencing the success of profitable customer relationship management, which are further explained in details.
Organizational Design focuses on the ways in which the corporate organizes to satisfy its strategic goals. This can be geographical, product oriented, customers focused, or a blend of these.

Culture and Leadership focuses on culture of the corporate on how things are done in the corporate and in what ways. The presence of customer centric business culture leads to successful CRM. Leadership behavior, formal systems and internal relationships also determine an organization's culture, which reflects employee behavior, which have a major impact on customer satisfaction.

People focuses on the way the corporate builds, maintains, and manages a relationship with the employees, including provision of motivation, supporting, and incentives.

IT and Data focuses on systematic acquiring, storing, enhancing, maintaining, distributing, and using customer data.

Functional Processes focuses on day-to-day actual functional processes of the corporate across all business functions, which should be designed with processes that create and/or add values to customers.

In conclusion, in order for the corporate to create a successful customer relationship, the corporate has to look at its own structure from the customers’ point of view. Customers do not look at the corporate having two different parts, front office and
back office, which most corporate look themselves at, but they look at it as a whole. The corporate should organize its structure based on this point of view.

![Customer-Centric Organizational View](image)

Figure 2-3: Customer-Centric Organizational View

### 2.3 Mobile CRM Overview

Mobile CRM is a solution that extends the reach of corporate core business processes especially customer relationship management applications to employees, channel partners and outsourced field professionals whenever and wherever needed.

The need for such a solution has only grown as more and more employees of the corporate work remotely. Specific to CRM, mobile technologies promise sales representatives and field professionals an efficient, fast way to stay current with their accounts. For instance, a salesperson might need to know the most recent billing history of one of her regular clients. A field professional might have a question about inventory levels of a certain item back at the corporate warehouse. Likewise, the corporate office must have timely field intelligence collected by field professionals for financials, inventory, marketing, fulfillment, and almost every other corporate function.

The theory behind Mobile CRM is that through laptops, Web-enabled phones, PDAs, mobile phones and other mobile tools, field professionals can access the latest information they need from the corporate server in real time to better serve their...
customers. This kind of environment where users can access to information and CRM Applications whenever and wherever needed for 24/7 around the world both inside and outside of the corporate via mobile devices increases the effectiveness and efficiency of the corporate in several aspects.

mCRM closes the gap between field professionals and the corporate office by providing the right information at the right time whenever and wherever it is needed. mCRM concentrates on the power of productivity, which lies in the speed and ease of communication. mCRM increases sales productivity, service quality and efficiency, enhances collaboration within the corporate and with employees as well as with partners, and improves efficiency of field operations as well as lowering field service costs.

For better understanding of the benefits of mCRM, it is essential to understand the view of information Gap exists in the traditional CRM life cycle. The following chart illustrates traditional CRM information gap.

Figure 2-4: Traditional CRM Information Gap
Within the traditional CRM system, the information gap exists when filed professionals such as sales representatives and service technicians are unable to access to customer information, product information, service order, and other valuable information at the time when it is needed and at ad-hoc basis to response to emergencies. Field professionals develop their own manual system for managing their contacts, schedules, taking notes, and tracking product inventories. Corporate executives and support personnel locating in the corporate cannot respond effectively to emergencies to allocate resources, conduct analysis, or manage ongoing relationship with incomplete and/or out of date information. This gap results in a risky delay for responses, investments, and critical decisions.

In a mobility world, the gap between the corporate and its field professionals is removed. The following chart illustrates how mobile devices keep the corporate and filed professionals connected.
The gap exists within traditional CRM system is removed by the ability of connectivity provided by Mobile CRM. mCRM provides the ability to field professionals to access to customers data, and any critical information needed from the corporate information resources via their mobile devices. mCRM simply extends corporate CRM system to sales professionals, service technicians, and also partners to have access to the system whenever and wherever they need with the mobility.

mCRM solutions minimizes the time required for paper work and information access, thus results in decreasing probability of losing sales and also leads to a better customer service. On the other hand, mCRM solutions also provide full information visibility from sales representatives to top management, which results in ability to leverage the full resources of the corporate and optimize customize customer relationship.

2.4 Mobile CRM market drivers

The most common elements that drive mCRM applications are Instant Access, Time Sensitivity, and Niche Time. Instant Access: mCRM applications are spontaneous and provide instant access to critical information. Time Sensitivity: some information is only valuable if it is received on time when it is needed, and mCRM applications provide timely access to information. Niche Time: with the use of cell phones or other mobile devices enable users to make productive use of niche time by accessing to applications at the time they are convenient.

The popularity of cell phones and mobile computer devices among business users is the main market driver for mCRM, on top of the necessity of connectivity and visibility of information at anytime and anywhere. mCRM market in Asia Pacific will
change and increases in the next five to ten years with the rollout of mobile phones and PDA being the main driving forces. The key market drivers of mCRM and also mobile commerce include the followings:

- Mobile phone and PDA penetration
- Increase functionalities and convergences of mobile phones and PDAs
- 2.5G and 3G mobile network migrations
- Wireless network penetration

Figure 2-6: Mobile phone shipment into Asia Pacific (source: Datamonitor)
Figure 2-7: Evolution of wireless capabilities (source: IDC, 2002)
CHAPTER 3: MANAGEMENT PERSPECTIVE

3.1 Strengths and weaknesses of mobile CRM

The main benefit of mCRM is the ability to exchange data between corporate employees and the corporate CRM system whenever and wherever needed. This timely information exchange benefits corporate field professionals, determines future customer relationship, and significantly impacts operating cost of the corporate.

The followings are the three main areas where mCRM fits in to provide the most ultimate benefits to the corporate to maintain customer relationships.

3.1.1 Strengths

Mobile Marketing/Public Relation Activities

*Location based marketing:* Corporate can keep in touch with customers through their mobile devices at anytime at specific places. The ability to provide specific information and services based on location when the customer is in need of the information enhances customer royalty and increase customer relationship. Imagine sending promotional or PR messages to customers traveling near by the area of corporate branches to attract them at their traveling convenience.

*Enable interactive responses:* mCRM solutions enable customers and corporate staffs to respond interactively upon their receipt of any corporate promotional or PR
messages. This provides not only convenience and timely response but also accuracy in their response to the messages.

*Increase effectiveness:* By delivering information right on to customers' mobile devices ensures that customers receive the information, which increases the effectiveness of message delivery, and also lessens investment on any marketing materials such as brochures and leaflets, which does not guarantee the delivery of message to target customers.

**Mobile Sales**

*Faster deals closing:* By extending sales applications and customers information to corporate sales personnel with necessary information required to close the deal at the time they are urgently needed, provides productivity and fasten the process of closing the business deals. Sales personnel are able to access real time to check the availability of required stocks or any relevant information required to response to customers' inquiry to help them close the deal faster.

*Increase sales productivity and service quality:* mCRM solutions leads to better customer service and also increases service quality by minimizing the time required to access information and lessens paperwork. In addition to this, it also maximizes sales effectiveness and productivity by providing relevant information to corporate sales personnel at the time when it is needed. It also increases effectiveness of sales calls by leading fewer callbacks to sales after meeting with customers due to their ability to answer customers' inquiries at ad-hoc and providing them with relevant information.
Increase information visibility collaboration: mCRM solutions provide corporate employees starting from top executives to sales personnel a full visibility to information. Sales personnel and field professionals can easily update information through their mobile devices at anytime from anywhere and the timeliest updated information is viewed by management for making optimal decisions. This enables collaboration between work forces providing a full timely updated information visibility to executives at every level of command, and significantly improves territory management and business decision-making.

Mobile Field Services

Lower field service costs: By exchanging information through mobile devices, field professionals lessen the time of phone and fax contacts for acquiring order information and service details. mCRM solutions achieves indirect cost savings for example by providing ability to notify field professionals of service order by mobile devices while they are on the field, and also enabling them to respond to the service schedule on the go, which saves time and phone bills for the call contacts.

Improve customer service and loyalty: Field professionals perform their scheduling activities, viewing orders, and accepting tasks on the go through their mobile devices, which in turn increase their time to face with customers and improve customer relationship and services. Miscommunications through phone conversations can also be lessen by providing a clear and detail information on the mobile devices.

Increase accuracy: mCRM solutions increase the accuracy of data by enabling filed professionals to be able to update the status and information immediately after the
meeting with customers and not only provide timely information but also preventing any loss of data if they have to wait the end of the day for making any reports on the customer visit. This improves data and reporting accuracy of any relevant information, which is necessary for any business decision-making.

Business Channels

*Improve business relationship:* Corporate provides information sharing to business channel partners at anytime and anywhere and provides options for them to share their information in return where corporate employees can have access on the go on any information updates.

*Increase channel collaboration:* Ease of information sharing and access between channel partners and the corporate keep both parties up to date to all the latest product and service information, where they can keep track each parties activities, and in return increases collaboration between each parties.

3.1.2 Weaknesses

Mobile CRM brings benefits to the corporate in various aspects as mentioned above. However, there are a few points of weaknesses to deployment of mCRM solutions.
Human Resource

*Less interpersonal communication:* Due to the ease of information access and information sharing on the go, corporate employees tend to spend most of their working hours outside the office on updating information and reports. This decreases face-to-face interaction time between employees and lessens interpersonal communication within the corporate.

Team Management

*Difficult to control a team:* Since most of the time for team members is spent mobile from the office and due to less close contact and face-to-face relationship between group members, managing and taking control of a team is becoming a challenge to team leaders.

User Interface

*Limited screen size for information display:* Due to the limitation of wireless device screen size, contents display sometime needed to be customized to fit across various types of wireless devices. The amount of content display is also restricted to the screen size.
3.2 Mobile CRM deployment pitfalls and recommendations

When we discuss about mCRM, the main concept is to deliver the right information anytime and anywhere when it is needed, but that is not sufficient to deploy an effective mCRM. To be effectively deploy mCRM applications and to increase the efficiency of filed sales, field service, or marketing and any other mobile activities that benefit the corporate, the flexibility and ease of use of the applications are also very critical. The applications must be flexible, user friendly and easy to access through mobile devices. User behavior is also very important for deployment of mCRM applications. The application architecture must be flexible to make any future changes as the corporate learns which kind of information and process increase productivity. Details of pitfalls and recommendations will be addressed in the following section.

Pitfall.1: Unrealistic Expectations

One of the most common pitfalls to deployment of mCRM is unrealistic expectation of the corporate on a high functionality of the mobile applications, which leads to complexity and slow for usage. Mobile devices are not expected to perform complex functions like standard computer PCs. The simpler the applications are to access from the mobile devices, the greater the productivity and the more value it provides. What field professionals really need is to access to customers and product information on the go and response to any schedule planning. They will not necessary need to enter detail sales meeting information or read detail product information chart or diagrams on a limited sized screen of mobile device. Providing unnecessary and complex features and expecting users to make use of it may not be as productive, since users behavior are also to be considered in conjunction with the user friendliness of the application.
Recommendation.1: Implement based on needs

Corporate needs to realize the restrictions of the mobile devices on screen size, keypad, memory, and the power of handling applications. It is essential to clearly understand what type of information is needed and the flow of the information. Once it is all well understood, it then should apply to the constrained capacity of mobile devices to deliver the most relevant features and data. Corporate needs to isolate the features and functions that impact the productivity, and avoid the inclusion of features that may leads to users’ frustration with irrelevant information and functionalities.

Pitfall.2: Inflexible Application Architecture

Inflexibility arises when the sales force and field professionals needs to rapidly response to the dynamic tactics by changing and adapting information provided by mCRM application, but poor architecture design of the application does not support the changes. To respond quickly to new threats and opportunities, corporate needs to dynamically adapt business processes. Effective mCRM application architecture allows flexibility of redesign and adjustment of the system to fit the dynamically changing business processes. Since mCRM application needs adaptation to corporate business processes over time, ongoing application management costs must be also considered. On top of this, the other costs and time must also be taken into account, such as time and cost required for users training on the new system, managing any technical problems such as fixing errors and bugs on the new system, and any possible loss of productive time due to system adjustment. The most important key to this issue is that corporate needs to understand how fast and flexible it is to add new
applications and make adjustment or modification to the mCRM system with the least time and cost.

