Field Deployment Process Transformation in IBM PC Services

By

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ABSTRACT

Field service, as an important focus area of service operations, has increasingly become a critical component of the overall service offering by high-tech enterprises. Enhancing productivity by optimizing field services could bring significant benefits to the organization. This thesis investigates the field deployment process in IBM PC services and attempts to identify potential areas of improvements by applying principles in capacity management, customer-oriented services, as well as IT technologies, such as database and the Internet. In addition, demand statistics are analyzed to provide important insights into the limitations of the existing largely manual planning and scheduling process. A transformation plan is developed, with due consideration to both the capacity and efficiency of the Customer Solution Center and the overall experience of the end users.

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CHAPTER 1

INTRODUCTION

1.1 General Background

Field service is traditionally a sub-component of the manufacturing sector. As it has increasingly become a major contributor to high-tech corporations' strategy and profitability, more studies and research have been devoted to improving and enhancing field service efficiency (Blumberg, 1994; Agnihothri, Mishra & Simmons, 2003). Corporations have looked at various approaches to achieve higher productivity, including some lean and Six Sigma techniques, capacity management methods, real-time mobile technology, web, and database systems, etc.

There seem no hard and fast rules to solving efficiency problems due to the heterogeneous nature of various service offerings. Moreover, some problems exist because management is not taking an entire end-to-end perspective. For example, some call centres push customers to the field team to lower their call volume while it may take the field team much longer to solve problems. The net result is a loss for the company as a whole. Even technology is not the one-for-all answer for all problems because the advantage of using real time technology only plays a role when the need for faster and more versatile communication interface brings significant value to the field deployment process. Many field deployment tasks are rather fixed and real time communication is not critical to improving efficiency.

The problems involved in field service operations usually have multiple dimensions, be they organizational, technical, economical, or even behavioural (Duris, 2000). In addition, for any positive change to take place, one really has to take into account all these dimensions. This makes field service a worthwhile topic to study and allows the use of both some in-depth analysis of the field service statistics and some operations design principles to obtain the appropriate solutions.

1.2 Internship Motivation

This thesis project was completed at the Customer Solutions Centre (CSC) of IBM International Holdings, Singapore. IBM Singapore CSC was a relatively young organization, established only two years ago. Since its inception, IBM CSC has faced similar challenges as many other firms with field service operations.

The goal management has set for the internship students to achieve is to evaluate the existing end-to-end service delivery processes and identify potential opportunities of improvement. Three students worked on this project and each student was supposed to identify a problem area of his or her own and propose a solution.

The author has focused on field service evaluation and improvement. This thesis describes and discusses some major problems in field deployment services that CSC faces, redesigns some of the service procedures, and designs a planning and scheduling method. Some of the proposed initiatives are the works of the transformation team and have been put into practice; others are still being evaluated by various parties involved.

1.3 Prevalent Problems in Field Services

A recent article published in *The Mckinsey Quarterly* pointed out the reason why commonly used improvement approaches, such as Six Sigma or lean, do not always work to achieve productivity gains. The author attributed the ineffective uses of such principles to application of the theory to only part of the service processes or failure to account for the inherent variability in services (Fagan, Harmon & Lukes, 2007).

The problem of one department pushing its costs to another downstream may also contribute to an increase in overall service cost if the downstream department has higher cost structure than the one upstream. The problem can be avoided if the measurements of performances are conducted across departments and functions (Fagan, Harmon & Lukes, 2007).

Over-delivery due to fear of missing service level agreement is another problem that exists in field services. Furthermore, exceeding requirements for one customer can generate a tendency to over-deliver for others as well. An excessively high service level agreement or a misunderstanding of the exact level of service to provide may lead to overstaffing.

An end-to-end perspective starts when customers raise service requests and ends when customers are served and followed up. Taking such a perspective will be helpful for executives to make meaningful changes to improve overall customer satisfaction, rather than making departmental fixes (Fagan, Harmon & Lukes, 2007).

1.4 Best Practices in Field Services

Commonly used approaches to achieving productivity gains in field services include:

1.4.1 Closer Monitoring

A supervisor could ride along with the field engineer, take some direct measurement of the service time and identify some possible areas of improvement. Immediate productivity gains can be achieved if field engineer idleness has been a major problem. The direct measurement data could also be helpful in guiding future planning and scheduling efforts, as well as gauging the appropriate staff level for given demand (Fagan, Harmon & Lukes, 2007).

1.4.2 Efficient Routing

Routing jobs more efficiently could also bring significant gains in productivity. Minimizing traveling time will increase the time available for field engineers to work on the jobs themselves and thereby increase productivity (Morse, Prema & Shulman, 2007).

1.4.3 Capacity Management

Some capacity management approaches, such as overbooking, could also prove to be effective ways to match relatively fixed capacity with fluctuating demand. Based on historical data on percentage of cancellations, more service appointments are made than the available capacity. By taking this percentage of cancellations into account, managers can safely overbook the days of the field engineers since cancellations will probably allow them to be able to fulfill the rest of the committed demand (Morse, Prema & Shulman, 2007).

1.4.4 Demand Forecasting

Many companies do not have a sophisticated forecasting model that takes into account all relevant factors but overly rely upon "gut instinct or memory". Better demand forecasting, in particular, models that identify broader cyclical patterns, such as seasons, weather, sales and marketing agenda, major events in the community, or the media, could prove to be effective tools to forecast demand (Morse, Prema & Shulman, 2007).

1.4.5 Self-Service

Like many businesses providing customer care, field service companies could look into ways of helping customers solve problems themselves by offering detailed instructions and providing necessary tools. Asking customers to log service requests online, for example, is a way of reducing workload of call centers (Gilhooly, 2000).

1.5 Use of Technology in Field Services

A central database that enables field engineers, planning personnel, customers, and every other stakeholder in the process to have access to exactly the same and most updated information is one of the tools that field service companies should use.

A web-based solution reduces the amount of paperwork and allows multiple parties to access and update the central database. A customer web portal also serves as the communication channel between the customer and the company. Through such a web portal, service procedures, contact information and the most up-to-date schedule information could also be communicated (ABERDEEN Group Inc, 2006).

Mobile devices that communicate real-time information between the back office and the frontline field engineer are other tools that could be beneficial for organizations that require up-to-date information to be communicated real time (Johnson, 1999; Fulcher, 2006).

Advantages and gains of using these technologies include the following:

- Better scheduling, because communication with the customer is more effective on the web and the field activities are more visible when field engineers are equipped with mobile communication devices (Haugen & Hill, 1999).
- Faster billing and accounting, because job completion information is communicated to the back office database instantly with customer endorsement. There is no longer the need to wait for the paperwork to return before billing activities could commence.
- Reduced paperwork and better morale, because information could be stored electronically, field engineers are happy that they can spend much less time on paperwork and focus on the jobs themselves (FIELDCENTRIX Inc, 2004).
- Better inventory management, because a central database keeps track of the inventory required for the field service and with service requests forecasts, more accurate prediction of inventory need could be made available to the field service companies (Vigoroso, 2004).

Key considerations on the use of these technologies include (Gilhooly, 2000):

- How is the information stored and communicated across different platforms, such as the database, the web, and the mobile devices?
- What is the cost of the technology?
- What is the core capability of the technology?
- Whether the complexity of the service requirements warrants the use of the technology?

1.6 Problem Statement

Field deployment, as the last steps in the end-to-end service delivery process, has been experiencing difficulties in meeting the Service Level Agreement for contract 31. It has run into backlogs worth of two months' capacity while CSC started working on this contract only 6 months ago. CSC has outsourced field services to third party IT service providers and since the inception of the contract, two vendor companies have pulled out and the current vendor has indicated its intention to withdraw as well. CSC management has decided to transform the entire operation for this contract. The author, together with the transformation team, has been asked to investigate the operation and redesign the service delivery process, particularly the field deployment process, to make the entire operation more efficient and hence boost productivity.

1.7 Thesis Outline

Chapter 1 discusses the general background of field services, the prevalent problems, the current best practices as well as the use of technology in this sector. Not all technologies will bring substantial productivity gains to CSC operations; however, many service operation principles can be applied.

Chapter 2 provides background on IBM, IBM in Singapore, and especially the Customer Solution Centre. It will cover the services CSC offers as well as its organizational structure.

Chapter 3 describes the service delivery process, with particular emphasis on field deployment process in contract 31. Contract 31 is a customer CSC has been serving since the beginning of 2007. Field deployment processes for other contracts are similar, except for some technical procedures due to different IT applications used.

Chapter 4 analyzes the Net-Add demand and fulfillment characteristics. The statistics supported the hypothesis that the field deployment team had been subject to unnecessary pressure due to demand fluctuations.

Chapter 5 develops an alternative service offering solution, i.e. the transformation. Taking the perspective of a customer, CSC will change some existing service procedures to reduce the coordination efforts and time commitments from customers. The planners will also be empowered with a central database that manages large amount of information efficiently. A scheduling algorithm that both minimizes travelling time and buffers fluctuations of demand will be used to increase the productivity of the field deployment team. All the changes that will enhance customer satisfaction actually reduce the cost for CSC compared with the existing practices.

CHAPTER 2

IBM Global Customer Solution Center

2.1 Overview of IBM[1]

International Business Machines Corporation (also known as 'IBM' or 'Big Blue') is the world's largest information technology company headquartered in Armonk, New York, USA.

IBM was founded in 1889 as Tabulating Machine Company. It was incorporated as Computing-Tabulating-Recording Company (C-T-R) in the state of New York in 1911. And it formally changed its name to International Business Machines Corporation in 1924.

IBM had revenue of US$91.4 billion, net income of US$9.5 billion, and over 355000 employees in 2006. These are increases of 0.3%, 19.1%, and 8.0% compared to 2005 respectively. IBM has managed to continuously increase its earnings per share for the last 16 quarters.

IBM has employees in over 170 countries. The geographical distribution of revenue is listed in Table 1 (dollars in millions). IBM Singapore falls into Asia Pacific, which makes up the third largest region in terms of generated revenue.

FOR THE YEAR ENDED DECEMBER 31:	2006	2005
Geographies:		
Americas	$39,511	$38,817
Europe/Middle East/Africa	30491	30428
Asia Pacific	17566	18618
OEM	3856	3271
Total	$91,424	$91,134

Table 1. Geographical Distribution of Revenue[2]

[1] Adapted from Li, C. (2007). Qualification of the IBM CSC Factory in Singapore: Resource Estimation and Allocation in Software and Hardware Services, Master thesis, Department of Mechanical Engineering, MIT

[2] Source: IBM Annual Report 2006

2.2 Business Segments of IBM[3]

Organizationally, the company's operations comprise the following segments:

- Global Technology Services (GTS)
- Global Business Services (GBS)
- Systems and Technology Group
- Software
- Global Financing

Global Technology Services and Global Business Services are both part of Global Services. The main objective of Global Services is to provide solutions to clients. This is usually done using IBM software and hardware. Global Technology Services mainly deals with infrastructure services. It includes outsourcing, integrated technology, and maintenance services. Global Business Services mainly deals with professional services. It includes consulting, systems integration, and application management services.

Systems and Technology Group provides business solutions that require advanced computing power and storage capabilities. That includes server and storage sales, semiconductor technology and products, packaging solutions, and engineering technology services.

Software consists primarily of middleware and operating systems software. Middleware is a standard software platform that allows clients to integrate systems, processes, and applications. Operating software is designed to run computers.

The mission of Global Financing is to generate a return on equity and to facilitate clients' acquisition of mainly IBM hardware, software, and services.

[3] Adapted from Li, C. (2007). Qualification of the IBM CSC Factory in Singapore: Resource Estimation and Allocation in Software and Hardware Services, Master thesis, Department of Mechanical Engineering, MIT

Table 2 shows the revenue from continuing operations.