**Recommendation 2: Concentrate on Flexibility**

Corporate should invest on the application with an architecture that enables easy modification and upgrades. And on top of this, the application should be able to run on various mobile devices. The flexibility does not only counts on the modification of the system but also factors such as how easy it is to change the content and structure of the display interface, how easy it is to customize data to deliver only relevant information to specific users, how complicated is the upgrading process, and finally the time and cost involved. Corporate needs to ask these questions prior to selecting any mCRM applications.

**Pitfall 3: Poor Synchronization Technologies**

Synchronization is the process of updating data between mobile devices and corporate application. It is the key to the entire mCRM application process where information is transfer to the mobile handsets. Corporate cannot look over this process if effective mCRM solutions are to be achieved. Some applications may take several hours for synchronization as well as a support from IT for any trouble shootings. Slow application synchronization on mobile handsets to update or retrieve information to and from corporate application may leads to user frustration, poor service quality, slow response to customers’ inquiries, and slow deal closings.
Recommendation.3: Select Thin Mobile Client

Corporate needs to ensure that synchronization between mobile device and back office application takes only a few minutes and needs minimal IT support. Mobile client is a software client that installed in the mobile device to interact with corporate back office application. When synchronizing a significant amount of data, large mobile client tends to slow down the network connection than the thin client. Thin mobile clients are faster and less likely to crash. It is necessary to make sure that the chosen mobile client has a proven architecture and efficiently fast enough to synchronize relevant information.

Pitfall.4: Poor Interface Design and Functionality

Functionality and interface design is the key factor for users to make use of the application effectively. Without a good user interfaces and functionality providing to users to obtain the relevant information, the application is almost useless. The key to effective mobile solution is the ease of use. Providing unnecessary functionalities and complicated user interfaces only frustrate users and only lead to slow access to the relevant information.

Recommendation.4: Simple Screen Layout and Navigation Menu

Mobile devices are limited to screen size and layout. Displaying reams of information on a small screen will not a good idea. For example displaying information on the screen should be fit to the size of the screen, and not scrolling left to right to read the information. When designing the interface it is important to consider whether the application displays data in an easy to find manner with logical order navigation menus. The less scrolling required on mobile device to read the information, the more
efficient the browsing is. The other point is that whether application can be customized to fit any mobile device screens in order to be effectively accessible by various models of mobile devices.

**Pitfall.5: Fail to Support the Channel Communication**

The needs of channel partners and vendors cannot be ignored when it comes to the development of mCRM application. Channel partners and vendors must be able to update and exchange any necessary product or service information for closing the deals and to support filed professionals. Sales channel partners may need to access to product and customer information and send any relevant information back to field professionals to help them in closing a deal. Collaboration between corporate and partners is essential for the success of business processes. The mCRM application needs to support collaboration between the two sides. Deployment of the same application on the partners’ system may not be as easy considering they have different types of operating systems and hardware devices. The application suitable for corporate access may not be suitable for accessing from partners’ site. A close application architecture leads to crippling communication channel between corporate and channel partners.

**Recommendation.5: Select Open Architecture that Supports Collaboration**

It is important to consider whether mCRM application architecture permits extension of application to users regardless of operating systems and hardware devices. Open internet architecture enables deployment of mCRM applications across almost every type of mobile devices and computers, as internet based applications can be accessible from almost any devices through any operating systems. Providing extension of
mCRM solutions to partners enhances collaboration however the cost of training and supporting partners should also be taken into account.

Pitfall.6: Fail to Involve Users in Implementation Process

Proactive and frequent input from users and their involvement during implementation process of application is very important in developing an application which is most suitable and with least obstacle to user adoption. Adjustment made to application after users interaction with the system to fit their requirements takes time and cost. To establish user productivity, different groups of users unique requirements are needed to take into account in order to best optimize mCRM solutions.

Recommendation.6: Get Users Involved with Phased Implementation Process

Corporate should select the vendor that provides phase development approach with mile stones and supports user involvement in each development phases. At each milestones, corporate should measure functionality and productivity gains. This phase development approach not only provides necessary user input but also accelerates user adoption to the system.

3.3 Measuring ROI

Accessing and measuring how implementing wireless solutions can help an organization addresses its core business objectives and Return on Investment of a particular wireless project. The role of wireless can play significantly for supporting activities and needs of various departments. While many organizations will be familiar with some of the benefits of deploying wireless solutions to both sales and engineering field forces, there are other areas, such as warehouse management, that
offer further opportunities for business development. Many wireless deployments provide benefits in more than one business area.

ROI for wireless investments are realized in the following terms:

- **Revenue generation**
  Increase revenue by selling the right product to the right customer at the right time for the right price.

- **Employee productivity and service quality improvement**
  Boost productivity and efficiency by leveraging existing enterprise applications for field workers.

- **Cost saving**
  Reducing costs by providing less expensive means to interact with both employees and customers.

- **Customer acquisition**
  Acquiring customers by reaching a wider audience unconstrained by time and place.

- **Customer retention**
  Retaining customers by providing service on their terms.

- **Competitive advantage**
  Increases market share by increasing product awareness and enabling customer choice.

There are several distinct business areas that can deliver ROI from wireless deployment:
Sales

Providing the Sales force with wireless access to systems delivers cost control and customer service benefits, as well as offering staff an improved work/life balance. On-the-road scheduling increases staff efficiency and productivity. For example, by using remote synchronization, diaries and contact databases can be updated, eliminating the need to visit the office and delivering a significant travel time saving. Additionally, the provision of laptops and other wireless devices enable staff to utilize what so called ‘waste time’ example when traveling. This has been estimated to represent a sales staff efficiency gain of up to 30%. Access to real-time information is hugely valuable, sales staff can review relevant information prior to the visit and answer customer questions immediately by accessing corporate systems.

Improved product information combined with pricing, inventory and delivery times leads to improved customer service. According to research studies, a 5 – 10% increase in sales conversions. Real-time access to corporate systems also removes the need for back-office administrative functions dedicated to inputting sales information. This is estimated to save up to 70% in input time, and enabling administrative staff to be refocused on more profitable or productive business activity. Direct interaction with corporate systems enables a business to implement new processes that improve
efficiency. For example, direct integration with billing systems can increase the speed and accuracy of invoice generation.

Wireless solutions can directly reduce costs by reducing remote access and telephone and fax charges. Indirect cost reduction is achieved by increasing worker productivity, improving customer responsiveness, enhancing customer satisfaction and improving employees’ working life.

Field Service

Wireless enablement of the field service workforce delivers many of the benefits those mentioned above. In addition, the provision of information enables a reduction in task completion time as a result of access to parts and relevant product information. As a result of enhanced task completion, organization achieves a reduction in number of service visits required to fix problems. The productivity rises when field service professionals can access to parts information for the availability of needed parts and update corporate billing information on the services and update customer service information.

Human Resource

Wireless solution provides a huge opportunity to improve the work/life balance of employees, facilitating new working practices and improving morale. Flexible working practices are proven to increase productivity and reduce absenteeism. Additionally, companies report increased loyalty and a reduction in staff turnover, as well as an ability to attract new skilled personnel. Wireless technology is also being used to build and maintain dispersed teams and team members, irrespective of staff
location. Time can be reduced because dispersed teams can communicate more effectively and they will be better informed about cancelled or delayed meetings, traffic congestion and so on.

However, there are also dangers in working remotely, such as workers feeling isolated and the challenge of managing people remotely. It is, after all, a change in people working lifestyle. Providing the introduction of the systems and practical education with training sessions on how to use the systems will be an essential part of successful implementation.

**Customer Service**

Many of the improvements achieved through Field Force Automation and Sales Force Automation have a direct impact on customer service levels. The availability of real-time information provides the customer with the ability to make valid decisions immediately based on the cost and availability of goods or services. Though the benefits to an organization of improved customer services are intangible, any developments that increase customer retention are extremely valuable with a significant cost of attracting new customers and retaining existing ones, and reduce customer churn rates. In addition, the delivery of enhanced customer information via wireless devices can reduce the cost of a customer services infrastructure. This further frees up the customer services staff to concentrate on more productive and profitable customer initiatives.
3.4 Mobile CRM vs. traditional CRM

Traditional CRM is the practice or approach that enables organisations to identify, attract and increase retention of profitable customers by managing relationships with them, where the main business operations are done by telephone calls, fax calls, and data sheets.

MCRM is the use of technology to provide corporate employees and customers with anytime anywhere access to an organisation information through self service personalised applications and enable two-way interactivity between the employees or customers and the enterprise continuously at anywhere at anytime.

The following table describes the comparison between traditional CRM and mobile CRM in several aspects, and benefits of mCRM over traditional CRM.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Traditional CRM</th>
<th>Mobile CRM</th>
<th>Benefit of mCRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>• Customer feed backs, follow up appointments, and product requirements are recorded independently to each field sales representative.</td>
<td>• Customer feed backs and appointments are updated directly to customer database right after the sales meeting. • Field sales accept/reschedule appointments, access</td>
<td>• Connectivity and real time update to customer information at anytime anywhere. • Real time sales status updates.</td>
</tr>
<tr>
<td>St. Gabriel's Library, AU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Field sales** make phone inquiry to office for product information, contact information, and scheduling.  
**Field sales** receive customers' call back on product information and follow up by fax or phone calls.  
**Service orders and scheduling** are made by phone calls.  
**Product inventory checking and ordering** are made by phone or fax calls.  
**Service details and tracking/billing records** are updated |
| **to detail product information and customer contact information, product inventory through their mobile device on the go.**  
**Field sales present and transfer product information on their mobile device to customer at time when it is inquired.**  
**Service orders and scheduling/rescheduling are done through mobile device at real time.**  
**Access to product inventory system and detail product information at point of service.**  
**Service details and tracking/billing service records are updated** |
| **Faster deal closing.**  
**Less customer callbacks.**  
**Less phone and fax calls for sales.**  
**Improve customer services.**  
**Increase accuracy of data.**  
**Easier tracking of service records.**  
**Enable faster service ordering and** |
| Marketing, Public Relation | • Marketing messages are distributed by printed materials, fax, mail, email, phone calls.  
• Customer response made by phone calls, emails, forms.  
• No guarantee reach/read of message to target customer. | • Marketing messages are distributed to customers’ mobile devices.  
• Customer response sent through mobile device and store in the system.  
• Guarantee reach/read of message to customer mobile device with delivery report.  
• Enable location-based marketing. | • Provide customer with convenience of instant responding.  
• Increase effectiveness of campaign.  
• Decrease marketing cost. |
| --- | --- | --- | --- |
| Internal Operation | • Meeting requests are made by individually calling each attendee or by email, which does not guarantee reach of request message. | • Meeting request broadcast to all the attendees, and accept/reject response made through mobile device.  
• The most recent visibility. | • Increase operational effectiveness and efficiency.  
• Increase information visibility. |
to those who are out stationed.

- The most updated information is available only after system synchronized with individually recorded information.

<table>
<thead>
<tr>
<th>Channel</th>
<th>Collaboration</th>
<th>Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business channel contacts and information sharing are reachable while online to pc and to corporate system or by fax and phone calls.</td>
<td>Contacts and information access/sharing reachable at anytime at anywhere when needed.</td>
<td>Customer has several points of contact such as marketing, sales, support.</td>
</tr>
<tr>
<td>Improve business relationship between channel partners.</td>
<td>Increase channel collaboration.</td>
<td>Customers’ information is synchronization of</td>
</tr>
</tbody>
</table>
recorded separately at each department, and need more time employee to realize customers’ needs after collection of pieces of information.

information provides employees with the same information and view on customer data.

- Increase customer loyalty.
- Centralized control of data.