RESULTS OF CONTINUING OPERATIONS
Revenue
(Dollars in millions)

FOR THE YEAR ENDED DECEMBER 31:	2006	2005
Statement of Earnings Revenue Presentation:		
Global Services	$48,247	$47,407
Hardware	22499	24343
Software	18204	16830
Global Financing	2379	2407
Other	94	147
Total	$91,424	$91,134

Table 2. Revenue from Continuing Operations[4]

2.3 IBM Worldwide Organizations[5]

There are three companywide organizations at IBM:

- Sales & Distribution
- Research, Development, and Intellectual Property
- Integrated Supply Chain

Employees at the Sales & Distribution organization work in integrated teams with IBM consultants and technology representatives to deliver high-value solutions that address the clients' critical needs.

Research, Development, and Intellectual Property has the main objective of producing high impact hardware and software products as well as service solutions for the company's clients. IBM spends approximately US$6 billion annually for R&D. It has managed to be awarded more U.S. patents than any other company is in 2006. This is the 14th year in a row. These innovations have been able to generate direct intellectual property income of around US$1 billion.

[4] Source: IBM Annual Report 2006

[5] Adapted from Li, C. (2007). Qualification of the IBM CSC Factory in Singapore: Resource Estimation and Allocation in Software and Hardware Services, Master thesis, Department of Mechanical Engineering, MIT

Integrated Supply Chain works to transform its clients' supply chains for greater efficiency and responsiveness to global market conditions. It also continuously improves the IBM supply chain. Around US$36 billion are spent through the IBM supply chain annually[6].

2.4 IBM in Singapore

IBM established its first branch office in Singapore in 1953. The aim was to market and service its range of data processing equipment. Today, Singapore is a regional hub for several thousand IBMers comprising a growing Singapore team and members of the teams in Asia Pacific.

Singapore is the region's leading nation to adopt e-business and e-government. This has been attributed to both strong government support and presence of large number of multinational companies. IBM Singapore, as one of the major IT solution providers, is striving to play a major role in the development of IT in Singapore. IBM's technological capability, as well as its extensive experience in the sector has made IBM a strong player in the IT sector nation-wide. IBM's influence of everyday life in Singapore could also be seen in the IT infrastructures that are based on IBM technology----more than half the ATMs in Singapore use IBM technology[7].

IBM International Holdings (IIH) was formed to meet the overall manufacturing strategy for IBM Integrated Supply Chain (ISC). In 1994, ISC IIH Singapore began operations as a hard drive and network peripheral assembly site. In 2000, the unit added on facilities to provide microelectronics testing. Overall, there were 4000 employees in the Manufacturing and Development (M&D) community in Singapore in 2002. As Asia Pacific becomes the center of growth for many sectors, IBM has been continuously expanding and adjusting its position in the region.

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[6] Adapted from the 2006 IBM Annual Report and www.ibm.com

[7] Adapted from www.ibm.com.sg

Today, the main missions of IBM International Holdings include:

- Disk storage system manufacturing
- Tape storage system manufacturing
- Global Customer Solution Center
- Asia Pacific Integrated Supply Chain Configurator Centre of Competence
- Procurement Engineering, Southeast Asia
- Retail Store Solution (hardware & software)
- Software Development Lab
- Product Introduction (Software)
- Business Transformation and IT Deployment
- On Demand Supply Chain Lab (partnership with National University of Singapore)

2.5 Global Customer Solution Center (CSC)[8]

2.5.1 Overview

IBM Customer Solution Center (CSC) is part of IBM Integrated Supply Chain Organization (ISC). Globally, there are in total eight customer solution centers located in Rochester, New York, US, Markham, Canada, Poughkeepsie, New York, US, and Fujisawa, Japan, etc. CSC Singapore was established in 2005, and currently employs 25 professionals, working on different functions, such as planning, operations, IT, etc.

In IBM, CSC does not negotiate and develop business directly with the recipients of the services, but serves as the back office supporting department for IBM Brands/Services Team by physically delivering services for PCs and Servers, for example. IBM Brands/Services Team and its sub-groups are internal or potential internal customers for CSC. CSC, however, competes with IBM's business partners, who usually have the capability

[8] Adapted from Zuo, J. (2007). Pre-engagement Process Improvement in IBM PC Services, Master thesis, Department of Mechanical Engineering, MIT

to perform the same range of services. The end customers CSC serves are usually companies, educational institutions, and government bodies in Singapore.

To perform its functions effectively, CSC has internal contracts, referred as Document of Understanding (DOU) with its internal customers. Figure 1 illustrates the relationships among CSC, an internal customer, and end customers.

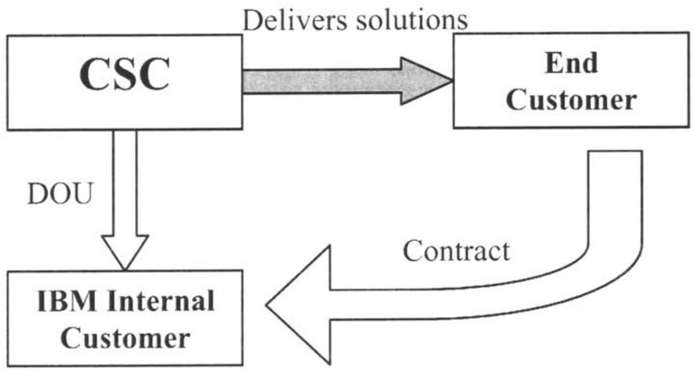

Figure 1. Relationship between CSC, Internal Customer and End Customer

2.5.2 Services

CSC supports customers' integration needs, including integration and staging services at both IBM and partner Customer Solution Centers, lifecycle asset services to extend the lives of used assets or handle leased returns and asset disposal, worldwide CSC network support, and logistics optimization to ensure fulfillment efficiency with the lowest cost possible. Table 3 lists down the range of services CSC offers.

Currently, CSC provides 5000-6000 PC and server units annually and has a cost recovery of US$800,000 per year. CSC Singapore is looking to expand its business in Southeast Asia.

CSC provides lifecycle management for IT equipments to customers, shown in Figure 2, including Pre-engagement Service, Ordering Management, Pre-Deployment Service, Deployment, Maintenance, and Retirement.

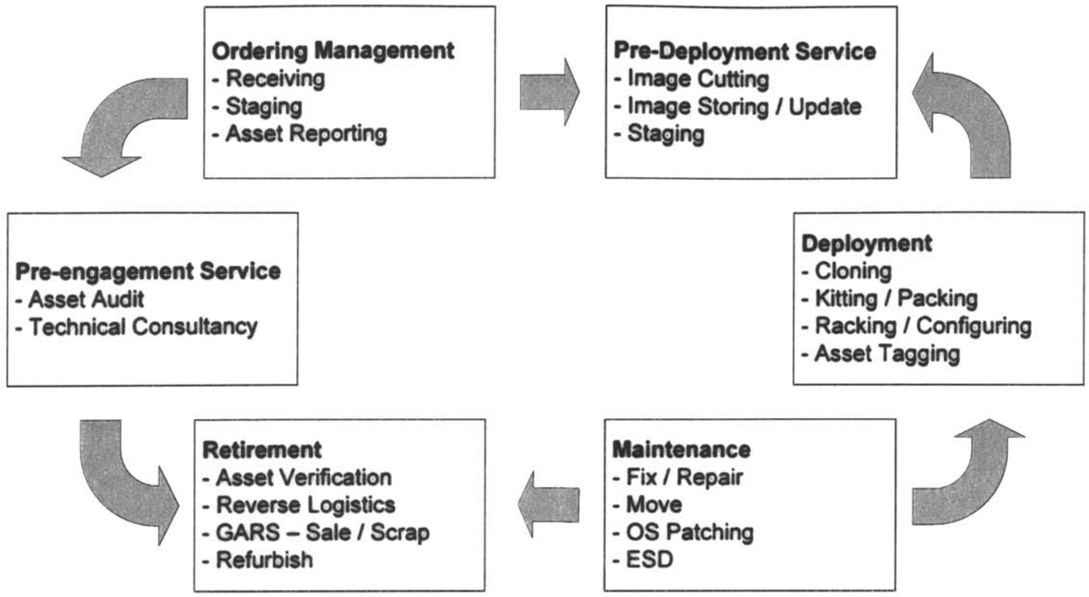

Figure 2. Lifecycle Management for IT Equipments[9]

2.5.3 Organization

Organizationally, CSC has three functional components, namely business, technology, and operations. The business function includes a Business Development Team, an Engagement Team and an Engagement& Project Management Team. They develop and maintain relationships with customers. The technology function is fulfilled by the Enablement, Process & Implementation (EPI) Team. On the one hand, they design the process and develop solutions with Engagement Team; on the other, they implement the solutions with operations teams. Operations functions include Customer Fulfillment Representatives (also known as planners), receiving, operations, shipment and procurement teams. Planners are in direct contact with end customers for order management, planning and scheduling. Receiving, operations and shipping teams directly handle PCs and servers on a daily basis. Procurement team is in charge of sourcing of vendors for delivery and field deployment services which CSC outsources to smaller IT service companies.

[9] Source: CSC Service Offering Presentation

Service Products	Service Components
Pick, pack and ship worldwide	o Receive inventory, verify and record
	o Pick from warehouse
	o Pick-per customer request
	o Ship-per customer request
	o Warehousing services
	o Short and long term storage
	o Custom packaging and shipping
	o Worldwide export expertise
Integration of packaged solution	o Single interface with owners of the solution
	o Acquire components required to build the solution
	o Integrate and test components
	o Build, package and ship solutions
	o Installation support at customer sites
	o Support for sales execution
Pre-loaded software	o Customer-specific software loads
	o Image loads to server and client machines
	o Bluebase applications packaging & deployments
	o Customization and parameters set-up
	o Test and quality tracking
	o Write media and documentation
Solution development, prototyping & integration	o Solutions design support
	o Hardware customization and software pre-load
	o From rack-&-stack to turn-key solutions
	o Solutions validation
Mass deployment	o Large scale operations
	o Customized hardware
	o Pre-loaded software
	o Integrated solution
	o Pick, pack and ship
System Test	o Hardware and software rental
	o From prototyping to large scale performance test
	o From proof-of-concept to certification
Product life cycle	o Installation of the solution
	o Pre and post-sales support
	o Project management or administration
	o I/T specialist services
	o Project administration services
	o Install
Life cycle asset services	o Hardware and software upgrades
	o Data migration from a used to a new machine
	o Erasing hard drive information
	o Assets refurbishing, recycling or disposal
	o Central repair and warranty tracking
Customized hardware	o Customized builds or upgrades
	o Integration of hardware components
	o Hardware parameters set-up
	o Test and quality tracking
	o Standard compliance

Table 3. Range of CSC Services[10]

[10] Source: CSC Service Offering Document v2.0

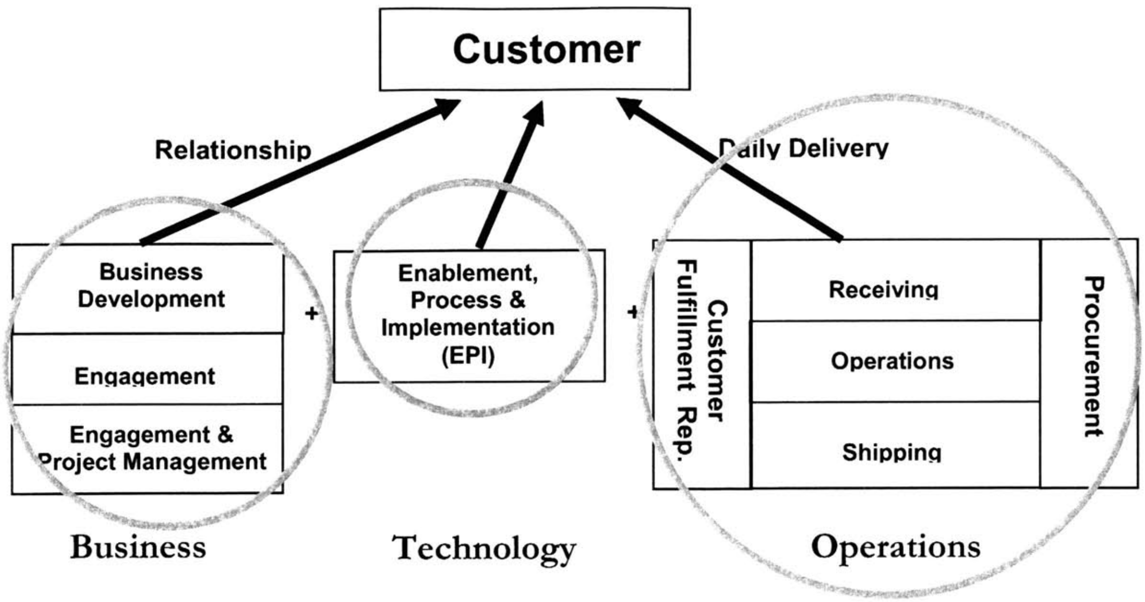

Figure 3. CSC Organizational Structure

2.5.4 Business Process

CSC's own business process can be divided into two categories: Engagement Process and Delivery of Services.

Engagement Process can be further divided into Pre-engagement Process and Post-engagement Process. During the Pre-engagement Process, internal customers evaluate CSC to determine whether CSC has the capability to provide the required services under certain cost constraints. At the same time, CSC proposes how to provide services to end customers. Post-engagement Process, on the other hand, provides post-sales services, including customer satisfaction, continuous cost improvement, etc.

Delivery of Services starts after CSC and internal customer agree upon the exact terms according to which services will be delivered. This process will be described in detail in Chapter 3.

CHAPTER 3

FIELD DEPLOYMENT PROCESS FOR CONTRACT 31

3.1 Field Deployment Process

The entire service delivery process can be divided into 5 phases based on the activities performed at each phase, as illustrated in Figure 4. Based on the IT service offering solution that IBM designed collectively for and with the client, a set of requirements for the PCs to be provided will be set out. These requirements typically include hardware configurations, software to be pre-installed, the timing and process of deploying the PCs, responsibilities of the respective IBM departments in providing the services, etc. Field deployment phases are the last steps in the service delivery process and are also the physical contact points that IBM, as a service provider, has with end users of the PCs. Not all service requests involve all 5 phases. More detailed descriptions will follow the discussions of each type of service requests.

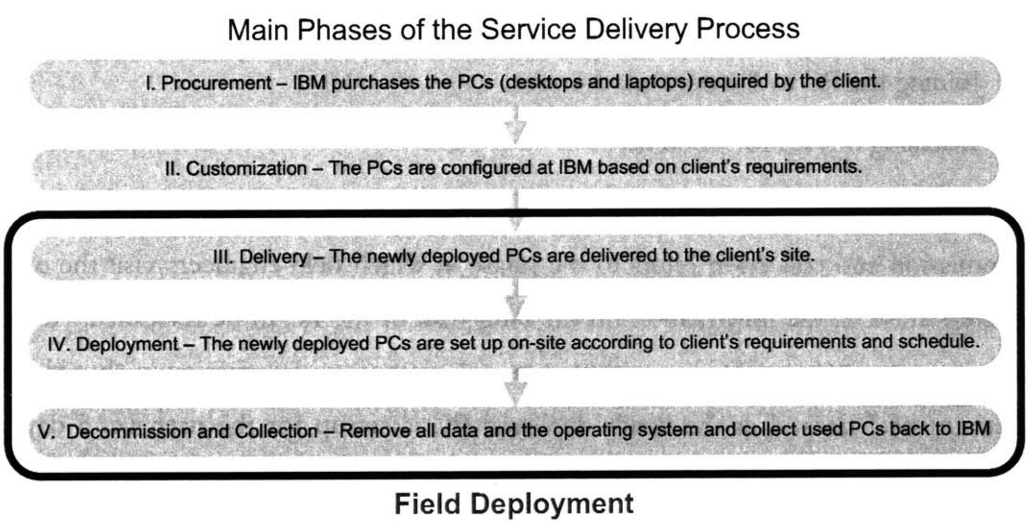

Figure 4. Main Phases of the Service Delivery Process

Procurement refers to the ordering of new PCs from suppliers and physical handling of them after they arrive at CSC. The ordering is performed by CSC's internal customer and CSC receives the PCs in batches and stores them temporarily at its internal warehouse.

Customization refers to the configuration process of PCs performed by CSC technicians at the factory. For hardware, it may involve adding RAMs, changing accessories, or not. For software, CSC uses a tool to copy cloned operating system images to newly deployed PCs in a standard manner. Some additional software not contained in the image will be installed separately at the factory.

Delivery refers to the procedure of physically delivering PCs to the end users. CSC currently makes appointments with individual users or the Business Unit in charge (BU), a contact person for PCs that are not issued to a particular user but to a department for common usage. Currently, CSC engages a third-party IT service company to perform the delivery.

Deployment refers to the phase in which field engineers from another IT service vendor company that CSC engages visit end users on site. Currently, CSC makes appointments with users before the deployment. The standard deployment process has four major steps:

1. Setting up the newly deployed PCs
2. Configuring email accounts
3. Joining the PC to the network domain
4. Installing drivers for printers.

Decommission and collection refers to the phase in which field engineers visit the user and completely erase all the information on the hard disk of the PC to be refreshed. According to the service agreement CSC has with its internal customers, decommission should happen a minimum of 5 days after the newly deployed PC is set up for the user, i.e. 5 days after deployment date. This is to make sure the user's work is not affected in case of certain PC configuration problems or data integrity problems with the newly deployed PC. After the complete removal of all information, the field engineers collect the PCs and ship them back to CSC internal warehouse.

3.2 Type of Tasks in Contract 31

In the documents of understanding (DOU) that CSC has with internal customers, detailed service items are described. For this research study, only two main types of service requests are considered as they account for more than 90% of the overall workload. The characteristics of these service requests are simplified for analysis.

3.2.1 Scheduled Refresh

Also known as Technical Refresh (TR), Scheduled Refresh is a service that replaces PCs that reach the end of their useful lives with newly deployed PCs. Most of the time, new PCs are deployed to replace the existing ones. Occasionally, used PCs are also deployed to replace other PCs with lower technical configurations. It involves all 5 phases of the Service Delivery Process. Therefore, all TRs are performed in a standard manner, except for some differences in physical handling steps for laptops and desktops.

In the case of a TR, one or two weeks before the deployment, field engineers make a site-visit appointment of 20 min with the user to visit and manually collect hardware and software information of the PC that is due to be replaced. After obtaining the hardware and software information, field engineers forward the information to CSC so that CSC technicians can pre-configure the PCs at the factory based on the information collected. In addition, for TR, in the deployment phase, a field engineer will also perform data migration from the existing PC to the newly deployed PC. Such a step is not necessary in the Net-Add case to be discussed later.

An annual refresh schedule, also known as the master schedule or master list, is given to CSC at the beginning of the year. The schedule contains all the details of the PCs due to be refreshed, including user name, location, PC model, RAM size, hard disk size, etc. The hardware and user information is the information on record and may not be up to date.

3.2.2 Net-Add

Net-Add is a common category of a variety of ad-hoc requests, including requests for new PCs, requests to add RAMs, and requests to add new PC components or accessories. Requests for new PCs involve hardware preparations as the PCs have to be pre-configured

(Customization) at CSC factory before they are sent to the clients. A Net-Add does not involve Phase IV. Decommission and Collection, nor does it require any site-visit to collect existing PC information as in the case of a TR.

Net-Add requests are sent to CSC in a daily consolidated list containing details about what is requested and user information. The agreement CSC has with its internal customers dictates that CSC should respond to these requests within 3 working days. A detailed characterization of the Net-Add demand will be found in a later section.

3.3 Daily Operations in Contract 31

CSC has one planner dedicated to contract 31. She has at hand the master schedule of all TRs in the whole year in excel format and receives Net-Add requests in a daily list, which comes to her at the end of every working day through email. The master schedule and the daily Net-Add list contain all the information needed to perform the service, including user information, PC information, End of Depreciation Date (date on which a PC is to be refreshed, Expected Installation Date in the case of a Net-Add), etc. For TR, field engineers will be given a list of PCs due for refresh for a whole month and they are supposed to collect updated user and PC information prior to the actual deployment. This is called a site visit because it requires a field engineer to visit the user and perform a few simple operations on the PC. The entire process takes about 20 min. For Net-Add, there is no such need. With the necessary information at hand, the planner calls up the users and makes appointments with them for the delivery and deployment. Delivery was outsourced to an IT service firm that specializes in delivery and deployment is outsourced to another IT service firm that specializes in deployment. For most cases, delivery and deployment happen on the same day; occasionally, delivery is done one day ahead of deployment. After the planner confirms a number of appointments with the user, a deployment schedule will be formed. This schedule is normally only ready one day prior to the deployment and is given to the deployment field engineers at the end of that day. While this is happening, once an appointment is made, the planner will also inform the operations department to configure the new PCs according to the PC information collected (for TR) or get new PCs ready for delivery (for Net-Add). An illustration of the entire process is shown in Figure 5.

The problem with the current system is that field engineers are only given the schedule the night before the actual day of deployment. They do not have time to make phone confirmations with the users and they do not have any flexibility to schedule with another user in case any scheduled appointment gets cancelled at the last moment.

On average, each field engineer is able to complete 2-3 deployments or decommissions and collections per day. End users are located at 3 major locations and about 100 branch locations in Singapore. Requests for the same locations are not consolidated to minimize travelling time of the field engineers. One field engineer could complete 4-5 tasks in a day when the jobs are all at the same locations but only 2-3 tasks if he has to travel to more than one location.

There have been huge backlog of Scheduled Refresh, roughly equal to the number of TRs due to be completed in two months. CSC took over the business 6 months ago.

Two third-party IT service companies, referred to thereafter as vendor companies, previously engaged by CSC for deployment and decommission have pulled out because they found the business unprofitable. The current vendor company has also realized the problem and is reluctant to allocate sufficient manpower to the contract, which has been the major cause of the backlog. CSC has been informed by the current vendor company of their intention of pulling out and is in search of alternative vendors.

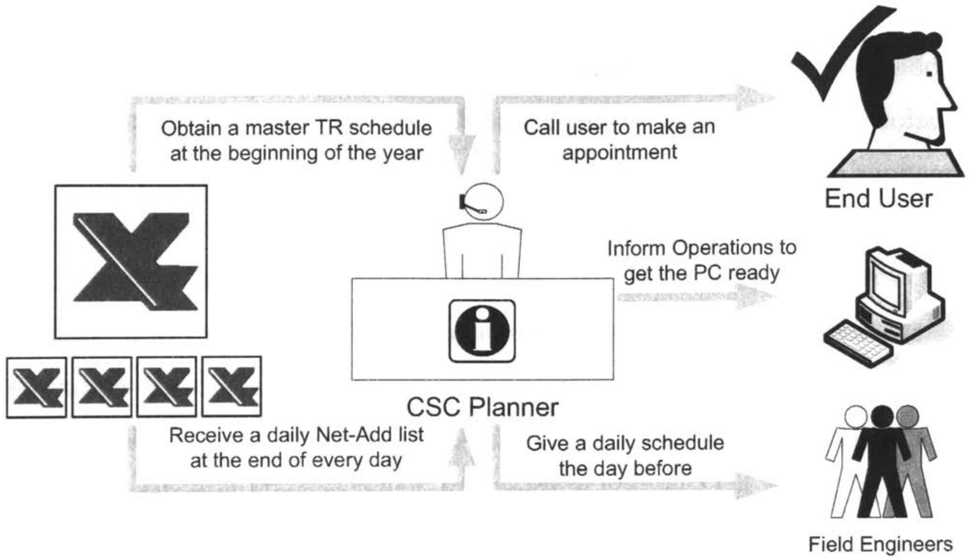

Figure 5. Main Phases of the Service Delivery Process

CHAPTER 4

NET ADD DEMAND AND FULFILLMENT ANALYSIS

In order to develop a viable solution for planning, it is necessary to have a good understanding of demand. Demand for Scheduled Refresh is known in advance and hence does not pose significant challenge to planning. The following section is devoted to analysis of demand of Net-Add, part of the field deployment services that were previously understood to be ad-hoc and unpredictable. As shown in the analysis below, not all Net-Add requests are urgent requests that add pressure to the staffing of field engineers. The fulfillment statistics also provide us with important insights into how the field engineer vendor company has been undertaking more pressure than it otherwise has to if the Net-Add demand is better managed and service requests better scheduled.