Table 3.1: Comparison between Mobile CRM and Traditional CRM

Figure 3.2: Traditional CRM Structure
3.5 Criteria for mobile CRM investment

There are several major criteria that an organization needs to consider prior to making any decision for investment of mobile CRM solutions. Mobile CRM may sound to be the best solution to apply to CRM activities in the organization, however the effectiveness of mobile deployment depends largely on consideration of the following criteria:

**Organizational size / Number of filed professionals**

The size of organization plays a huge role in consideration of mobile investment. Whether the organization consists mainly of field professionals who spend most of their working hours out of the office closing deals and providing services to clients or most of the business is done working from the office desk.
Marketing Activities
The frequency of marketing activities that the organization set up play a part in decision making whether to deploy mobile solutions. Mobile CRM reduces marketing cost and increase reach of marketing message to the target.

Customer Interactivity
The organization needs to consider whether how much of organization's business activity is involved with direct customer interaction to organization itself and organization data. Interaction means in terms of customer direct responses to organization messages, billing, information access, etc.

Data Mobility
Need of data mobility due to many factors such as sharing information access with business partners where their major business activities are outside the office location, filed employees need of access to corporate data on the go, need of real time data updating, etc.

Collaboration
Organization needs to consider how much and how often communication is needed for collaboration between the organization and the business partners in terms of retrieving information, accessing to products data, and synchronizing information between the two parties to support decision making process.
Business Nature

The nature of business is something that organization needs to look into when considering deployment of mobile solutions. Whether the business is product based or service based, needed to be consider due to the fact that the business that provides services needs real-time data and involves in more filed services than the business which is mainly product based.

The following diagrams illustrate the criteria in making a decision of mobile CRM deployment. The term CRM means the traditional CRM, where most of the information and documents are stored in paper form with long process of analyzing data to support any decision-making. ECRM in this project paper covers the operation of CRM in electronic forms except for wireless or mobile media. MCRM means the use of mobile media in corporate CRM operations.

Figure 3-4: Criteria for mobile CRM investment.
Organizational size and the number of filed employees within the organization plays a major role in consideration of mCRM investment. However, either one of organizational size or need of data mobility or collaboration does not independently determine the need of mCRM investment. The organizational size must be medium to large with a high priority in needs of data mobility and collaboration, in order to efficiently and effectively deploy mobile solutions for CRM.

While the organizational size is still very small with not many partners or business channels, it is better for the organization to stick to traditional CRM operational processes to avoid any inefficient use of electronic or mobile solutions. If the organizational size is large but data mobility and real-time information access is not at the high priority, organization should consider in investment of eCRM to enhance CRM operations, but does not necessarily move towards mobile solutions. Despite the company needs mobility of data and high collaboration between business channels, if the company size is very small, it tends to take a long period of time to gain any return on investment and efficiently make use of the mobile CRM solutions, thus it is recommended that the organization should invest in eCRM to enhance any CRM operations rather than mCRM. If the organization is mostly staffed with field professionals and the organizational size is medium to large and the need of data mobility and collaboration between business partners is high, mCRM is the most efficient solution to support this type of business environment.
Mobile solutions in terms of mobile marketing increase the reach and effectiveness of marketing campaigns and encourage customer interactivity to marketing messages. Organization needs to consider the amount of marketing activities it involves and how much of customer interactivity it needs for response to marketing messages, product inquiries, customer support, etc. The more marketing activities the organization involves in, and the more customer interactivities it needs, the more it is efficient to invest in mCRM solutions to gain the most effectiveness out of marketing campaigns. If the organization’s business nature is mainly providing services rather than selling products, it should consider mCRM investment at a high priority for better service provision and improving quality of services.
3.6 Vertical industry mobile applications

Business applications that are being deployed today with 2.5G wireless networks fall into two general categories: horizontal "mobile office" applications such as email that are used across most industries and "vertical" applications such as sales and field force automation programs that are specific to particular industry segments.

![Diagram of vertical industry mobile applications](source:IDC,2002)

Mobile office applications include voice communications and seamless wireless access to standard and customized applications such as email, calendar, corporate LAN access, Internet access, short messaging and instant messaging, and personal information being introduced to the market for 2.5G GSM/GPRS services is designed to support these applications, with features ranging from small standard keyboards to high-resolution, and rich color screens. In addition to these capabilities, 2.5G GSM/GPRS service also supports wireless deployment of a number of vertical applications specific to particular industries, such as the followings.
• **Sales force automation (SFA).** Constant wireless access to corporate information systems that help close a sale, such as customer profiles and information (e.g., CRM applications), inventory and order status, customer-centric enterprise resource planning (ERP) workflows, and remote communication tools including wireless access to email, instantaneous alerts, and traditional Product Information Management functions.

• **Field force automation (FFA).** Wireless dispatches, alerts, staff location status and management, picture imaging, real-time updates to central databases from mobile personnel, and order completion status.

• **Fleet management.** Vehicle location management, dispatches, completion status updates, messaging, in-vehicle navigation, and repair and functional status of vehicles.

• **Government communications and public safety.** Wireless access to key personnel, field personnel connected to centralized databases and command centers, field reporting, information sharing, and in-vehicle navigation.

• **Telemetry and remote monitoring.** Machine-to-machine wireless connectivity for automated meter reading, inventory status and updates, asset and fleet management, and customer-to-machine ordering and billing via wireless devices.
- **Point of sale.** Verifications of credit card sales, order inputs and status updates, and voice communications with mobile staff members, all with handheld wireless devices.

- **Customized solutions.** Flexible new wireless technologies such as GSM/GPRS that allow the development of customized applications to meet specific business industry needs, such as Point of Care applications and Disease State Management applications for Medical industry, wireless transaction management applications for Financial industry, and so on.

### 3.7 Mobile applications benefits

The benefits from any automation project, including mobile computing, can be classified into two categories - tangible benefits and intangible benefits. Tangible benefits can be quantified more easily than the latter variety.

**Tangible Benefits**

The saving that results from staff reductions is probably the most obvious economic benefit associated with a mobile computing solution. Mobile computing can lead to increased individual productivity, increased sales per sales person, more service calls per repair person and less time spent by professionals on administrative work, all of which can ultimately translate into a reduction in total staff required.

However, there are several other tangible benefits associated with mobile computing solutions. A higher order-fill ratio as a result of accessing real-time inventory
information at the time an order is submitted can translate into reduced inventory costs. On-the-spot invoice production in service vehicles can lead to shorter payment cycles and better cash flow. The electronic citation/ticketing applications with credit card payment of traffic violations that public safety agencies are experimenting with can lead to a higher ratio of paid fines.

**Intangible Benefits.**

Many of the applications of mobile computing involve automating sales, improving customer service or gaining a competitive advantage, which all benefits that tend to be difficult to quantify. The project team should outline these benefits with as much detail and as specifically as possible. The group should then translate these benefits into percent increases in sales, market shares and productivity improvements. If the benefit can not be quantified with a high degree of reliability

The following table shows a range of potential benefits that can all be used to justify mobile computing applications.

<table>
<thead>
<tr>
<th>Mobile/Wireless Applications</th>
<th>Benefits (Tangible &amp; Intangible)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales Automation</td>
<td>• Shorter sales cycle; increased sales per sales person — reduced head count • Elimination of order entry staff; more accurate data in database • Better customer service — reduced merchandise return • Lower inventory costs</td>
</tr>
</tbody>
</table>
| Computer Aided Dispatch For Service Representatives | • Increased number of service calls per day  
• On-the-spot invoicing — faster payment cycle  
• Electronic dispatch of parts — reduced administrative and inventory costs  
• Improved customer service |
| Health Care Industry | • Less administration for doctors  
• Better patient care  
• Tele-diagnostics — faster diagnosis |
| Public Safety Applications | • More efficient deployment of law enforcement staff;  
• Reduced time to reach scene of crime, hospital or fire — safer communities  
• Lower voice-network costs  
• Fewer dispatch or communications control center personnel  
• More efficient records management through officer entry of incidence reports |
<table>
<thead>
<tr>
<th>Industry</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accident/Collision Data Systems</td>
<td>• Real-time entry of accident data avoids subsequent duplication of effort</td>
</tr>
<tr>
<td></td>
<td>• Information available to police and insurance simultaneously</td>
</tr>
<tr>
<td>Taxi Dispatch</td>
<td>• Less cruise time</td>
</tr>
<tr>
<td></td>
<td>• Credit card authorization leads to improved service and more customers</td>
</tr>
<tr>
<td></td>
<td>• Reduced dispatch personnel costs</td>
</tr>
<tr>
<td>Financial Industry (Insurance)</td>
<td>• Reduced selling cycle</td>
</tr>
<tr>
<td></td>
<td>• Superior customer follow-up</td>
</tr>
<tr>
<td></td>
<td>• Higher dollar sales per sales presentation</td>
</tr>
<tr>
<td>Financial Industry - (Stock</td>
<td>• Faster trades — more trades per hour</td>
</tr>
<tr>
<td>Trading)</td>
<td>• More accurate trading</td>
</tr>
<tr>
<td>Retail Industry</td>
<td>• Faster sales stations during seasonal sales</td>
</tr>
<tr>
<td></td>
<td>• Reduced electrical and wiring costs</td>
</tr>
<tr>
<td></td>
<td>• Improved customer service</td>
</tr>
<tr>
<td></td>
<td>• Automated vending machines with credit authorization lead to higher sales</td>
</tr>
<tr>
<td>Airline Industry</td>
<td>• Better customer service leads to higher</td>
</tr>
<tr>
<td>Category</td>
<td>Benefits</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>sales</td>
<td>• Fewer missing baggage complaints — reduced tracing costs</td>
</tr>
<tr>
<td></td>
<td>• More accurate maintenance data leads to safer plane flights</td>
</tr>
<tr>
<td></td>
<td>• Electronic dispatch of parts results in less time in grounding of planes under service</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>• Lower wiring costs as a result of wireless LANs</td>
</tr>
<tr>
<td></td>
<td>• Accurate inventory control</td>
</tr>
<tr>
<td></td>
<td>• More accurate production tracking</td>
</tr>
<tr>
<td>General Office Applications</td>
<td>• Better document control</td>
</tr>
<tr>
<td>(Public Sector)</td>
<td>• Reduced administrative staff requirements</td>
</tr>
<tr>
<td></td>
<td>• Timely access to bills under debate in the legislature</td>
</tr>
<tr>
<td>News Communications (Sports,</td>
<td>• Lower wiring costs as a result of wireless LANs</td>
</tr>
<tr>
<td>conferences)</td>
<td>• Real-time scores fed to media - score competitive advantage</td>
</tr>
</tbody>
</table>
Most of the benefits of mobile/wireless solutions are considered to be intangible in terms of automating sales, improving customer service or gaining a competitive advantage, which all benefits that tend to be difficult to quantify. However, the amount of money savings after implementation of the solution should be able to quantify for justification of the efficiency of mobile deployment. The following is the basic formula used by large corporations in quantifying the amount of money savings obtained by a particular mobile solution deployment, which is directly affected by number of users effectively using the solution.

*Formula for Quantification*

\[
\text{Savings} = \text{Number of Users} \times \text{Bundled Wages} \times \% \text{Productivity Improvement} + \text{Sales Increase} \times \text{Profit Margin} \text{ (because of improved customer service)} + \text{Decrease in inventory costs} \times \text{interest rate multiplier}
\]

[Source: www.mobileinfo.com]

### 3.8 Business sectors for wireless applications

Various business sectors are increasingly realized the importance and benefits of wireless applications and the power of 2.5G and 3G integrated voice and data solutions. The following industries are deploying wireless applications to bring productivity and benefits to their business operations and to increase competitiveness.

**Financial services.** The financial community is at the forefront of experiencing the power of wireless, particularly Stock Exchange and mortgage brokers. Through widespread deployment of wireless email and distributed financial services
applications, the financial community remains constantly connected to key staff, customers, and critical business applications.