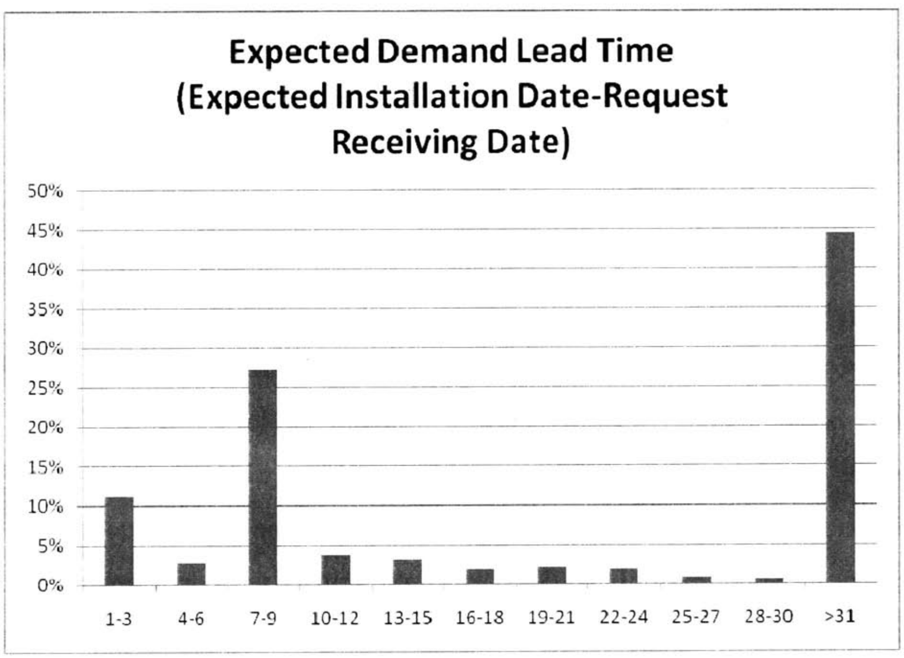

Figure 6. Days Requests are Made in Advance

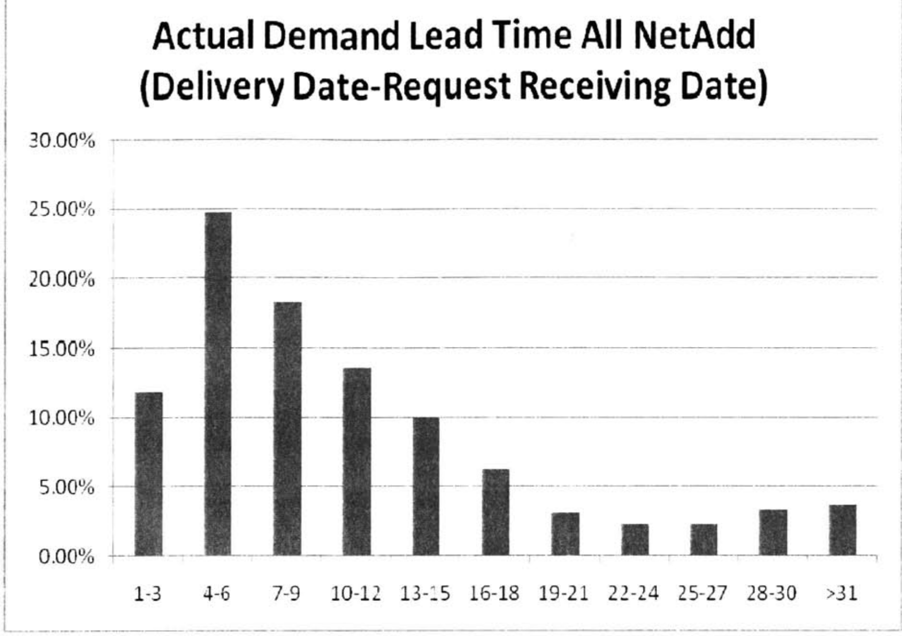

Figure 7. Days Requests are Fulfilled after They are Received.

The following analyses are based on data of a historical period from 1 Jan 07 to 30 Jun 07. CSC took over the business of contract 31 on 1 Jan 2007. There are a total number of 569 Net-Add Requests and CSC was able to complete 510 during the same period. The remaining unfulfilled requests are either cancelled or scheduled to be completed on a later date.

When an end user raises a Net-Add request, he or she will indicate an Expected Installation Date. Figure 6 illustrates the days that these requests are made in advance. Clearly, over 70% of requests fall in two categories, short-term (7-9 days) and long term (>31 days). 10% of the requests are urgent requests that have to be completed within 1-3 days. In the planning algorithm to be discussed in Chapter 5, in order to fulfill the urgent requests, 2 out of the 12 slots per day are reserved until two days before the actual day of deployment. Those reserved slots are meant for the 10% urgent situations when CSC receives requests that must be fulfilled within 3 days.

Given such a distribution of the levels of urgency of Net-Add requests, it seems that CSC has been given relatively generous lead time to arrange for the service. However, the days by which requests are fulfilled in advance, as illustrated in Figure 8 show some interesting aspects of the planning system that is worth noticing. About 10% of the total requests are delivered within 1-3 days, which matches with the days requests are made in advance. This makes sense and CSC is fulfilling customer demand. However, over 90% of the total requests are delivered within 18 days, out of which about 52% are delivered within 9 days. The overall distribution of the actual delivery date of all the Net-Add requests relative to their expected date demonstrates substantial earliness of CSC's fulfillment of such requests. This must have added pressure to the planning personnel themselves, the operations department, the upstream PC suppliers, and mostly strikingly to the field engineers who have to perform their duties on a shorter notice than what is otherwise necessary.

The striking difference between Figure 6 and Figure 7 leads us to take a closer look at each request and see exactly when each one is fulfilled. Figure 8 shows how many days we are early in delivering the services. The requested lead time is the expected demand lead time, i.e. how many days in advance do end users raise their service requests. The actual lead time is the actual number of days between CSC receiving the request and CSC delivering the request. The results on the positive side of the graph are consistent with our previous observation that CSC is delivering a substantial number of services early. Despite that about 20% of all services are delivered later than the initial Expected Installation Date, a breakdown of the reasons for such late fulfillment (Figure 9) shows that 81% of all late fulfillments are due to users' own reasons or users prefer to have the installation scheduled on a later date.

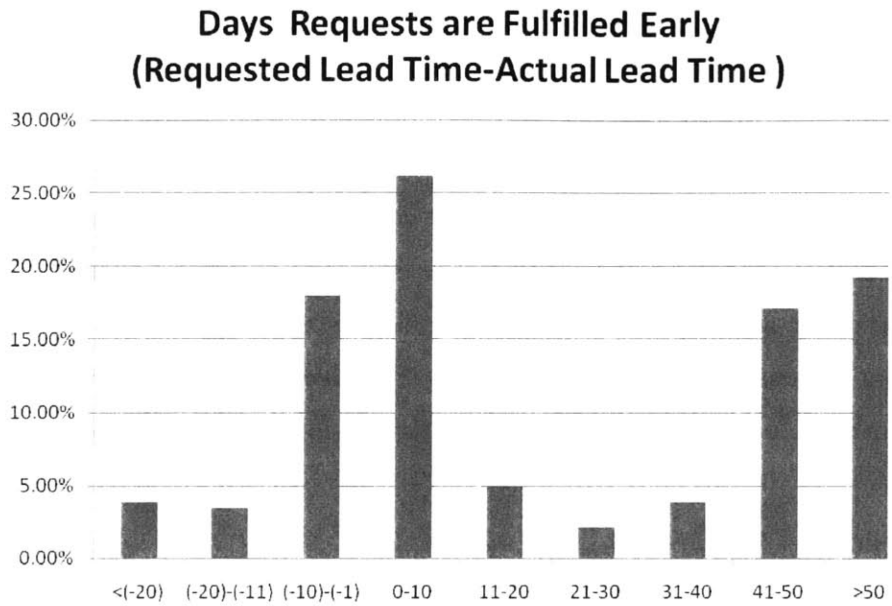

Figure 8. Days Requests are Fulfilled Early

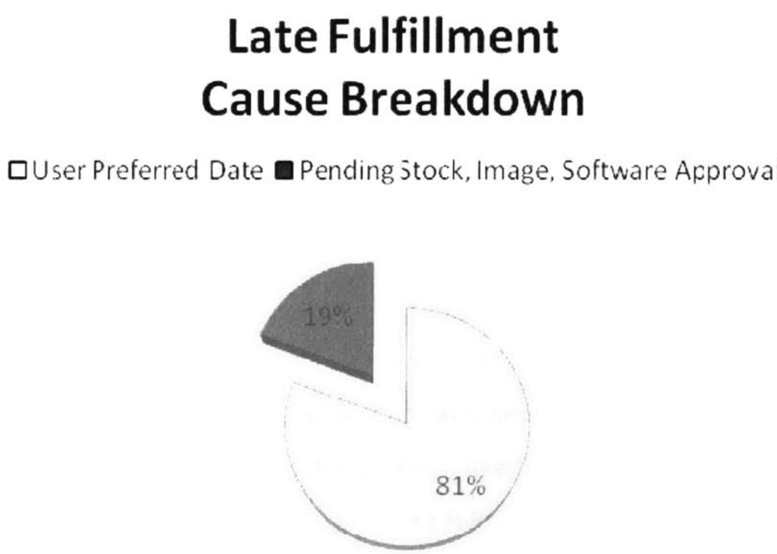

Figure 9. Late Fulfillment Cause Breakdown

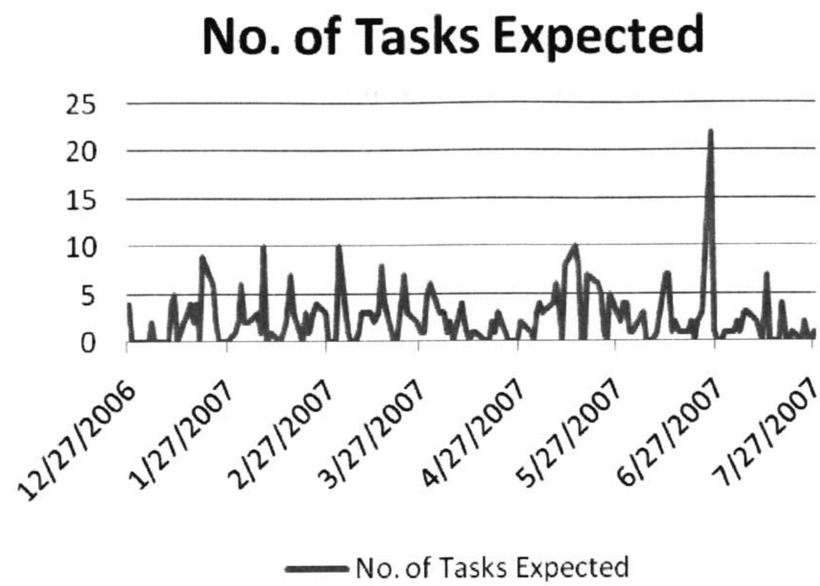

Figure 10. Number of Tasks Expected

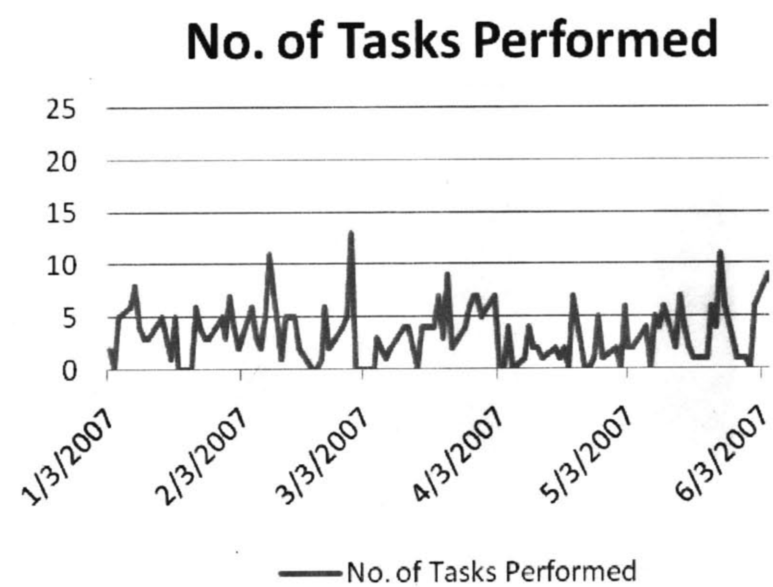

Figure 11. Number of Tasks Performed

The numbers of tasks expected and performed each day are shown in time series in Figure 10 and Figure 11. As can be observed, there is a great deal of volatility in Net-Add demand. Figure 12 and Figure 13 shows the distribution of various number of tasks expected and performed. Theoretically, the number of tasks performed could have been less volatile if the planners release nearly uniformly distributed number of tasks every day. However, the actual number of tasks performed per day has substantial volatility, similar to that of the number of tasks expected. This suggests that most likely the planner has not been taking advantage of the pooling effects of requests of different urgency and hence making the number of tasks deployed per day more uniform over time. This could be due to the lack of an effective planning tool to help the planner see the demand pattern and keep track of the tasks planned but not yet performed. Without an effective planning tool, it was easy for the planner to follow a first-in-first-out method of planning and hence pass the volatility of demand entirely through onto the field engineers. The planning system to be described in Chapter 5 has a central database that shows the distribution of known future demand and keeps track of all scheduled and unscheduled tasks.

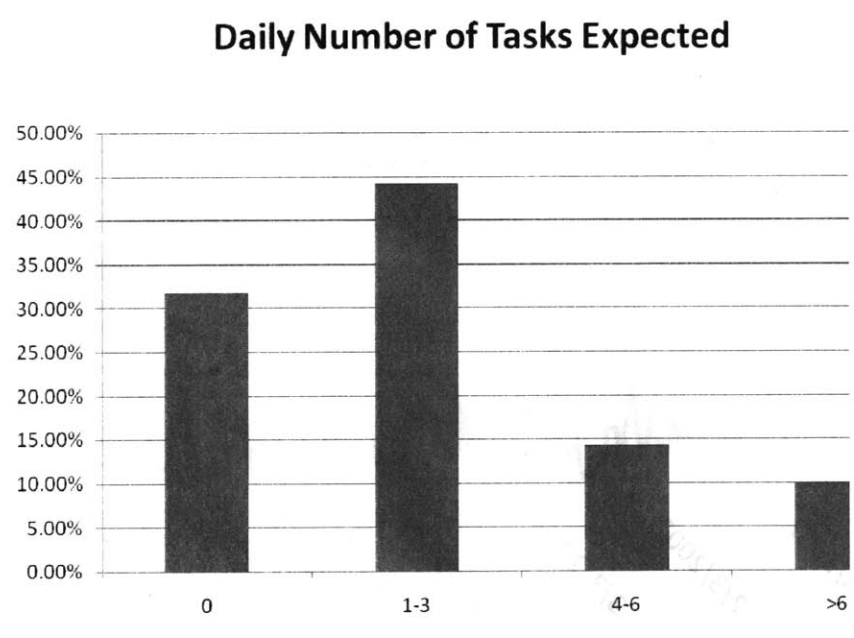

Figure 12. Daily Number of Tasks Expected

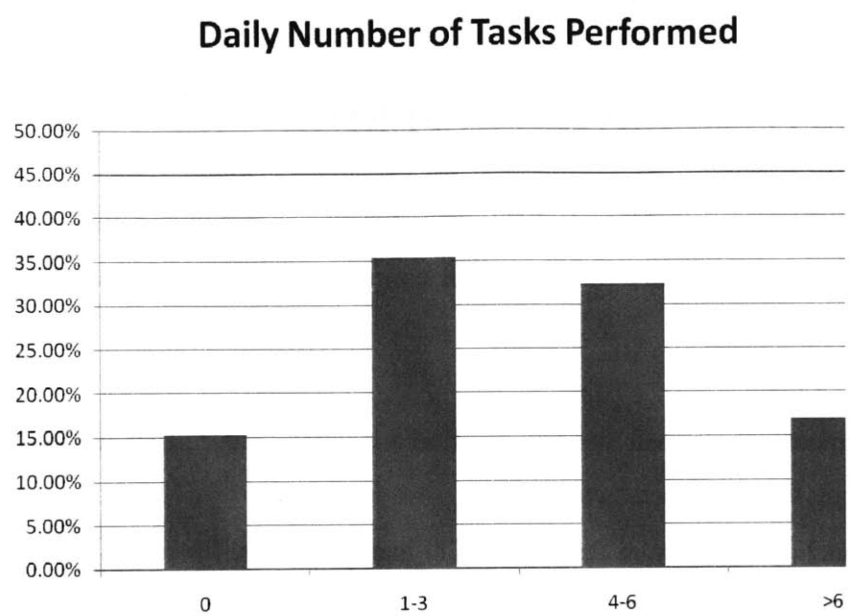

Figure 13. Daily Number of Tasks Performed

In face of fluctuating demand as such, the priority rule that the planner should use for planning should be the earliest deadline rule. She should also look at the available capacities of the field engineers after the TRs have been scheduled and try to make the total number of TR and Net-Add tasks constant or nearly constant every day.

CHAPTER 5

ALTERNATIVE SERVICE OFFERING

In view of the situation in field deployment, CSC has set out to implement a transformation of the entire end-to-end service framework for contract 31 in several phases. Major changes include:

- Implementing an email site-visit method to replace the current physical site visits, reducing field engineers' workload.
- Eliminating the software installation CD loan procedure for the user and eliminating delivery step by a separate team.
- Revamping the planning system by introducing the use of a central database to manage information and formulating more efficient planning algorithms.
- Automating the report generating processes by using the central database maintained and updated by the planner.

5.1 Email Site Visit (Self-Service)

A computer program has been developed to assist the users to extract PC information themselves and send the output file back to CSC through email. This new way of collecting PC information has been proposed and experimented by another team and CSC is in the process of adopting such a method. This method effectively eliminates the need to perform physical site visits and it greatly reduces the workload of field engineers. However, the implementation of such a system requires changes to the planning system because the planner now is the person handling all the emails and if users' response time is taken into account, the entire planning horizon will be different from the original one as well.

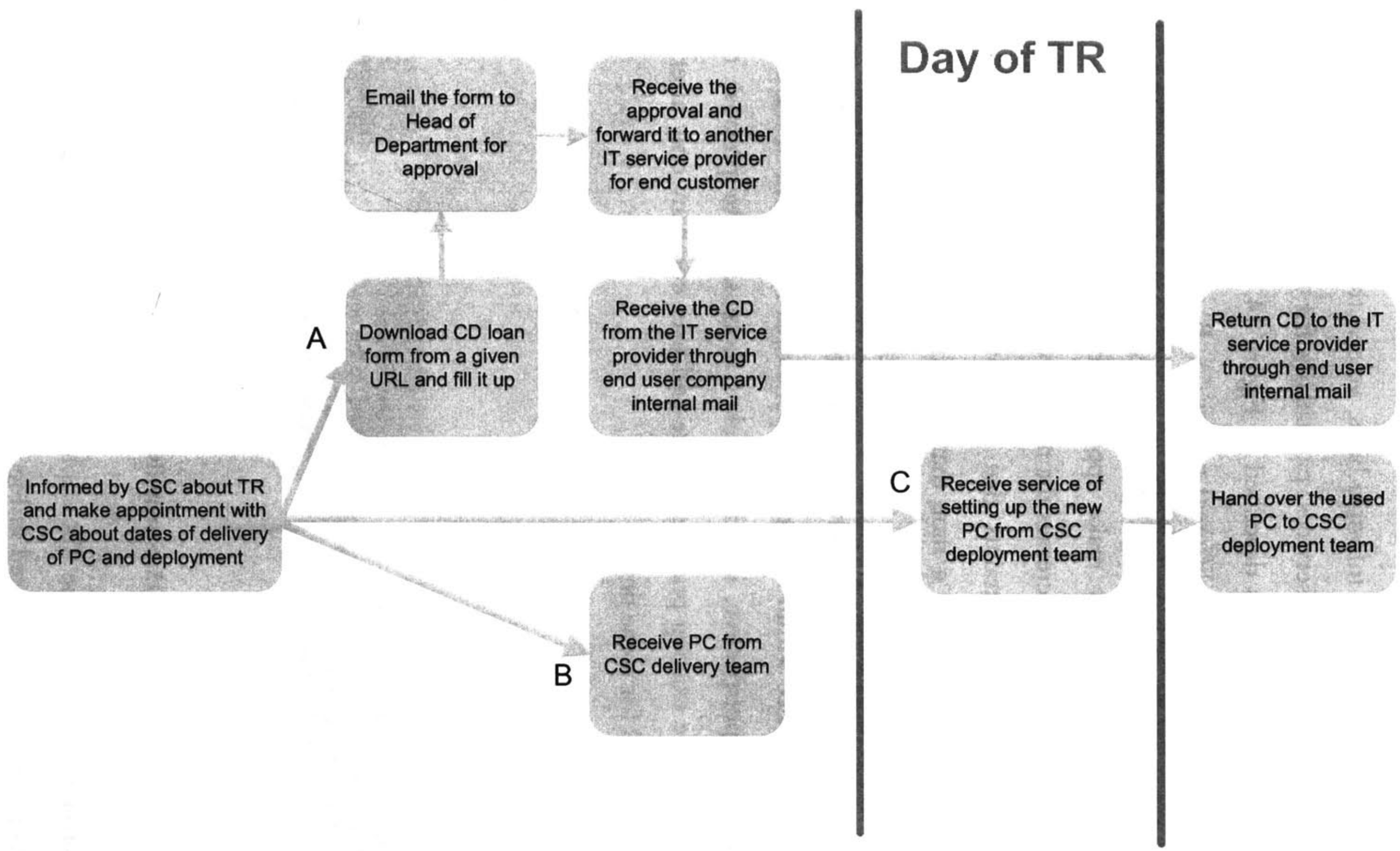

Figure 14. Original Deployment Process in the Service Offering

5.2 Elimination of CD Loan and Elimination of Delivery by a Separate Team

End users have, largely on an informal basis, voiced their suggestions on some alternative ways that CSC may offer its services, particularly for the deployment phase. The current deployment process for TR is described in Figure 14. From the users' perspectives, they have to coordinate with three different parties (A, B, and C) and make sure on the day of deployment the software installation CDs (from A) and the PCs (from B) have already been delivered to them when they make appointment with the deployment team (C). This coordination effort not only increases the number of procedures each user has to follow, but also becomes a set of constraints that make it less flexible for CSC to schedule an appointment with the user at a time that CSC most prefers to deploy. The reason why current service offering solutions are organized and designed as such is largely historical. Our hypothesis is, at the initiation of such a project, CSC, as the newly engaged service provider, tried to provide service within the existing operational framework of the end user company. From a business perspective, it indeed makes more sense to propose to alter or make amendments to the existing practices of the end user company only after the engagement has been successful for some time.