**Public safety and government.** Integrated voice and data communications allow constant access to centralized command centers and databases, real-time access to critical applications such as staff and resource status, instant database checks, and remote reporting into centralized monitoring functions. In addition, the robustness of wireless communications systems in both natural and man-made disasters enable instant update of information for real-time data.

**Manufacturing and wholesale trade.** Solutions such as ERP, CRM, and supply chain management (SCM) applications can be wirelessly deployed to both staff and key vendor partners to allow instant access to SCM information, inventory and delivery status, and latest pricing developments. By utilizing the real-time benefits of wireless, enterprises can gain efficiencies in inventory management and other distribution-related costs. By putting critical inventory information in the hands of its salespeople, large manufacturing and wholesale goods companies can provide their field representatives with vital analysis to complete a more consultative sale.

**Transportation and fleet management.** The transportation sector, which is intensely focused on mobile assets and personnel, can particularly benefit from wireless data solutions. Beyond voice communications, wireless can offer real-time updates to and from field personnel and vehicles to central databases, ERP, location-based services such as vehicle tracking by geographic location or Global Positioning System (GPS), inventory management with real-time wireless updates.
to and from delivery vehicles, and remote wireless monitoring of vehicle performance.

**High tech.** The extremely competitive high tech industries are in one of the first sectors to deploy wireless solutions to key staff and business partners. They may include financial industries such as banks, Insurance, Trading, Medical, Education, and so on that realized the benefits of wireless solutions to bring operational efficiency and effectiveness. In particular, front-office CRM applications are being deployed into the field, creating a competitive edge for sales and field staff by providing instant access to updated customer data, order and inventory status, pricing, and supply chain management information.

Other historical and/or emerging types of mobile/field services segments, not generally included in the high tech mobile/field service base, but that also represent attractive market targets to wireless-based service management system services providers, include:

- Electro-mechanical equipment maintenance and support
- Postal/Delivery services
- Consumer home appliances (e.g., refrigerators, washers/dryers, satellite dishes, etc.)
- Commercial/residential utility services (e.g., gas, electric, water, oil, plumbing, etc.)
- Construction services (commercial, consumer, institutional)
Transportation services maintenance (e.g., local/regional transit, freight, rail, etc.)

Metrology/telemetry installation/calibration services

Medical services

Home-based healthcare

Travel/Leisure (e.g., hotels, airlines, tour agencies, etc.)

Media/Information (e.g., news, movie theatre, etc.)

Educational Institutes

Public safety (e.g., police, fire, etc.)

Insurance

Trading Companies

Wholesalers/Retail Stores

Government/social services

Other non-IT and emerging segments

3.9 Cost consideration for mobile CRM deployment

Deployment of mobile/wireless solutions within the organization concerns with various aspects of cost ranging from one time capital investment, consulting, and ongoing operational costs. The following describes the various issues that the organization needs to take account for cost consideration.

1. One time capital expenditure

1.1 Hardware

1.1.1 Mobile workstation hardware (ex: cell phones, PDA, etc.)
1.1.2 Wireless Radio Modems - wireless LAN adapters, Access Points

1.1.3 Mobile Communications Server Switch (MCSS) hardware and software

1.1.4 Hardware Upgrade costs

1.2 Software purchase or license fee

1.2.1 Software license for end user devices

1.2.2 Software for backend network servers, application servers etc.

1.3 Software development or customization

1.3.1 Application Development Tools Unique to Mobile Computing

1.3.2 Wireless Communications Software in the client device and servers

1.3.3 Software changes and enhancements

1.4 Vertical or Horizontal application package costs

(Package cost per user multiply by number of users)

1.5 Mobile application testing cost

1.6 End user documentation and Training cost

1.7 Project implementation cost – system installation cost

1.8 External consulting service cost

1.9 Contingency – allow 10-15% over run

2. Ongoing operation expenditure

2.1 Telecommunication network services cost

2.1.1 Short message services cost

2.1.2 Data services cost
2.1.3 Wireless access service cost

2.2 Computer processing and operations

2.3 Maintenance cost – hardware, software, applications, equipment

2.4 Ongoing users training and documentation cost

2.5 Technical Support cost – internal and/or external outsourcing

3.10 Selection criteria for mobile middleware

Once your organization has determined to engage outside help for its mobile initiatives, the following selection criteria should be used to help evaluate vendors:

Does the middleware support multiple devices?

The ability to support a broad spectrum of devices is very important. The organization needs to be certain that the vendor to be selected supports current device operating systems and is committed to incorporating additional devices as they become more prevalent. At a minimum vendor support should include:

- Palm
- Pocket PC
- RIM
- EPOC
- J2ME
- GPRS
- WAP
- SMS
Beyond just multiple device support, your vendor should be able to maximize devices functionality so that the user experience is optimized – regardless of device type.

Does the middleware support multiple networks?
Though the build out of high-speed next generation wireless networks promises to eliminate many of the holes in network coverage, there will always be competing carriers and some degree of network latency. Vendors with relationships with most of the major carriers should be given preference.

Does the middleware support voice and data applications?
For some applications, data is enough. For others, voice integration is crucial. Take care to select a vendor capable of supporting applications that offer both voice-centric, data-centric and integrated voice/data applications.

Does the vendor offer a hosted and installable version?
Hosted applications are usually located at vendor sites built with stringent security protocols and enterprise-class redundancy. When enterprises are ready to bring the application behind the corporate firewall, a vendor with proven expertise in both models can assure an elegant migration. The following describes the comparison between Hosted deployment and Enterprise deployment.

Hosted Deployment: wireless service is co-located at secure data center.

- Achieve a quicker time-to-market
- Enjoy a reduced initial investment
- Support a smaller number of users
• Support a moderate usage pattern
• Deployment where usage is difficult to predict

Enterprise Deployment: wireless software is installed behind corporate firewall.
• Ensure additional control
• Achieve a lower cost of ownership over long term
• Support a large number of users
• Support a heavy usage pattern
• Deployment where usage is easier to predict

Does the platform support multiple applications?
The solution to select should support certain applications, and be capable of extending corporate applications through an extensible, open-source platform. Compelling wireless applications are created by developers experienced in optimizing the end user experience while overcoming limited bandwidth, screen sizes, device memory, etc.

Several criteria for developing compelling wireless applications are:
• New wireless applications
• Dedicated data feeds
• Timely information
• Interactive to any device
• Optimization of devices
• Closing actions
Does the vendor support multiple languages?

Preference should be given to vendors who support multiple languages so as not to burden IT resources. The platform should come equipped with support for the following languages:

- WML
- JAVA
- XML
- HTML
- MML
- HDML

3.11 Security consideration for mobile CRM deployment

Wireless data brings productivity and efficiency to enterprise, however securing data access from mobile devices is much complex than traditional security. Authentication of mobile devices is simply not sufficient enough for providing wireless security. Enterprises must be aware of how traditional security challenges change in relevance in a wireless world. Key considerations include the followings.

Privacy. This is the most important component of secure transactions and is required when transmitting sensitive information (such as credit card numbers, financial details or patient records) so the information cannot be seen or used by other parties. Established privacy protocols and procedures are critical for wireless applications as wireless transmissions are ground zero for hackers.
Authentication. Electronic authentication typically involves using a token or certificate that can be verified by a recognized Certification Authority (CA). Digital signature technology is one way of authenticating users. However, simply authenticating the device is insufficient for providing wireless security.

Two Factor Authentication. This process is used to verify both the device and the identity of the end-user during a secure transaction (i.e., two-factor authentication confirms that both the device and the user are authorized agents). Two factor authentication is critical in protecting network integrity from the inevitability of stolen or lost devices.

Data Integrity. This concept involves the detection of any change to the content of a message. For example, when an end-user instructs a bank to transfer $1000 from one account to another, integrity guarantees that transaction specifics in the user's message cannot be altered without alerting the bank or the user. If the message is altered in any way during transmission, an integrity-driven security system detects this alteration.

Non-repudiation. This process establishes a system so that users cannot deny they took part in a transaction. Non-repudiation is similar to authorization, in that it requires successful authentication of the user, but it also establishes a credible and legally enforceable record of all transactions.

Encryption. Encryption involves scrambling data bits using mathematical algorithms to protect data.
CHAPTER 4: CASE STUDY – MOBILE HEALTHCARE

4.1 Healthcare overview and challenges

Healthcare professionals are among the most mobile workers, so there is demand for fast access to healthcare information that is critical to decision making and saves time in the workday. A large number of high-priced professionals - physicians, surgeons and nurses employed in this industry do not render services from a fixed location and are essentially mobile within one or multiple hospitals, clinics or home care institutions. They need to be in constant touch with specialists who can render advice in their specific specialty area of expertise, sometimes from remote locations.

Currently, for hospital administrators, executives, physicians, researchers, lab technicians and financial staff, making informed decisions is complicated by:

- Data that is not easy to analyze;
- Lack of timely information;
- Restricted access to information that limits them from performing the desired information analysis; and
- Restricted access to information at the time when it is needed.

These are due to the multiple challenges and weak points of healthcare centers. Accurate and up-to-date data is paramount for physicians to successfully treat their patients. A written diagnosis misread, a record lost in mounds of papers, or time-sensitive information in piles of documentation waiting for processing can impact the way in which a physician can deliver timely treatment to his patient and can make a
difference in a patient’s health outcome. The challenges that face healthcare industry’s ability to carry out its mission are numerous:

- Physicians’ patient notations improperly deciphered or erroneously input into medical record keeping systems result in costly and cumbersome report processing. Quality patient care can suffer. Records may have to be edited or re-entered adding to the cost. Corrections and changes to patient information make it less reliable.

- Hundreds of thousands of patient fatalities and injuries occur due to the errors in the administration of prescription medication. These errors result in the loss of billions of dollars annually for the health care industry and costs for lawsuits. With thousands of drugs and drug combinations on the market for doctors to choose from and prescribe, human processing errors markedly increase.

- Use of paper-based reporting processes to deliver critical medical transportation and response services result in lost income for transportation providers. Inconsistent patient information duplicated between the providers and hospitals, most often on illegible carbon copies, add to the cost of providing medical services. Quality services and the health concerns of patients can be compromised. Emergency professionals need accurate patient information to the hospital prior to the patient’s arrival.
A dependency on paper-based medical records, surgical reports, and lab test results by physicians and health care workers adding unnecessarily to an already overloaded work schedule. Patient information can be mishandled while health care workers spend more time reprocessing documents. Using manual storage and retrieval methods increases the potential of misplaced documents and compromises patient confidentiality. Not only does this consume an enormous amount of time, it takes away from what the health care worker was trained to do - provide care for patients.

Improper collection (and recollection) of a myriad of diagnosis codes result in lost revenue charges. With the complex and ever changing rules and regulations in the billing process, many health care professionals "downcode" in order to avert denials in charges and insurance audits. This results in lost revenue to medical institutions and decreased compensation to medical professionals.

Inconvenient and time-consuming access to medical reference documentation result in medical students spending less time on direct patient care and learning. Timely healthcare information is needed immediately in the clinical or hospital operations. Health care professionals cannot afford to spend more time trying to find the appropriate information and resources for their patients.

Healthcare interaction consists of internal environment and external environment. Internal environment consists of medical centers, outpatient centers, operation centers, inventory department, purchasing department, which perform internal operations of
the center. External environment consists of consumers, vendors, payers, and transaction processor. The following figure describes the external environment which most of the healthcare center needs to interact with.

![Healthcare external environment diagram](image)

Figure 4.1: Healthcare external environment

4.2 Major drivers for mobile healthcare

Mobile healthcare application not only eliminates those weak points and but also reduces any possible medical errors, many of which caused by the time-consuming, paper processes used throughout the industry.

The followings are the major drivers for healthcares for moving towards deployment of mobile applications.

To improve patient care and satisfaction. Mobile healthcare applications enable patients to have access to hospital information at real time whenever and wherever
they are in need. Enabling direct access to medical related information such as pharmacies, insurances, and other medical resources from both inside and outside the medical settings provides convenience and saves time for any decision making. Providing such speedy and convenient access to medical information and services to patients at time they need it, increases patient satisfaction and loyalty to health care center.