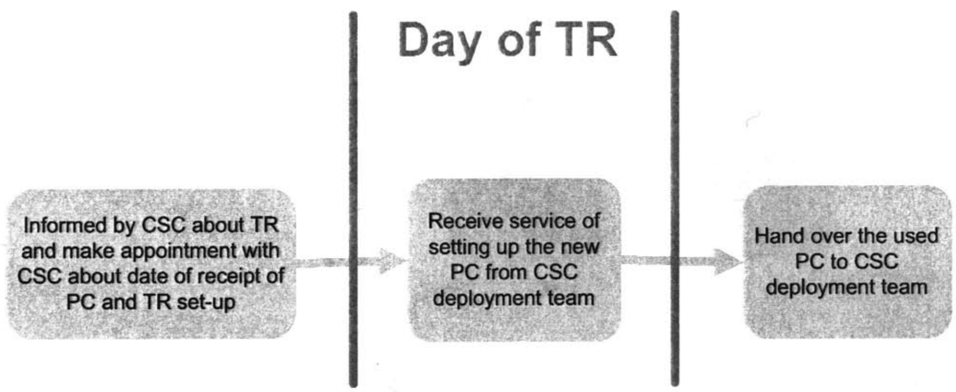

Figure 15. Streamlined Service Offering Solution

After thorough analyses of the TR deployment processes, a streamlined service offering solution is proposed, as illustrated in Figure 15. The proposed changes could greatly reduce the procedures that the end user has to follow. It also makes CSC's scheduling effort less constrained, which will translate into less fluctuation in daily workload for the field deployment team and hence lower the additional manpower cost due to varying demand. In addition, some software previously installed by the deployment engineer on site could now be installed at the factory level, which has greater efficiency due to parallel operations on multiple PCs. This will reduce the total time of each TR deployment and allow more TRs to be performed by each field engineer on a single day.

Putting it all together, CSC will be moving towards a lower cost service model with greater customer satisfaction. Such an effort has been embraced by the management and is in the process of being implemented. The implementation requires several steps and the cooperation of other parties as well as the approval of the end user company. Briefly, CSC has formulated the following action plan:

1) Submit to the internal customer a list of most frequently encountered software and make a request for a few copies of the installation CDs. The internal customer makes a proposal to the end user company for CSC to keep copies of installation CDs at hand so as to eliminate the need for the user to obtain them on an ad-hoc basis. For this to be implemented, CSC will consider providing tracking information of the installation of software for different users if the end user company requires.

2) Factory level operations (Customization) will become more complex than previously due to increasing levels of customization that occur at the factory level. A more in-depth analysis of the occurrence rate of different software is needed for further recommendations about which software combination could form a few new basic packages of software, which can be incorporated into the cloned operating system images. Based on such packages, more customized software combinations can be produced with separate installations. In addition, more detailed instructions, containing detailed software combinations to be installed, need to be communicated by the planners to the operations department in CSC through its internal inventory management system, the RIIS.

3) Implement internal procedural changes to adapt to the new process. In particular, the shipping team has to allow early morning shipping so that deliveries and

deployments can occur on the same day without compromising effective working hours of the field deployment engineers. Currently, the shipping team is only expected to be ready to handle daily shipments at noon.

5.3 Transformation of the Planning System

The current planning system has been carefully examined and some changes in the planning processes are proposed and evaluated. Additionally, some historical demand data for Net-Add are analyzed and form the basis of the detailed planning algorithm proposed.

5.3.1 The Interim Planning Process

In automating the entire end-to-end process with IT, CSC has deployed one IT engineer to work on the IT infrastructure necessary for the transformation. It will take more than 2 months for him to develop and put in place the required IT support for all the changes. In the mean time, all the existing operations have been temporarily suspended because the current field service company is withdrawing. An interim system has to be put in place immediately to keep operations and field services going. The email site visit will be incorporated into the interim system while the database gradually phases in. Because it takes time for the final planning system and the report-generating function to be developed, an interim planning process is needed to meet the urgent demand.

The database is a critical component of both the proposed interim planning system and the final planning system. It not only contains information from the TR master schedule, but also takes in Net-Add requests on a daily basis. The database will be maintained by the planner and plays a key role in information processing, scheduling, and hardware planning as well as reporting.

Analysis of the current planning system has provided important insights into potential areas of improvement, which include:

- The planning role should be performed by one single person given the volume of work CSC faces so that he or she can have an overall view of all the activities performed by the field engineers and make job allocations efficiently. This will give the planner centralized control of all tasks that field engineers are supposed to perform and also give end users a single contact point for changes of schedule or cancellation. An illustration of the changes required with regard to the planning process is provided in Figure 16.

- For every 10 calls a planner makes, one appointment is probably made. This low yield in calling has posed challenges to the current mode of contact CSC has established with its users. A new system is proposed and illustrated in Figure 17. First of all, overall number of calls and call durations will be reduced because more information is communicated through emails. Second, call yield will be improved since users will be calling in. A multi-line voicemail system will be established to enable such functions.

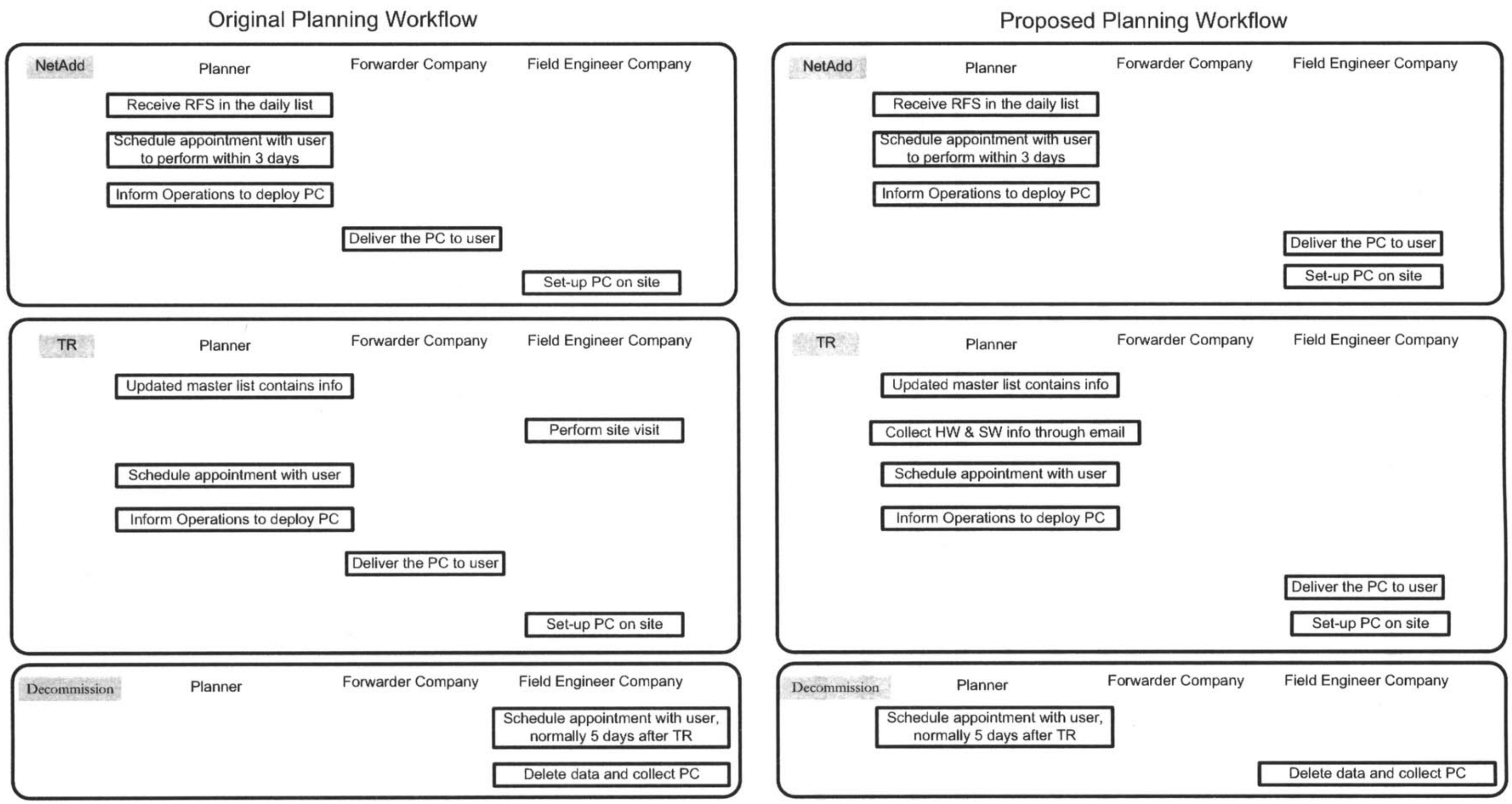

Figure 16. Comparison of the Original and Proposed Planning Workflow

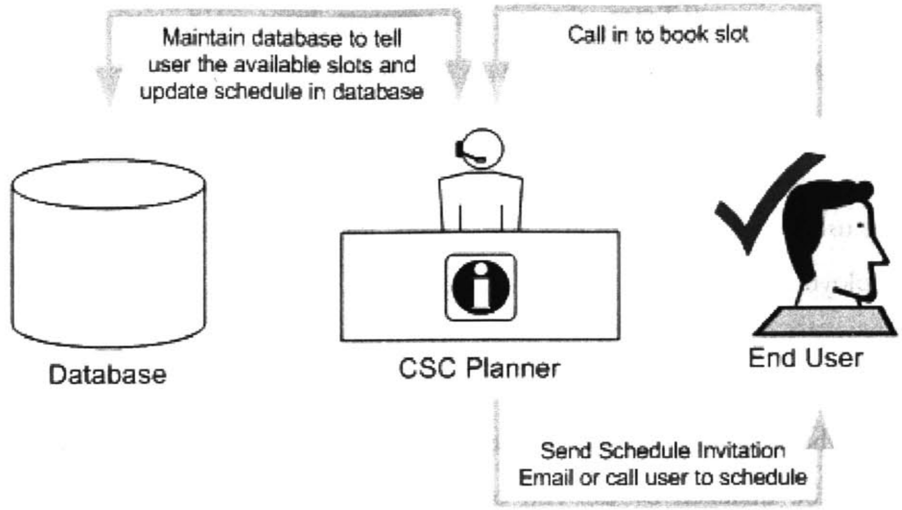

Figure 17. Proposed Planner's Role

Due to the limitation of time, this interim planning system has to be instantly put into use by CSC to handle the ongoing TR and Net-Add requests. To simplify the analysis, we have illustrated the planning horizon in July for TR tasks only. Deployments scheduled using the interim planning process commence in week 3 and this planning horizon was developed during week 0, the week before week 1. The four blocks stacked on top of each other in Figure 18 denote the planning horizon for deployments in Week 3, Week 4, Week 5, and Week 6, respectively. The planner starts planning for all four weeks in Week 1. At the beginning of Week 1, the planner sends emails to users to be scheduled in all four weeks. While waiting for users to be scheduled in Week 4, 5, and 6 to reply, the planner can call users to be scheduled in Week 3 to get a fast response. The planning process involves the following steps:

1. The planner sends users HW & SW emails (emails asking users to provide hardware and software information by running a computer program attached).
2. Users reply the emails with hardware and software information attached.
3. The planner inputs the hardware and software information to an excel database and calls user to schedule an appointment.
4. The planner inputs the hardware and software information and delivery information (user name, date and location) into RIIS (the internal inventory management system IBM CSC uses). This step is also known as loading into RIIS.

5. CSC Operations Team obtains the requests from RIIS, performs the requested hardware configurations and installs the operating system images onto the PCs. This step is also known as cloning.
6. Field Deployment Team receives the requests from the planner, delivers the PCs to the users and sets up the PCs at the users' locations. This step is also known as field deployment.

For deployments scheduled in Week 3, the deployment schedule will be finalized by the end of Week 2. For deployments scheduled in Week 4 and 5, the deployment schedule will be finalized by the end of Week 3. For deployments scheduled in Week 6, the deployment schedule will be finalized by the end of Week 4. Figure 18 shows the interim planning horizon.

5.3.2 The Final Planning Process

5.3.2.1 The Concept

The concept of the final planning process incorporates the suggested improvements discussed above and is based on the assumption that CSC will be devoting resources necessary to put such an initiative into action. The inputs and outputs of the planning operation are illustrated in Figure 19.

In the final planning system, a full-fledged database will have been put in place and will have all data stored in an orderly manner. On the one hand, it interacts with the planner on a daily basis for updates and data presentation. On the other hand, some of the schedule data is linked with a slot-booking website that serves as the communication portal with end users. The database is supposed to not only display available slots and relevant information, but also take in end user booking information. Upon receiving an invitation email from the CSC planner, an end user is supposed to log on to the website, see the most updated information on CSC's available capacity for deployment and make his or her choices of preferred time slots of deployments. The planner will monitor the booking from time to time and adjust available capacity as demand comes in, i.e. increase or decrease number of engineers available for deployment on certain day for certain locations.

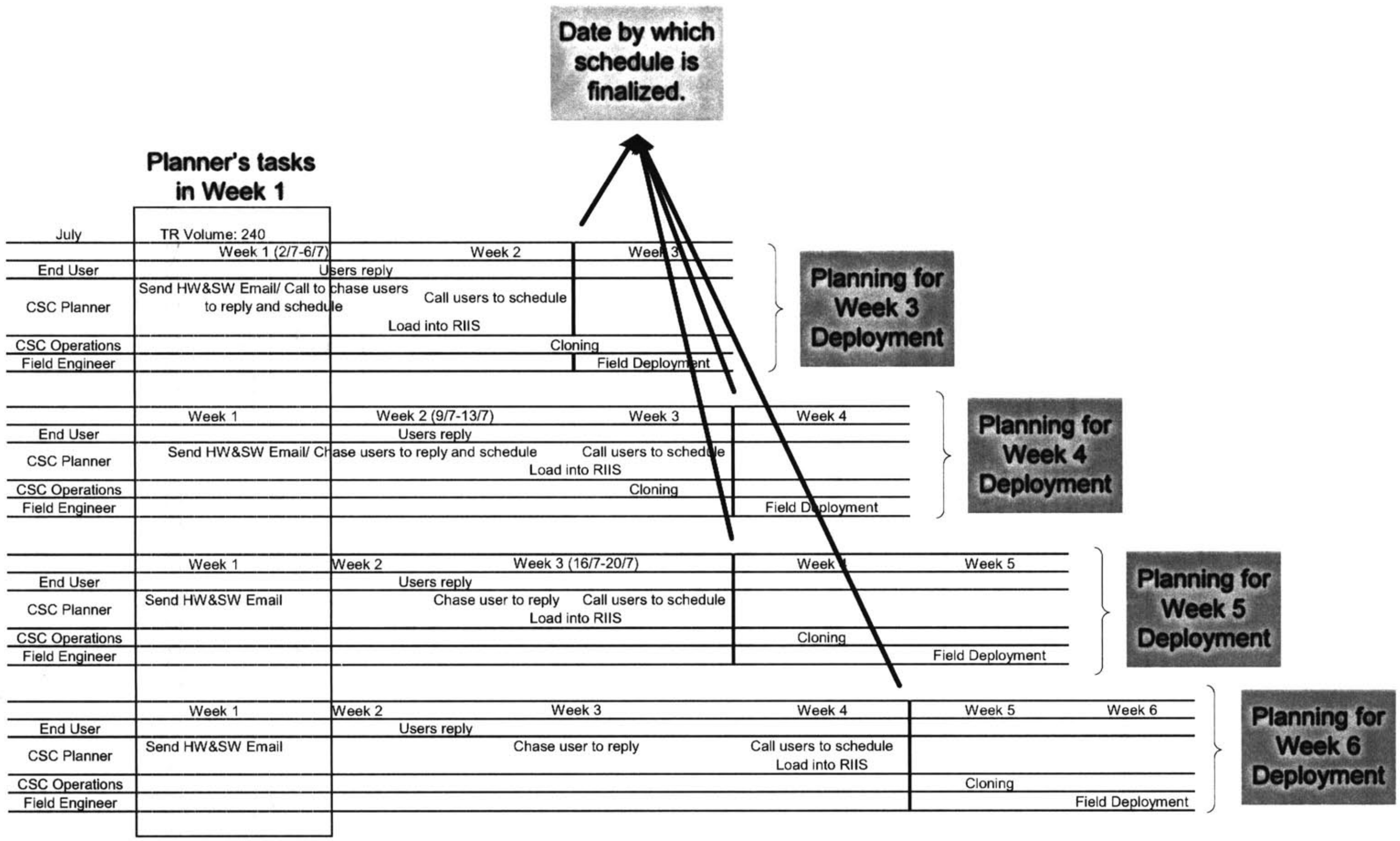

Figure 18. Interim Planning Horizon in July 2007

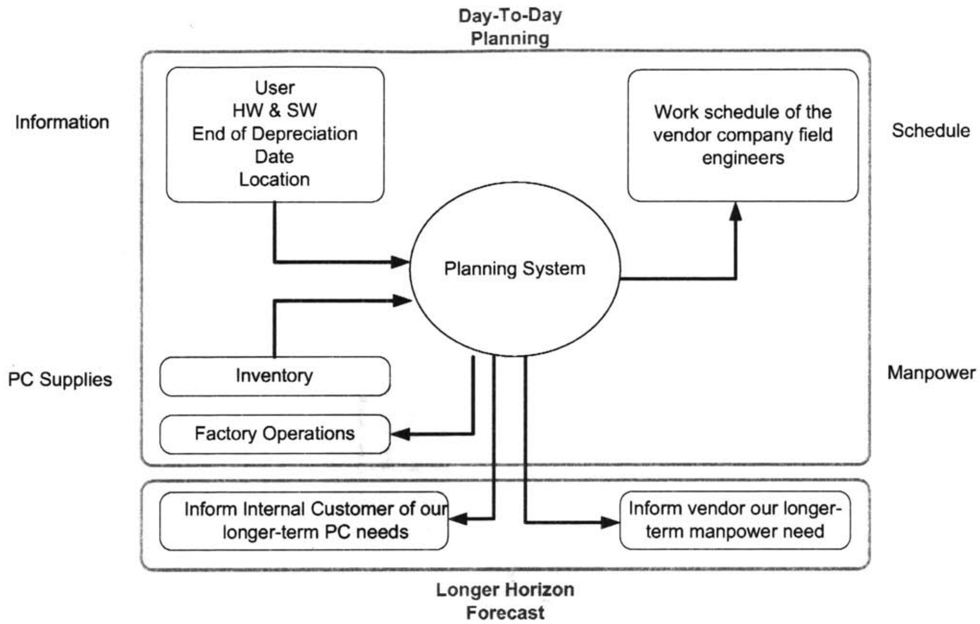

Figure 19. Inputs and Outputs of the Planning Operation

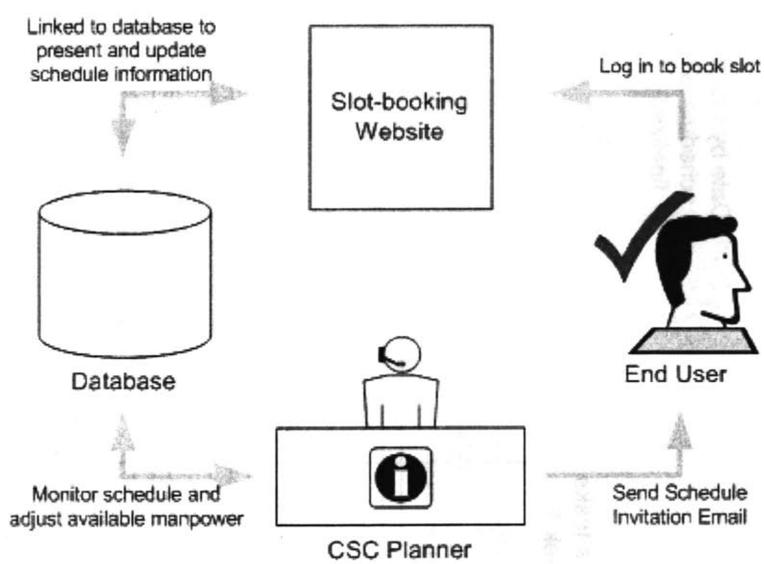

Figure 20. The Role of the Planner in the Final Planning System

Figure 20 illustrates the role of the planner in the final planning system, how parties involved are supposed to interact with each other, as well as how IT infrastructure will be supporting the day-to-day operations of CSC field deployment.

5.3.2.2 The Planning Horizon

The ideal planning horizon spans 7 weeks and the planner leaves ample time for users to respond on their own initiative. Figure 21 illustrates the ideal planning horizon.

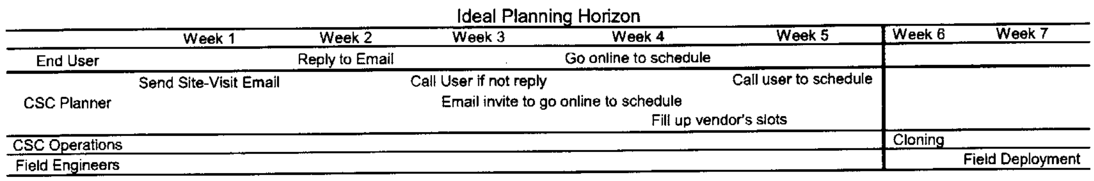

Figure 21. Ideal Planning Horizon

5.3.2.3 The Workload

Given the design of the new planning system, the management is interested in a few related issues:

- How much resource will be needed to run such a system?
- How much time does the planner have to spend on this contract for daily operations?
- How much work will be taken away from the field engineers?
- How much less can we pay them?

Figure 22 gives a comparison of a planner's workload and a field engineer's workload before and after the implementation of the new system.

Table 4 lists the breakdown of the planner's task time in both the interim and the final planning system. The planner has to work effectively 8.85 hours a day in order to complete all the tasks in the interim system. This exceeds the effective working hours of 7.2 that IBM assumes every employee works every day; therefore, another temporary administrative staff member was hired to assist the planner in carrying out all the tasks.

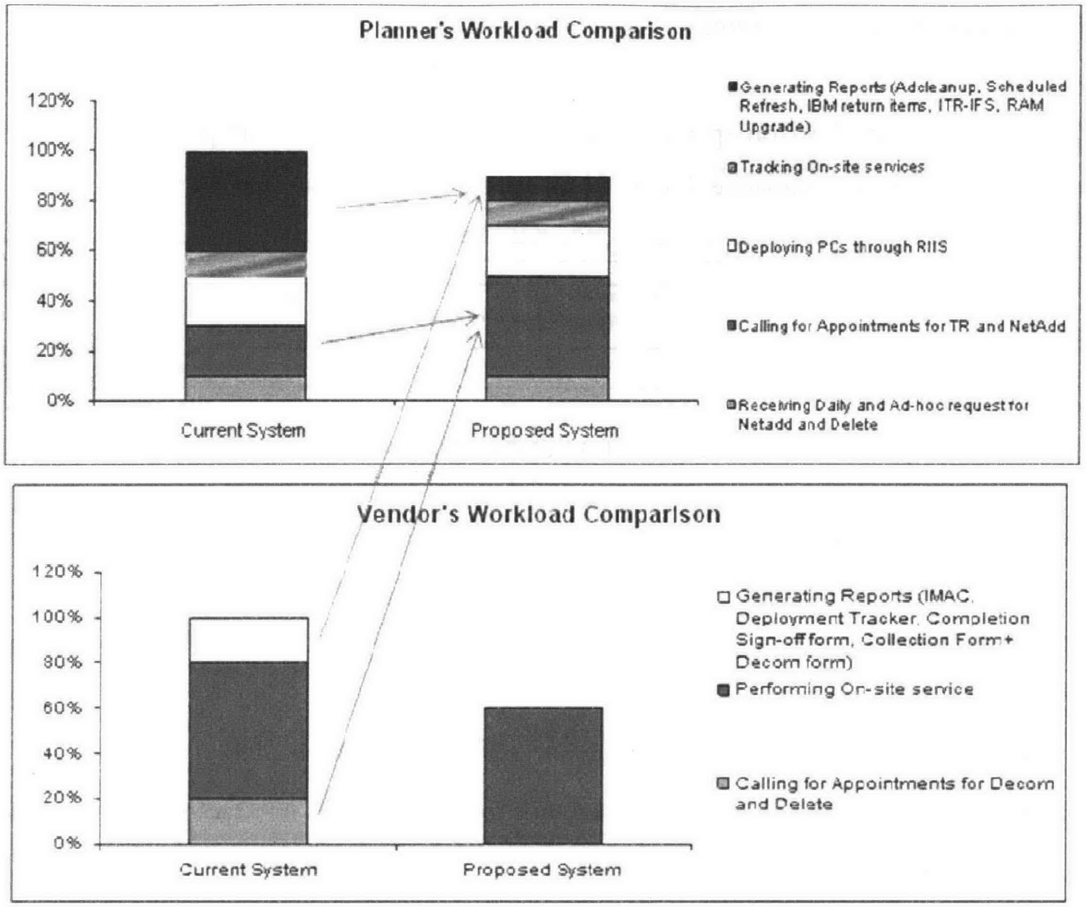

Figure 22. Comparison of a Planner's Workload and a Field Engineer's Workload

Planner's Workload Estimation			
Interim Planning System		Final Planning System	
Tasks	Task Time (min)	Tasks	Task Time (min)
Sending Site-visit Emails (Manual customization of customer info)	3.00	Sending Site-visit Emails (Auto-generation of customized emails)	<3.00
Receiving Emails and Updating Records	4.29	Receiving Emails and Updating Records	4.29
Calling to chase users	3.60	Calling to chase users	3.60
Reading HW&SW Info and Updating Matrix (Using Paul's DOS program)	20.00	Automatic updating the database	0
Calling to schedule	6.00	On-line schedule	0
Total	36.89	Total	<11.00
Total with safety factor 1.2	44.26	Total with safety factor 1.2	<13.2
Tasks need to be planned per day	12.00	Tasks need to be planned per day	12.00
Total time spent on planning (hour)	8.85	Total time spent on planning (hour)	<2.64

Table 4. Estimation of a Planner's Workload

5.3.2.4 The Algorithm of Scheduling

In order to understand how the planner should schedule different tasks for differerent field engineers, we need to have a good understanding of the information flow in the planning process. Figure 23 illustrates the acquisition, processing, and storage of information at different stages of the planning process.