**To increase practitioner productivity.** With the mobility of accessing patient information and any critical medical information across the hospital branches and networks provided to medical practitioners, it improves faster decision making and better use of their time in other medical activities such as spending more time in hospital with patients to provide a closer consultancy and etc.

**To increase operational efficiencies and save cost.** Mobile healthcare solutions reduce any paper works and transactions, providing less data errors and speedy operation processes. Mobile applications also reduce cost by streamlining the claim submissions and collection processes and cutting down errors caused by traditional paper-based systems.

**To increase revenue.** Mobile solutions can increase revenue for healthcare centers by reducing errors in charging for services, reducing the amount of claims denied, and increasing the number of patient visits due to increase in customer satisfaction of health care services.
5.3 Components for mobile healthcare empowerment

Healthcare centers require three basic yet critical components, as illustrated in the figure below.

- **Portable Devices**: The recent handheld computing phenomenon and the maturing of the Internet is now playing a key role in eliminating the challenges mentioned above facing the health care industry. Deployment of handheld computers (HPCs) and personal digital assistants (PDAs) with network access is advancing the goal of providing the highest quality medical care. Devices running Palm’s PalmOS and Microsoft’s Pocket PC have literally placed the power of immediate and accurate information in the hands of medical professionals.
• Software Applications: An increasing number of medical software applications able to run on these devices are becoming available. Through local area network and Internet synchronization to networked database servers these applications help physicians download and capture critical clinical data, service charges, prescribe proper medication, and document essential patient information accurately and timely. Nurses and medics easily record vital statistics and deliver the correct services and medication to the correct patients.

• Network Access: Enabling the portable devices to connect to the network to avail of the software applications is the crucial third component to empower the caregivers. As physicians, nurses and other care givers spend a larger percentage of their time on patient care than at their desks, network access products are now available that can be cost effectively deployed at MANY conveniently locations. These network access points must meet four important criteria.

  o Easy to deploy: Network Access products must be easy to deploy and should integrate seamlessly with the facilities infrastructure.

  o Cross facility access: The Access products must allow care givers to access information from a wide variety of locations within the facility and also from other facilities as physicians often work at hospitals and clinics.

  o Non-Interfering: Healthcare facilities must be satisfied that network access products will not interfere with the facilities patient care equipment.
Cost effective: Cost is often a factor of time to deployment, cost of incremental products for each caregiver and cost of access points.

Building the foundation for integration of each department within the healthcare center to enhance secure information flow is the major step to mobile healthcare solutions, where integrated information can be accessed from anywhere.

Integration of existing different legacy systems and applications can be done by XML integration layer consisting of information management and security management tools. The XML integration layer enables the development of new applications and functionality based around XML-driven workflow. XML technology has the ability to easily create this type of data integration layer. In XML the structure of data is sent along with the actual data over standard Internet protocols (HTML). An XML-based language schema consists of a set of tags — the vocabulary — and the way tags can be used — the grammar. In addition, many XML-based languages have been, or are being, defined through collaborative ventures by standards bodies, groups of companies in a particular vertical market, and governments. Adoption of such XML standards, where available, will make interoperability easier.

The following figure describes the integration of existing healthcare systems and applications with XML integration layer and provides single view access of information from any kind of devices.
4.4 Mobile healthcare applications

Mobile healthcare applications can be categorized into different categories according to the objective and usage of applications, as described further in this section. Different applications are designed for different users such as physicians or nurses, patients, or pharmaceutical sales representatives, based on users needs.

Point of Care Application

Point-of-care applications are designed based on needs and requirements of doctors, nurses, physicians, and hospital staffs to increase their productivity in daily operation activities. Point-of-care applications reduce the overhead associated with traditional paper-based systems. They provide improved efficiency and timeliness of healthcare services. Faster access to critical data enables physicians to spend less time doing
paperwork so they can spend more time interacting with patients. Since better quality services are provided to patients, the exposure to potential lawsuits can be reduced.

Billing cycle benefits are also derived from streamlining the claims submission and collection processes. Mobile healthcare applications automate charge capture, provide properly coded documentation, and cut down on the number of claims that are reduced or denied due to inaccurate record keeping, thus assisting healthcare organizations increase profitability. Insurers and managed healthcare companies are also interested in point-of-care wireless applications because they can reduce costs by directing doctors to less expensive drugs when there is a choice of medicines to prescribe. In addition, prescription drug mistakes caused by illegible handwriting can be reduced.

The following are specific point-of-care wireless applications:

*Patient referral information / patient referral generation.* Tracks key data as patients are referred from one physician to another. Time taken for documents transfer between department sections and any possible lost of data and documental records are reduced.

*Electronic medical record (EMR) retrieval.* Enables electronic medical records such as diagnostic & procedure histories and progress notes to become mobile medical records. Enable patient history to be viewed from a mobile device and for vital patient data to be entered, real-time, at the point-of-care.
**Wireless note-taking capabilities.** More efficiently captures data electronically while in front of patients rather than dictating information from scribbled notes afterwards. Enable updates of patient medical record from wireless notes to medical database.

**Access to medical condition databases.** Enable access of patient medical records and medical reference information through wireless device both from inside and outside the medical settings.

**Access to protocols and guidelines.** Enable wireless access to medical protocols and standard procedures or guidelines.

**Lab test order / lab test results.** Gives physicians immediate access to critical information such as the date and time the test was performed and the exact test values. Lab review applications are especially valuable to physicians that order high-volume tests, such as infectious disease specialists, endocrinologists, hematologists, and oncologists.

**Medication databases.** Enable access for checking drug references, formulations, and interaction information faster and more accurately.

**Prescription generation and distribution.** Electronically writes and transmits prescriptions to a pharmacy section wirelessly with or without the option of prescription alert to patients for their medication.
Queue call alert. Provides mobile paging or text messaging alert to patients' mobile devices notifying the call for their queue while patients are away from the healthcare counter.

Clinical Trial Data Collection

Clinical trial data is recorded, transmitted and managed by a time- and labor-intensive paper system. The system is complicated and inefficient, with data often remaining hidden for weeks in unprocessed piles of paper forms. Wireless applications deployed for clinical trial data collection streamline complex data collection methods. This translates into increased accuracy and timeliness of data and enables quicker processing time for trial medications. The following are specific Clinical Trial Data Collection wireless applications:

Data collection from trial subjects. Captures electronic data at the point of origin and update the record remotely to medical database, and results can be tracked on an ongoing basis.

Symptom monitoring. Collects and stores patient information such as blood sugar levels, blood pressure, cholesterol, weight management data, etc. using a mobile device as a personal healthcare assistant. This data creates a clinical trial subject profile on the go and allows clinicians to remotely monitor and more accurately recommend a course of action.
Disease State Management

Disease state management (DSM) examines how to efficiently and cost-effectively care for patients who have a certain disease condition or state. DSM applications are designed for patients providing them convenient access to any relevant medical information and better services while they are at remote sites. DSM enables aggressively management of disease and keeps preventive care centralized when clinicians have less time, fewer resources, and increasing demands for efficiency and accountability. The following are specific Disease State Management wireless applications.

Access to medical condition databases. Enables patients to retrieve information regarding insurance, medical conditions, physician contacts, and make appointment with physicians.

Symptom monitoring. Collects and stores patient information such as blood sugar levels, blood pressure, cholesterol, weight management data, etc. using a mobile device as a personal healthcare assistant. This data creates a clinical trial subject profile on the go and allows clinicians to remotely monitor and more accurately recommend a course of action.

Symptom analyzer. Enable patients analyze their symptom remotely without visit to health care center, and provides questions for patients to ask doctors during their visit.

Drug interaction checker. Information database that allows patients to access and check to determine whether a drug or supplement they are taking interact with their current medications.
Alerting & confirmation for prescribed medications. Notifies the patient to take prescribed medications, and patients can then remotely confirm that the medication has been taken. The medication record is then kept in patient medical record for future reference.

**Pharmaceutical Sales Force Automation**

Wireless applications provide mobile connectivity to back-end enterprise systems like Sales Force Automation solutions. Mobile workforce automation enables pharmaceutical sales representatives to completely capture time sensitive physician and prescription information at the point of origin. This cut down decision cycle times and provides the sales force with the latest, most accurate information. As a result, sales representatives are more productive and responsive to physicians’ needs. The following are specific Pharmaceutical Sales Force Automation wireless applications.

*Account data access and Lead tracking.* Enables field sales to access to corporate database of key information on particular prospects and accounts. Tracks the status of a sales pipeline and the status of particular prospects and accounts.

*Corporate data access.* Provides sales, product, compensation, and quota information. Integrates with enterprise resource planning solutions such as SAP as well as contract and pricing software.

*Medication dispensed tracker/medication prescribed tracker.* Enables field sales representatives to follow the demand for particular medications prescribed by particular accounts.
Access to calendar/email software. Provide access for field sales to personal information management (PIM) software like Lotus Notes and Microsoft Outlook and calendar or scheduling software on the go, and share with group members.

4.5 Direct benefits to patients

Mobile healthcare solutions benefit the healthcare centers as a result of increasing productivity, increasing operational efficiencies, saving costs, establishing architecture and standards, simplifying ongoing management and administration for IT. While the mobile application benefits across healthcare organization business departments such as human resources, finance and administration, there are many direct benefits that touch patient care.

The followings are some of the areas where patients are being positively affected.

- Billing and claims processing becomes more efficient for patients, insurers and healthcare providers as information is extracted from electronic records and at anytime at anywhere.
- Disease management takes into account the entire health status of each patient and offers a prescribed treatment and medication. By providing convenience in accessing medical information, and providing alerts for prescribed medication, patients are more closely monitored of their treatment and medications.
• Patients are provided with anytime anywhere access to physician information and make appointments prior to their visit, access to their medical records and treatment information.

• Patients can spend more time with physicians for treatment and consultancy due to physicians’ time effectively productive by the use of mobile applications.

The results of a well-implemented mobile healthcare solution improve the quality of care, decrease costs, and enhance healthcare providers' organizational performance. Physicians, researchers, lab technicians, administrators, financial staff, and managers are able to focus on improving quality of patient care. In addition, patient care is often enhanced because health care providers can share and analyze information freely and flexibly, increasing productivity and efficiency by having access to timely information that is most relevant to them at their fingertips.

4.6 Framework for mobile healthcare initiatives

There are six main initiatives that drive successful mobile healthcare deployment, as illustrated below.
The key to successful development through deployment of mobile healthcare solutions relies mostly on creating a clear strategy. The key points for creating successful mobile healthcare strategy include the followings.

- Creating a clear strategy which brings tangible/measurable results
- Frequent communication with physicians or practitioner the direct benefits to them in conjunction with business benefits
- Initial development of project with limited scope, which meets the highest priority requirements, and provides flexibility for expansion for future needs
- Creating milestones that extend functionalities
- Ensuring continual feedback and comments
- Constant measures of performance in general terms

The strategy for mobile healthcare deployment starts with the end-users such as patients and practitioners, where their needs and requirements are the main focus of
application development. *End-users* enable information and process needs to drive application. *Application* concerning design, process, reports, access, etc developed based on the end-users needs. The application will drive mobile device requirements. User interfaces, content display, functionalities of the application are the factors for selection of *mobile devices* required. The complexity of application and connection needed for specific mobile devices drive the requirement of *network* needs. The complexity of the entire system and proficiency of end-users determine *support* requires for medical healthcare solutions.

### 4.7 Initial investment projection summary

The investment data is based on the investment of mobile healthcare solutions in one of the top five hospitals located in Bangkok, Thailand. Top five hospitals are selected based on the criteria such as number of beds, quality of services, and facility provide. Based on the initial research studies, all of the top five hospitals are equipped with local network wired connection within the center with personal computers and servers, and most of them readily deployed electronic CRM (eCRM) system.

The investment projection figures below are based on the following information of the hospital.

- Hospital building: 12 stories, 1 million square feet
- Number of Inpatient beds: 600
- Number of Clinic Examination suite: 125
- Total employees: 2,000
- Number of doctors: 300 (full-time), 400 (part-time)
- Number of nurses: 500 (senior), 250 (nurse aids)
- Total number of Patient: 850,000 per year, 35% international patients
- OPD patient: 3,000 per day
- Total number of OPD Centers: 40
- Total number of Special centers: 9
- Total number of operation theatre: 19
- Total revenue per year: US $ 75 million

In this study, investment of mobile health care solution means upgrading of existing eCRM system to mCRM with the usage of existing computers and servers and with some additional investment on new equipments and software that support mobile connectivity and synchronization. There are two parts of investment for mobile connectivity for this hospital.

One part of investment will be for medical professionals, doctors, and nurses to wirelessly access data within the hospital compound using pocket PC devices for accessing to the followings:

- Patients’ medical records: detail information of each patient medical history, diseases, allergies, etc.
- Lab test results: notification for lab test result of each doctor’s diagnosed patient, and allows doctor to access for more detail of the lab test result through his/her pocket device.
- Transferring patients between doctors and hospital branches: allow doctors to refer or transfer patient to another doctor or specialist with recommendations and comments through their pocket device.
- Real-time note takings and diagnosis: practitioners can take notes on pocket device at real time during their diagnosis to patient, and update the information at real time to the server.

- Medications: allow doctor to prescribe medication to the patient through pocket device and information is updated real time to pharmacy department of hospital. This medication application is securely access by doctors with encryption and password for prevention of any misleading cases.

- Medical directories: allow medical professionals to access to them at convenience for their reference.

The other part will be mobile services to cellular phones of patients and hospital staffs for accessing and receiving the following information:

- Patient’s own individual medical record: allow patient to securely access through WAP or GPRS access to WAP pages of hospital, to retrieve their own medical records.

- Medication directory: patients can access for detail description of their medication pills through WAP page access.

- Marketing/PR messages: sent to patients’ mobile phones in short message (SMS) format, where patients can reply and response to the text message.

- Appointment making & reminder: allow patient to make appointment with doctors through WAP access or SMS text messaging, and send appointment reminder messages in SMS text message format to patients’ mobile phones.

- Pill taking reminder: allow patients to set reminder on their own on hospital web site to send reminder messages to their mobile phones at the time they wish, and repeat the reminder at various time intervals.
- Queue calling messages: send to patient’s mobile phone prior to their payment or pharmacy queue call.

The following table is the projection of investment based on the initial research on the products and services available in the market quoted in average cost, and none specific branded products or services are taken into account. Hospital should consider the flexibility of the costs stated below.

<table>
<thead>
<tr>
<th>Item</th>
<th>Expense (THB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. One time capital expenditure</td>
<td></td>
</tr>
<tr>
<td>Hardware</td>
<td></td>
</tr>
<tr>
<td>Mobile workstation hardware – PDA with Windows OS</td>
<td>6,600,000</td>
</tr>
<tr>
<td>(300 for doctors, 250 for nurses)</td>
<td></td>
</tr>
<tr>
<td>Wireless Radio Modems – wireless LAN adapters for all PDA</td>
<td>1,650,000</td>
</tr>
<tr>
<td>Wireless Access Points (100 points)</td>
<td>700,000</td>
</tr>
<tr>
<td>Mobile communication server</td>
<td>50,000</td>
</tr>
<tr>
<td>Hardware upgrade cost for existing PCs</td>
<td>500,000</td>
</tr>
<tr>
<td>Software Purchase or License Fee</td>
<td></td>
</tr>
<tr>
<td>Software license for backend application/network server</td>
<td>40,000</td>
</tr>
<tr>
<td>Software Development, Customization, and Testing</td>
<td></td>
</tr>
<tr>
<td>Customized Application development for mobile computing</td>
<td>500,000</td>
</tr>
<tr>
<td>through access to Mobile operators – server, PCs interfaces</td>
<td></td>
</tr>
<tr>
<td>Customized Wireless communication application for server and client devices</td>
<td>2,000,000</td>
</tr>
<tr>
<td>Component</td>
<td>Cost</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Software changes and enhancements</td>
<td>300,000</td>
</tr>
<tr>
<td>End user documentation and Training</td>
<td>200,000</td>
</tr>
<tr>
<td>Project implementation cost – system installation</td>
<td>250,000</td>
</tr>
<tr>
<td>External consulting service</td>
<td>200,000</td>
</tr>
<tr>
<td>Contingency (10% over run)</td>
<td>1,299,000</td>
</tr>
</tbody>
</table>

Total one time expenditure: 14,289,000

### 2. Ongoing Operation Expenditure (per YEAR)

<table>
<thead>
<tr>
<th>Expenditure</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telecommunication service cost – Short Message Service</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Maintenance cost – hardware, software, applications, equipment</td>
<td>500,000</td>
</tr>
<tr>
<td>Ongoing users training and Documentation</td>
<td>400,000</td>
</tr>
<tr>
<td>Technical Support cost – internal and/or external outsourcing</td>
<td>500,000</td>
</tr>
</tbody>
</table>

Total ongoing operation expenditure: 2,400,000

The hardware investment is recommended to use Pocket PC. This is due to the reason that most of the mobile applications available in the market are Microsoft operating system compatible in case that hospital needs any add on applications in the near future, less user training required since most of users are used to with the existing healthcare system runs on Microsoft operating system on their PCs, and better and easier interoperability between handheld devices and existing healthcare system running on Microsoft operating system.

Wireless access (WI-FI) IEEE 802.11 is recommended for investment as it has more stronger points over other wireless networks such as, more reliable, much faster at
11Mbps, has a longer range (1,000 ft / 305 m in open areas, 250 to 400 ft / 76 to 122 m in closed areas), and easy to integrate with into existing wired Ethernet networks. Mobile healthcare application is recommended to customize for better fulfillment of requirements and interoperability between existing systems and applications. Ongoing maintenance cost is not to be neglected as it is necessary to upgrade and make further adjustments to the system and applications as requirement changes.

The initial SMS charge is based on estimation of 70% patient description to hospital marketing and PR messages sent 3 to 4 times per month. This cost shall be incremented over period of time, as the hospital attracts more patients to hospital and subscribe to the service over period of time.

4.8 ROI and justification - benefits

While costs of hardware and software for these projects are less difficult to estimate, application development, application integration, and wireless network usage costs are far more difficult to predict. Estimation of benefits is even more difficult effort because many of the potential benefits from mobile computing and wireless applications result from mobile worker/professional productivity gains, business process changes (elimination of sub-processes), superior customer service and competitive advantages.

Return on investment of mobile computing in hospital can be realized in many terms, in both tangible and intangible benefits:
• **Revenue generation**

Increase in revenue by providing convenient services to patients such as providing the following services to patients’ mobile phones: queue number calling message, pill taking reminders, appointment reminder, access to medication directory and lab results, making appointment through mobile phones, public relation/marketing messages. Increase in revenue not only based on existing customer retention, and/or new customer acquisition, but also hospital needs to take account on increment of services charges to patients in a reasonable amount to cover mobile healthcare solution investment over period of time.

• **Hospital staff productivity and service quality improvement**

Mobile healthcare solution enhances doctors and nurses efficiency through increased access at real time to online medical resources such as patients’ medical records, medical directory, transfer of patient from one doctor to another, etc. It also increases sharing of knowledge among staffs, and improved quality of decision making by keeping key staffs informed with most updated information. In addition to this, service quality can be improved by providing better customer service (employees: are better informed, have shorter response times, have an improved ability to sense and respond), and higher quality interaction with customer due to doctors’ higher productivity. Research studies show that hospitals increase in productivity of 15 – 30% through deployment of mobile healthcare solutions [source: mobileinfo.com].
• **Cost saving**

The hospital has to look into mobile health care solution as a long-term beneficial project and should not expect a return on investment over a short period of time. Cost saving on mobile deployment over traditional CRM can be realized in various areas such as marketing/PR expenses, cabling cost, telephone bills, documents, etc, providing less expensive means to interact within the center and with patients. Formula for quantification of cost saving can be described as follow: [source: mobileinfo.com]

\[
Savings = Number\ of\ Users \times \$\ Bundled\ Wages \times \%\ Productivity\ Improvement + \$\ Sales\ Increase \times \ Profit\ Margin\ (because\ of\ improved\ customer\ service) + Decrease\ in\ inventory\ costs \times \ interest\ rate\ multiplier.
\]

It implies that the more the users of mobile solutions, the more the cost saving is for the hospital, with all the other factors remaining at constant.

• **Customer/Employee Acquisition and Retention**

Hospital can acquire new customers by providing services to patients without any constrain of time and place, and retaining existing patients by providing services on their terms with convenience. Increment of retention not only involves with hospital’s patients but also hospital staffs are less likely to leave the hospital not mentioning their morale is also increased, and hospital also attracts high quality employee to the work place. Based on research studies, hospital can increase 30-35% in customer retention and acquisition [source: mobileinfo.com].
• **Competitive advantage**

Hospitals provision of convenient and quality services increases customers' awareness of products and enables their choices on top of other healthcare providers. Gaining competitive advantage over other healthcare providers means acquisition of new customers and increasing market shares.

### 4.9 Future trend of mobile CRM

The future trend of mCRM industry will be rapid CRM growth for mid-size to large-size market, and a rapid penetration of various new models of mobile devices supporting voice, data, and multimedia contents. The penetration of divergence mobile devices at reasonable prices and high-speed mobile networks supporting both voice and data connection enhances the feasibility of mCRM deployment nowadays and further more in the near future. The importance of CRM to the organization and a rapid growth of mobile devices determine future growth of mobile usages for CRM operations.

Currently, there are five trends that are strongly influencing the mobile or field service market:

- Service management software is now being developed to handle the entire service business, and not just small tactical areas.
- Communications technology is promising to greatly improve the efficiency, flexibility and performance of service organizations.
- The web has made universal access a requirement for software.
- Organizations are attempting to limit customization of software and for the first time the software industry has the ability to make products far more configurable.

- Integration/interoperability between different software packages – the transfer of information between applications – has been made much easier because of XML.

Once again, it is clear that the technology is already here. However, the problem has always been to find the one software package that has been able to successfully integrate all of the relevant technologies into a single, practical, real-time solution based on a wireless foundation with GPS mapping functionality. The most recommended approach is to develop a customized application or solution based on the organization requirements to fit the real needs.

To address the trend that nowadays customer are equipped with information more than ever so as to increasing needs of obtaining personalized product and service, CRM performing companies have to accomplish such a challenging task of putting CRM into electronic form and extension to mobile handsets to increase the reach and effectiveness of their CRM operations.

4.10 Mobile device penetration

Penetration of mobile devices has been staggering over the past few years with new models launching quarterly supporting various options for voice, data, multimedia, video, and applications. Almost every phone in the market nowadays fully supports
SMS two-way messaging technology, which is the basic technology for mobile CRM solutions. As impressive as SMS device penetration is, perhaps more remarkable is consumer willingness to receive marketing messages and product information on those mobile devices, and marketing research found that mobile permission based marketing is 50% more effective than TV marketing and 130% better than radio [source: Enpocket].

The emergence of MMS technology enables the communication with combination of graphics, text, animations, and audio and creates rich user experiences. MMS users can send messages to other MMS device users, PCs, PDA users. MMS usage scenarios include animated greetings with audio or text, synchronized playback of audio and text, and video clips. As carriers further develop MMS strategies and expand high-speed network footprints, MMS technology will become far more mainstream.

Figure 4-5: Examples of MMS mobile phones

No matter what the preference is, there is a mobile device available to match the need for either organizational use or personal use with various kinds of options. Whether
QWERTY keyboards or pen-based computing; small SMS phones or more powerful smart phones; long battery life, black and white displays or color displays, there are hundreds of mobile devices available. The following chart provides a brief look at the more prevalent devices on the market today.