The planner should start with the Scheduled Refresh Master Schedule since it is readily available demand data given to the planner at the beginning of the year. The planner will then send an email to a particular user with the information on record about this user and his or her PC, asking the user to verify the information. Upon receiving the updated information from the user, the planner updates the Master Schedule. This gives us accurate and up-to-date information about PCs due for refresh. In the mean time, on a daily basis, the planner will continue to receive a daily list of Net-Add requests. Some of these Net-Add requests are urgent, while others are not. All the demand data will then be put together into the central database, containing detailed information about the date CSC is expected to deliver the service, the user, and the PC. Such requests should be reorganized and grouped based on the location of the user. The four bins in Figure 23 represent the four major locations for contract 31. Each colored rectangular bars represent one user request. Every four requests in a particular location are grouped together and are allocated to one field engineer. Assuming there is only one field engineer, he will visit Location 1 on June 12th (Monday), Location 2 on June 13th (Tuesday), Location 3 on June 14th (Wednesday), Location 4 on June 15th (Thursday), and Location 5 on June 16th (Friday). Then users within each group, i.e. those working in the same building, will be sequenced according to the expected date of deployment. The planner then will have an aggregate estimate of how many users need deployment service at which location around which date. She will then make a manpower allocation decision by allocating an appropriate number of field engineers to certain location on certain date to fulfill the demand. This will give the planner a preliminary guide in the schedule. The number of field engineers available at each location on a particular date will be made available to end users on the slot-booking website.

However, these provide only aggregate numbers of jobs at each location; the schedule will not be complete before users log in to the slot-booking website and make their bookings of certain slots during the day.

With the above information, end users will be able to see available time slots on different days for their particular locations. For example, a user at location 1 at the current date will probably see Table 5 after he or she logs in and indicates his or her location.

The planner at the back office will be able see all the bookings in a calendar view, as show in Table 6. Some slots are reserved slots until two days before the actual deployment for urgent Net-Add requests.

5.4 Automatic Report Generation

With information constantly being updated, the planner will be able to draw the information needed from the database with ease to generate reports according to customer requirements. More work will be done in customizing the formats of the reports and automatically generating them.

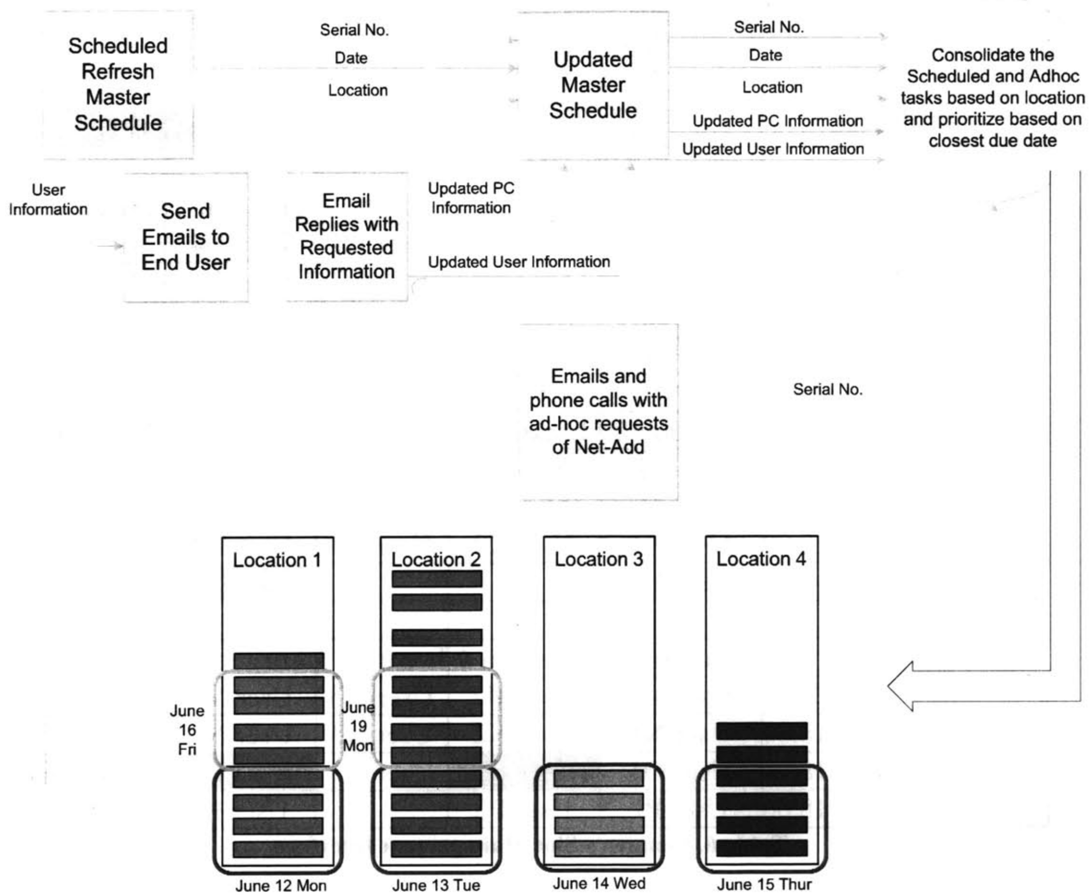

Figure 23. Information Flow in the Planning Process

	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul
	Mon	Tue	Wed	Thu	Fri
9:30-12:30	Click to Book	Unavailable	Click to Book	Unavailable	Click to Book
14:00-18:00	Unavailable	Click to Book	Click to Book	Click to Book	Click to Book

Table 5. User's Slot-Booking Interface

		Current Date				
		26-Jul	27-Jul	28-Jul	29-Jul	30-Jul
		Mon	Tue	Wed	Thu	Fri
Engineer A		Location 1	Location 1	Location 1	Location 1	Location2
	9:30-12:00	User A1	User A2	User A3	User A4	User A5
	14:00-18:00	User B1	User B2	User B3	User B4	User B5
	14:00-18:00	User C1		User C3		User C5
	14:00-18:00	User D1		Reserved	Reserved	Reserved
Engineer B		Location 3	Location 2	Location 3	Location 1	Location 2
	9:30-12:00	User E1	User E2	User E3	User E4	User E5
	14:00-18:00	User F1	User F2	User F3	User F4	User F5
	14:00-18:00	User G1	User G2	User G3		User G5
	14:00-18:00	User H1		Reserved		User H5
Engineer C		Location 2	Location 2	Location 2	Location 2	Location 2
	9:30-12:00	User I1	User I2	User I3	User I4	User I5
	14:00-18:00	User J1	User J2	User J3	User J4	User J5
	14:00-18:00	User K1	User K2	User K3	User K4	User K5
	14:00-18:00	User L1			Reserved	User L5
Engineer D		Location 4	Location 4	Location 3	Location 4	Location 4
	9:30-12:00	User M1	User M2	User M3	User M4	User M5
	14:00-18:00	User N1	User N2	User N3	User N4	User N5
	14:00-18:00	User O1	Travel Time	User O3	Travel Time	Travel Time
	14:00-18:00	User P1	User P2		User P4	Reserved

Table 6. Planner's Slot Management Interface

CHAPTER 6

CONCLUSION

In this study, the author closely examines the operations of field deployment services in Customer Solution Center, IBM Singapore. Contract 31 is taken as a sample case and the entire field deployment process for this contract is described in detail. The ad-hoc demand, i.e. the Net-Add demand, and its fulfillment statistics are analyzed. The results suggest that there are a substantial number of requests that are fulfilled earlier than required by the service level agreement. These early fulfillments essentially pass all the fluctuations of demand onto the field deployment team, forcing the field deployment team to have a larger percentage of capacity on standby than otherwise necessary. Moreover, analysis of the service offering process from the end users' perspectives also suggests that the steps of providing field services need to be streamlined to reduce the coordination efforts from end users. The changes required include the introduction of the use of emails and a computer program developed in house to replace the previous physical site visits to collect PC information, the elimination of CD loan steps, and the use of separate delivery personnel. These changes will not only increase the service rates of the field engineers, but also reduce the time the end users have to commit to the service offering process. In addition, the planning process has been redesigned, incorporating the use of a central database system to automatically capture, process, and store user information. A longer planning horizon has been proposed to allow the field deployment team to have the deployment schedule earlier than they do now. This will give the field deployment team more time to respond to the fluctuations of field service demand. A new algorithm of planning has been proposed to enable the planner to consolidate service requests from different locations before scheduling. Lastly, the total time it takes for a planner to complete all tasks is estimated to assist CSC management in making necessary hiring decisions.

As this thesis is being completed, CSC is still in the process of transforming their organization and implementing the proposed changes. The potential of using the central database for information management has not been fully exploited and future efforts shall be directed towards detailed plans to enable the database to automatically generate service reports, which are currently done manually.

GLOSSARY

BU: Business Unit in Charge, a person dedicated to keep track of all PC information in a department or business unit.

CD Loan: The client company in Contract 31 has internal control procedures over the installation of software in its organization. The end user has to complete certain administrative procedures to borrow the installation CD.

Cloning: installing pre-configured images of operating systems to new PCs

CSC: Customer Solution Center, IBM Singapore

Decommission: The used PCs due to be replaced are left with the user for approximately 5 days after the new PC is set up. They are then decommissioned, i.e. data removed and ceased to be used, and collected by field engineers.

DOU: document of understanding, an internal agreement between CSC and its internal customers that states the scopes and levels of services

Field Deployment: deploying a field engineer to provide service on site

Forwarder Company: CSC used to use a third party company other than the company providing deployment services to deliver PCs to users.

HW & SW: hardware and software

Internal Customer: CSC serves as a back-end support function in the PC service value chain and the other IBM departments that are closer to the end customers are CSC's internal customers.

Load into RIIS: input information into RIIS

Master list: also master schedule, an excel file containing the user and PC information of TRs in the current year, dates on which PCs are due for refresh, etc. CSC is given such a list at the beginning of the year.

Net-Add: a service request for installing a new computer

RAM: a type of computer memory that can be upgraded

RFS: request for service

RIIS: the internal inventory management system CSC uses

Site Visit: Field engineers visit the client a few days prior to delivering the new PC to collect information about the PC being used.

TR: scheduled refresh, also known as technical refresh, the process of replacing old PCs with new ones

Transformation: the process of revamping the operations for providing field deployment services in Contract 31.

Vendor: the field engineer company

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