<table>
<thead>
<tr>
<th>Mobile Device Type</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMS and WAP phones</td>
<td>Widely available, Reliable, Small, Inexpensive, Long battery-life, Few color models, Limited audio capabilities</td>
</tr>
<tr>
<td>J2ME and BREW</td>
<td>Offline processing, Larger memories, Color displays, Animation support, Shorter battery-life, Not widespread, More expensive</td>
</tr>
<tr>
<td>Smart phones</td>
<td>Powerful processors, Large memory stores, Rich color displays, Concurrent applications, Shorter battery-life, Not widespread, Clunky, Very expensive</td>
</tr>
<tr>
<td>Two-way pagers</td>
<td>Inexpensive, QWERTY keyboard, Longer battery-life, Popular primarily in youth market</td>
</tr>
</tbody>
</table>

Table 4-6: Mobile device divergence [source: Air2web]
CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

In conclusion, mobile CRM is an effective solution for investment in large organizations with service oriented business processes. However, several factors shall be considered prior to the investment. One of the major concerns for this investment is a high initial investment cost of mobile hardware and mobile solutions integration cost. However, organization should look into the return on investment of this solution over a period of time, which can be in terms of both tangible and intangible benefits that bring effectiveness and efficiency to the organization. In terms of technology, mobile CRM solutions can be deployed through wireless network such as WIFI, or through existing 2.5 G telecommunication network with the use of either WAP or GPRS technology. In Thailand, mobile CRM solutions seem to be pretty new to the market, and solutions providers need to educate the market on the benefits it brings to the organization. In addition, telecommunication providers of 2.5 G, and in the future with 3G technology, should provide corporate mobile solutions with reasonable investment cost, to penetrate the market.

The technology is already there for extension of mobility to CRM solutions, but it’s the market that needs to be educated on the pains and needs of the industry and how mobile CRM can fit to it to bring more productivity and efficiency to organization business processes. However, the increment of mobile CRM market in Thailand can be foreseen as there is a very high penetration of mobile devices and a high competition among telecommunication and solution providers, where they all have the same vision in their market penetration to corporate solutions.
5.1 Limitations of the project

The limitation of this study is that the project research works are done based on the case and research studies of the companies and industries in other countries that are fully deployed with mobile CRM solutions, due to the fact that currently in Thailand there is no such industry of the scope that is fully deployed with mobile CRM solutions and thus no practical management strategies or/and financial projections are available. In this project, a top five hospital is modeled for the initial investment of mobile CRM solutions, based on the information publicized by one of the top five hospitals in Thailand but with no actual studies on the hospital due to a very restricted access of confidential information, and estimated return on investment for the case study includes no financial projection but figures based on the research studies on the reference articles of related industries.

5.2 Contributions of the project

This study contributes the knowledge and understanding on the advantages of deployment of mobile CRM solutions over traditional CRM solutions, from management point of view. The information provided in this study is intended for enhancing management decision making process for deployment of mobile CRM solutions from various aspects. The study intends to contribute essential knowledge to top management and general management of the organization for empowering CRM with mobility.
5.3 Recommendations and future research

The study recommended that future research can be extended to this paper on the technical aspects of the mobile CRM solutions based on the actual implementation process. The actual case studies for industries in Thailand is also recommended for further studies as in the near future more and more organizations in Thailand will realize the advantages of mobile solutions in various aspects of organizational operations, and deploy mobile technology to their current CRM systems. Since this study is based on deployment of mobile CRM over existing 2.5G telecommunication network infrastructure, future research can be done on deployment over third generation (3G) network where we can deploy a better user interfaces, higher interactivity, higher data transfer capability, and high speed multimedia support. This improvement of future technology will change various aspects of mobile CRM deployment on the positive side, in foreseeing future.
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APPENDICES

APPENDIX.1: Mobile healthcare solution vendors

The followings are some of the vendors who provide hardware, software, security, and applications solutions for mobile industry for deployment of mobile connectivity.

AvantGo

AvantGo Mobile Pharma is a customizable packaged mobile software application designed specifically for pharmaceutical sales forces. The only solution that offers real-time access to existing sales force automation (SFA) systems and other tools critical to influencing physician prescription behavior, AvantGo Mobile Pharma enables sales reps to maximize every physician interaction and drive market share.

The followings are the features of AvantGo Mobile Pharma:

- Detail planning and preparation including call objectives, notes, account information and physician data.
- On device call reporting. Real-time medical and clinical research news and alerts.
- 21 CFR Part 11 compliant sample management and signature capture capabilities on device.
- Access to all corporate information resources, including medical knowledge base, intranet, web-based data and more.
- Remote access to business-critical information such as contact and call history, just-in-time collateral, medical knowledge base, clinical data, intranet and more.
- Real-time capture of physician feedback.
- Always Available Access
- Supports all leading handheld device platforms (Pocket PC, Palm OS, RIM Blackberry Wireless Handheld™ Devices).
- Supports open standards (HTML, JavaScript, XML, and SSL)

Figure appendix 1-1: Detail Preparation

Figure appendix 1-2: Sample Management
Detail Preparation: Enable reps to easily make productive use of time between calls by accessing physician and prescription history, medical information and more.

Sample Management: Help reps manage sampling activity with electronic sample management tools Improve information accuracy by capturing.

Research indicates that as much as 75% of a rep’s time is spent in non-selling activities: waiting, traveling and performing administrative tasks. AvantGo Mobile Pharma transforms this downtime into productive, physician-focused activity, so that reps are better prepared and able to complete more calls in less time. (www.avantgo.com)

Clarinet Systems

Clarinet Systems is a global provider of wireless network connectivity for cell phones and handheld PC devices. Using innovative and patented technology, they are the first company to offer high-speed wireless LAN connectivity for virtually all handheld devices independent of their platform and OS, through a single access point. Using infrared technology to create a wireless extension of wired networks, Clarinet Systems’ enables healthcare, enterprise, education and public networks such as kiosks, hospitality and WiFi hot-spots the ability to create high-speed cost-effective content exchange and universal networking solutions for handheld devices. Platform independent to operate across multiple operating systems, the EthIR LAN family of products are designed to connect cell phones, Palms, Windows CE/Pocket PC, Laptops, Psion and Linux devices for content exchange and to the network using their existing built-in Infrared port and software.
The EthIR LAN family provides dedicated content exchange and high-speed network access for PDA, cell phone and handheld users. Utilizing infrared technology, TCP/IP and PPP ensure platform independence and compatibility with devices that are IR and TCP/IP capable. 10/100 Base-T & 802.11b unlink with DHCP capability guarantee maximum compatibility with your existing network. Auto-detect Pass Though Mode and IR Mode allow each port to switch between Ethernet or IR connectivity during operation without reconfiguring the switch. No driver or configuration software required because IR is build-in for most PDA, cell phone and portable devices.

A complete set of tools, software and accessories are offered to leverage the powerful functions in EthIR LAN beyond network access and enhance the security. These software and accessories include freeware such as ClarinetIRTM and Configuration ToolTM; OBEX web server application such as Download ManagerTM (DM); software development and deployment tools such as OBEX development kit (OBEX SDKTM) and OBEX deployment package (OBEX DPTM); security login such as RADIUS enhancement; Desktop and Wall Mounting Kits (DTK and WMK) for protecting EthIR LAN hardware products.

Figure appendix 1-3: Clarinet EthIR LAN ESB301
The EthIR LAN ® ESB301 provides all the benefits of a multiport EthIR Switch in a small form factor. The ESB301 contains two 10/100 Base-T switching ports, one IrDA infrared wireless network access point, DHCP and SNMP network management functions. One of the two 10/100 Base-T ports connects to your PC with a Ethernet port and the other one connects to the Ethernet uplink. The 4Mbps infrared (IR) port provides network access for Palm handhelds, Windows portable devices, Pocket PC, eBooks and other Internet appliances. All three ports in the ESB301 operate simultaneously and independently. (www.clarinetsys.com)

ePocrates

ePocrates provides a premium Clinical PDA software suite, eProcrates Rx Pro, which includes information on over 2800 drugs including off-label indications and formularies in an easy to use format, and compatible for installation on Palm OS and Pocket PC devices synchronized with PC/Windows and Macintosh computers . In addition to this, ePocrates RX Pro includes the following features:

![Figure.appendix 1-4: ePocrates Rx Pro™ Premium Clinical Software Suite features](image-url)
• Alternative Medicine Monographs & Interactions: Database with over 400 alternative medicine monographs, including drug interactions, adverse reactions, reported uses, cautions, reported doses, synonyms, and check interaction among up to 30 drugs and/or alternative medicines at once.

• Infectious Disease Guide: Application finds infectious disease treatment recommendations in less than 5 seconds, access over 300 diagnoses, and 350 bugs and 250 drugs, searchable by location and/or bug or drug.

• Clinical Tables and Guidelines: Treatment recommendation such as narcotic equivalents, endocarditis prophylaxis, hypertension guidelines, statin comparison, and medical formulas.

• Medical Calculator: Ideal body weight, body surface area, corrected QT.

(www.epocrates.com)

iMedeon

iMedeon provides ViryaNet mobile workforce management application, a complete support system for managing the delivery of services. The application includes functions such as Service call handling, Validation of contract terms and conditions, Entitlement, Call history, Non-contract calls, Parts usage, Calculation of charges.

ViryaNet's Workforce Management application is a complete call management system including call processing, scheduling, and dispatch, which fully integrated with ViryaNet Service Hub and other ViryaNet applications. The Workforce Management application components are as follow:
- Mobile FE: Support for a variety of mobile devices.
- Workforce Management Key Performance Indicators: Templates defined to provide workforce management information to support business decisions.
- Workforce Management Integration Server Services: Integration services to access mobile workforce management and interface packages to external workforce management systems.
- Dispatch Board: Internet-based assignment and scheduling system.
- Mobile Workforce Management Administration: Processes and interfaces to set up and configure the Mobile Workforce Management application.

MEDePASS
MEDePass is a leading provider of authenticated digital identities for licensed healthcare professionals and medical staff members. Medepass has combined Certificate Services from Microsoft with Luna CA3 from Chrysalis-ITS to create a digital identity service for physicians and healthcare professionals. Microsoft’s Certificate Services software provides the engine for managing certificates; while Luna CA3 provides hardware-based private key protection to ensure an efficient, secure solution for healthcare transactions.

MEDePass Certificates, designed to meet Health Insurance Portability and Accountability Act (HIPAA) security regulations, provide proof of a physician’s identity and the ability to encrypt and digitally sign email messages and other types of data such as medical records. The Medepass solution incorporates a highly customized version of Microsoft Windows Certificate Services to issue MEDePass Certificates,
and uses Chrysalis-ITS Luna CA3 hardware security modules to store and protect the critical private encryption key used in the issuance process.

MEDePass met its needs with a solution based on the Windows 2000 Server operating system with Internet Information Services (IIS) 5.0 (the Web server built into Windows 2000 Server), Windows 2000 Advanced Server with the Active Directory® service, and Microsoft SQL Server™ 2000, combined with the Chrysalis-ITS Luna CA3 hardware security module (HSM). The solution runs on two Windows-based servers—one hosting the Windows PKI-based Certificate Services, the MEDePass healthcare-customized certificate application, and the SQL Server database; and the second server providing a Web-based front end through which customers interact with the service.

Enabling the solution is the full PKI support and integrated security management features of Windows 2000 Server. The Certificate Services in Windows 2000 Server allow MEDePass to act as its own CA and issue and manage digital certificates, as well as to support multiple levels of a CA hierarchy. Active Directory provides both the PKI certificate repository and the management directory.

The cryptographic private keys (also known as root keys) used by Windows Certificate Services are stored in the Chrysalis-ITS Luna CA3 HSM, which provides dedicated protection for the CA's root certificate and private keys on which the rest of the certificate system is based. It also provides hardware-based key management and cryptographic acceleration designed to meet the stringent requirements of NIST.
PCS Health Systems

PCS Health Systems is a data warehouse management tool that bridges the gap between end users and its data warehouse.

PCS Health Systems had a good handle on system level details relating to its 800 Gigabyte data warehouse – items such as CPU utilization, disk utilization and the number of concurrent users. PCS has the ability to bridge the gap between the end-users and IT to better serve individual users, while at the same time ensuring the most efficient use of resources. PCS selected Usage Tracker™ data warehouse management software and is now able to track and analyze at the individual user and data level.

APPENDIX.2: Mobile CRM solution vendors

This paper covers introductory information on major mobile CRM solutions vendors providing full mobile connectivity to corporate solutions. Other vendors also listed for further references.

PeopleSoft

PeopleSoft CRM Mobile Sales and PeopleSoft CRM Mobile Field Service provide universal access to your enterprise applications wherever and whenever the company
sales representatives and service personnel need it. Solutions provide mobile and remote users enterprise information through: Disconnected access (from laptops and Pocket PCs), Internet access (both wired and wireless), Dial-up access (from any phone line), Office access (via LAN and WAN). PeopleSoft CRM Mobile Sales and PeopleSoft CRM Mobile FieldService enable users to set rules for simple conflict resolution based on their business processes, view a list of unresolved conflicts so users can take action immediately and control which information takes precedence. It also eliminates errors, decrease duplicate records, and maintain data accuracy.

PeopleSoft Mobile Agent consists of three technology components:

- **Mobile Page Processor**: Generates HTML pages on the fly.
- **Mobile Object Manager**: Manages both the synchronization and storage of local data.
- **IBM DB2E Local Database**: Provides high-performance data management with a footprint of approximately 200K significantly smaller than competitors’ products.

PeopleSoft CRM Solutions use the following technology for mobile deployment to create a collaborative global enterprise:

- **PeopleSoft Pure Internet Architecture**: to provide a multidimensional view of customers.
- **Enterprise Integration Points (EIPs)**: to communicate between PeopleSoft applications and third-party systems.
- **Industry-standard XML formatted messaging**: to share and exchange information throughout your extended enterprise.
• Unicode: to support the consolidation of over 120 languages into a single, worldwide system.
• PeopleSoft Enterprise Portal: to extend access beyond the enterprise, to customers, suppliers, employees, and partners.

(www.peoplesoft.com)

Air2Web
Air2Web is one the vendors providing a full mobile CRM solutions, and applies expertise in wireless, security, audio streaming, and enterprise software to the task of helping enterprises wirelessly enable applications for an increasingly mobile workforce and customer base. Air2Web solutions help companies discover new revenue streams and cut costs with mobile and wireless technology.

Air2Web applies comprehensive programming environment using open standards to access data directly; seamlessly blend voice and data in a single application; optimize device functionality; and not only reach, but interact with 100% of the digital device market. Air2Web provides the platform necessary to wirelessly enable all types of applications including critical back-end CRM, ERP, SFA, and SCM systems, and engaged in global deployment for multi-national customers including support for multiple character sets, local languages, and international standards including J-phone, I-mode, and 2-way SMS.

Air2Web provides the most powerful, flexible, and comprehensive technology for wirelessly enabling critical back-end information systems, corporate data, and email across any carrier, network, or device.
Air2Web wirelessly extends Back-end Information Systems with the following platforms:

*Mobile Internet Platform – Licensed Software:* Air2Web provides the Mobile Internet Platform – Licensed Software for businesses that are interested in the control and added security made possible by installing and maintaining their own wireless solutions behind their corporate firewall.

*Mobile Internet Platform - Hosted Deployment.*: Other businesses prefer Air2Web to host their wireless efforts in a highly secure environment to reduce initial investment and improve speed-to-market. The Mobile Internet Platform - Hosted Deployment is co-located in a secure data center with fully redundant network architecture.

Air2Web provides the most comprehensive wireless email solution called “2Mail” across the greatest number of back-end email applications and the broadest array of devices, minimizing total cost of ownership for the enterprise. 2Mail enables businesses to extend wireless access to Microsoft Exchange, Lotus Domino, IMAP and POP3 and comes equipped with access to email, calendars, contact information and attachments, and the ability to securely authenticate devices and users.

Air2Web Enables Wireless Notifications through an application called “2Nofity”. Air2Web technology enables corporations to interact more closely with customers and employees through wireless messaging. 2Notify supports messaging to a variety of landline and mobile devices including SMS, WAP and landline phones, PDAs, interactive pagers and desktop email systems.

([www.air2web.com](http://www.air2web.com))
SMP

SMP's Mobile Sales Solutions and Mobile CRM Solutions have an impressive track record of delivering superior business performance for both the insurers and the insurance professionals. SMP's Mobile Solutions are designed to meet the total business needs of the insurers and insurance professionals, by supporting the entire insurer insurance sales cycle in a disconnected environment. SMP's Mobile Solutions supports the entire sales cycle of the insurance professionals from understanding and performing financial needs analysis, to customizing a product(s) proposal for the client on the spot, to completing an electronic application, to underwriting the application at the point-of-sale, to submitting the proposal and application remotely -- anytime, anywhere. SMP's Mobile Solutions has the following features:

- **Two Strategic Business Tools in One-Device**
  SMP's Mobile Sales Solutions and Mobile CRM Solutions are two strategic business tools that meet the total business needs of the insurance professionals and insurers. These two strategic business tools are now available in a single device from a single technology partner.

- **Integrate-ability to Insurer's Back-End Systems**
  SMP Mobile Solutions are able to integrate seamlessly via SMP's eWORKFlow™ client-server application - with the ultimate objective of delivering a straight-through process capability to the insurers -- all the way from the points-of-sale.

- **Disconnect Capable**
  Using SMP's proprietary compression and database engine and life rating libraries, both the Mobile Sales Solutions and Mobile CRM Solutions can be
deployed in a disconnected mode - with connection to the back-end systems occurring only during submission. This capability empowers insurance professionals to be totally effective regardless of where he is - even when he is on the plane or on a cruise where there is communication is not easily available.

- **Multiple-Platforms Capable**
  SMP's Mobile Solutions are at their best when deployed on truly mobile devices such as handheld devices and PDAs - to take advantage of the devices' size, weight, long battery life, ease of use, and affordability. For users who prefer notebooks and desktops, SMP's Mobile Solutions are fully compatible and will work perfectly well.

- **Multiple-Language Capable**
  Languages supported include English (and other alphabet-related languages), as well as double-byte languages such as simplified Chinese and traditional Chinese, Japanese and Korean.

- **Track Record of High Adoption by Targeted Users**
  SMP's roll-out experience with insurers have proven that more than 80% adoption of the targeted users within 8-10 months is achievable and replicable through systematic implementation of high adoption strategies.

(www.smpdirect.com)

**Other Vendors**

- AvantGo
- Thinque
- Siebel
Firstwave

Firstwave offers a totally Web-based CRM solution, and has built a suite of adaptive and scalable products that easily integrate with your existing systems and allow for rapid deployment, ongoing maintenance and ultimately, a higher return on investment. Firstwave eFramework provides a foundation you can build on to address the unique challenges businesses face today, such as servicing an extended enterprise that incorporates direct sales, integrators, distributors, resellers, VARs, and any other business partners they may have. Firstwave eFramework empowers these diverse elements with instantaneous and complete information that communicates with a mobile, widely distributed sales force owning and controlling your data.

Architecture:

Firstwave eCRM Suite was specifically developed with an open architecture for the Internet. This architecture solves issues such as slow connection speeds and shared processors to easily accommodate users without sacrificing functionality or ease-of-use. In addition, this open architecture allows companies to easily integrate it with existing systems, avoiding time intensive and costly implementations.
Built on Extensible Markup Language, or XML, Firstwave's solutions utilize this open standards architecture to allow your company's software to talk with partners', customers', distributors' or other third-party's software. XML technology erases the line between applications and eliminates expensive and lengthy integrations. In addition, Firstwave eCRM components may be used in other applications to access data while enforcing security and business logic.

Firstwave eFramework is a true n-Tiered architecture with the goal to optimize performance over the Internet combining careful adherence to XML, MTS and COM+ standards with thoughtful enhancements at the application level.

- **Presentation Layer.** Access to the Presentation Layer is through Microsoft Internet Explorer version 5.0 or higher. Implemented as a truly thin Web-based client, the browser connects to Active Server Pages on the Application or Web Server for View and Data connections. The application user interface employs a number of novel interface concepts, including tab-based business objects with summary screens and task-based views.

- **Business Layer.** The Business Layer processes all requests for components and data functions and handles these requests with appropriate Business Logic.

- **Data Layer.** The Data Layer is comprised of an ODBC compliant database. Firstwave currently supports Oracle and Microsoft SQL Server. The application can be customized to support new or legacy data interfaces.

**Security:**

Firstwave solutions utilize a sophisticated, optimized data-locking mechanism. Firstwave allows application components to be secured, as well as individual data
components. Administrators can grant or deny access to specific components. When a user calls a secured object, the username and user group is read. Only those operations the user is allowed to perform can be performed. The user doesn't see the fields he is blocked from, so he or she is not aware of being deprived of functionality. Administrators can control access on multiple levels and for various functions. Administrators control the ability to create, read, update and delete at the business object (table) level, the field (column) level, and the specific row of a grid (record) level. Administrators also can determine which views are available for which groups and which items appear in the navigation toolbar.

Customization:
Firstwave eWorkbench provides a drag-and-drop, icon-driven development environment. With eWorkbench, users can easily perform the following functions:

- Change pull-down list boxes
- Customize security down to the field level
- Attach new Crystal Reports to Firstwave eCRM
- Add and delete fields, filters, and commands
- Create unique views of the data for each security group
- Create new business objects to extend the scope of the application

(www.firstwave.net)

PeopleSoft

PeopleSoft Customer Relationship Management is a comprehensive CRM solution offering greater user adoption, an improved user experience and real-time intelligence.
People soft uses PeopleSoft Pure Internet Architecture introduced with PeopleTools 8, which is completely focused on the Internet to support real-time business processes. It provides powerful new functionality for secure, scalable Internet-based access and integration. This next-generation architecture leverages a number of Internet technologies and concepts to deliver simple, ubiquitous, real-time PeopleSoft access with customers, employees, and suppliers.

PeopleSoft apply the following technologies on their solutions:

- **No code on the client**

  PeopleSoft Pure Internet Architecture is architecture without a client. There is no complex, expensive client software installation. The Internet device that accesses the Internet architecture already has all the software and configuration it needs. No Java applets, Windows DLLs, or browser plug-ins are necessary for this "thin" client architecture. Thus, the client can be a Web browser, mobile device, or external system that uses standard Internet technologies such as HTTP, HTML, and XML to communicate with the PeopleSoft Internet Application Server. Simple, open architecture creates easy, inexpensive access and collaboration where a Web browser and device operating system cannot be predefined, which is often the case for customer and supplier environments.
Power HTML

PeopleSoft has delivered an innovative user interface in its Internet architecture by leveraging standard Internet technologies such as HTML, JavaScript, and Web browser features. Power HTML features include:

- **User personalization:** Users can control their own personalization settings for how they interact with PeopleSoft.

- **Mouse-less data entry and access key support:** Power users no longer need to reposition hands constantly to and from the keyboard and mouse. Users can operate PeopleSoft applications completely from the keyboard.

- **Advanced search and drill down:** PeopleSoft relies heavily on search technology and click-through capability. Users can perform keyword, full-text, and natural-language searches to find relevant information quickly.
Minimized trips to the Web server: PeopleSoft new "deferred mode" requires no trips to the Web server until your application data is saved, and that means faster data entry for the power user.

(www.peoplesoft.com)

Other Vendors
- ACCPAC
- Applix
- Astea
- E.piphany
- Frontrange Solutions
- Pivotal
- SalesLogix
- Talisma
- Trivium Systems