EXECUTIVE SUMMARY

A PROGRAM EVALUATION OF THE ITIL-BASED CHANGE MANAGEMENT PROGRAM AT GENERAL MOTORS CORPORATION

By James W. Flosdorf, Jr.

Information technology has become a critical component of nearly every business and organization, often driving competitive advantage and the achievement of business objectives. Many organizations have begun to implement structured operational processes and governance models to help manage their IT environments. The IT organization at General Motors (GM) developed an enterprise-wide Change Management (ChM) Program, deployed in early 2006. The objective was to ensure the use of standardized processes for prompt and efficient implementation of changes and to minimize the impact of change-related incidents on IT service levels. The program was based on the best practice guidelines developed by the UK's Office of Government Commerce as the IT Infrastructure Library® (ITIL).

After two years of use, an evaluation of GM's ChM Program was undertaken to determine if the program had fulfilled the stated objectives and delivered expected benefits. The evaluation was conducted by establishing key performance indicators (KPIs) that could be statistically analyzed to draw conclusions about the program's performance. The data were extracted from GM's enterprise ChM system and other validated data sources. The sample data population utilized was the twelve months, January through December, 2007. In addition, an analysis comparing GM's KPI data to applicable industry benchmark ChM data was performed. The researcher was able to base evaluation conclusions on both internal GM data as well as external industry data.

Analysis of Gm's ChM Data showed that GM deployed over 84,000 changes to the

production IT environment in 2007 with a success rate of 98%. Of the total changes deployed, 10% were implemented as urgent changes, 1% were backed-out, and 0.05% were classified as unauthorized changes. There was a 1.15% change-related incident (CRI) to total changes deployed rate and an 18% CRI to total incidents rate. (Note: incident in this context refers to major IT service impacting incidents only).

Comparison with benchmark data from the IT Process Institute 2007 study showed that GM performed better than the top-performing IT organizations in four out of five KPI areas. These four ITPI top-performer KPI rates were change success rate (96.4%), unauthorized change rate (0.7%), change back-out rate (3.3%), and CRI to total changes rate (2.9%). GM's performance was below the ITPI top-performers rate of 7.1% but better than the medium-performers rate of 12.7%.

Based on analysis of the GM internal and industry benchmark data, it was concluded that GM's ChM Program met the program objectives and realized the expected benefits set forth at the program's inception. However, several areas for potential program improvement were noted, such as reducing the urgent change and CRI rates.

Recommendations for improving performance include increasing focus on upfront change planning and risk assessment to reduce the urgent and CRI rates. Additionally, GM should continue their current Configuration Management Database and Release Management Program deployment initiatives which will facilitate improvements in performance as well as improving overall IT services. The final recommendation is for GM's IT organization to begin the transition from their current ITIL v2 implementation to ITIL v3. GM should see improved change and release management performance due its full lifecycle approach, better integration of ITIL processes, and improved IT and business alignment.

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Concentration: Information Resources Management

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“The only thing constant in life is change”

François de la Rochefoucauld, French classical author, 1613-1680

DEDICATION

This study is dedicated to my wife, Sharon, and to my children, Christina and Nicholas; whose patience, understanding and support enabled me to complete this project so that I could attain my Masters degree, a long-time personal goal of mine.

CLEARANCE

GENERAL MOTORS CORPORATION

PM175
Sent by: Pamala Johnson
04/09/2008 09:58 AM

To: James Flosdorf/US/GM/GMC@GM
cc:
Subject: Re: Status - PM-175 Paper - Flosdorf

The attached paper has been approved. The file number is NTC 2008-52. Please retain for your records.

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DEFINITION OF THE PROBLEM

Introduction

It is the responsibility of Information Technology (IT) organizations to create and maintain a stable production IT environment for the business organizations they are charged with supporting. This is a very daunting task, especially in today's increasingly complex and rapidly changing technological climate. In an effort to address the many challenges associated with effectively managing IT operations many companies are turning to standardized IT operations processes. One method that has gained increased acceptance worldwide is the adoption of guidelines and process definitions specified by the Information Technology Infrastructure Library® (ITIL)[1].

ITIL was developed in the 1980's by the Office of Government Commerce (OGC), an office of HM Treasury, in the United Kingdom. The OGC's official website describes ITIL as follows (APM Group, 2007):

> The IT Infrastructure Library (ITIL) is the most widely accepted approach to IT service management in the world. ITIL is a cohesive best practice framework, drawn from the public and private sectors internationally. It describes the organization of IT resources to deliver business value, and documents processes, functions and roles in IT Service Management (ITSM). ITIL is supported by a comprehensive qualifications scheme, accredited training organizations, and implementation and assessment tools.

[1] ITIL ® is a Registered Trade Mark, and a Registered Community Trade Mark of the Office of Government Commerce, and is Registered in the U.S. Patent and Trademark Office.

The primary goal of ITIL is "to assist IT service provider organizations to improve IT efficiency and effectiveness whilst improving the overall quality of service to the business within imposed cost constraints" (Rudd, 2004, p. 8). To accomplish this goal and to ease the job of implementing ITIL guidelines by IT organizations, the framework is composed of seven core modules (as depicted in Figure 1). These core modules are then further subdivided into distinct IT operational processes.

Figure 1: ITIL v2 Service Management Framework
(Rudd, 2004, p. 10)

Within the IT Service Management framework, and more specifically the Service Support discipline, are the processes that IT organizations use to assist them with managing the day to day operations of their production IT environments. These processes include Incident Management, Problem Management, Change Management, Configuration Management, and Release Management. For the purposes of this study, the researcher has confined the scope to

the Change Management process. However, it is important to note that all of these processes are integrated, forming a complete IT service support operational structure.

Change Management, as it pertains to changes made to production IT environments, is defined as "the process responsible for controlling the lifecycle of all changes. The primary objective of Change Management is to enable beneficial changes to be made, with minimum disruption to IT services" (Office of Government Commerce [OGC], 2007, p. 10).

The purpose of this study is to evaluate the ITIL-based Change Management (ChM) Program that was recently implemented at General Motors Corporation (GM). General Motors, founded in 1908, is the world's largest automobile manufacturer, selling 9.1 million vehicles worldwide in 2006. GM employs approximately 284,000 people across the globe and manufactures its vehicles in 33 different countries (General Motors [GM], 2008). As might be expected from one of the largest corporations in the world, GM has a very complex IT environment which includes over 2600 applications, 7000 servers, 20,000 engineering workstations, 140,000 PCs, 2500 WAN links, and 12,500 LAN switches (Wedenoja, 2006, p. 4). Managing changes to this complex IT environment is not only challenging, but is vital to GM's operations. Therefore, the ChM Program is a critical component of GM's overall IT systems and services function.

To initiate the program evaluation, the researcher analyzed GM's ChM Program, noting the objectives and expected benefits. Then, using internal ChM Program data, a statistical analysis of key program metrics was performed to determine the success of the program. A comparison of GM's ChM Program to similar programs at other large corporations, using industry benchmark studies, was made to further aid in this determination. Finally,

recommendations for program improvements, as deemed appropriate based on this research, have been provided.

Program Description

A team of GM IT managers, sponsored by executive IT leadership, working with several consultants versed in training and implementing ITIL processes began developing GM's ChM Program in March 2004. The first draft of the ChM Process Definition Document (PDD) was issued in May 2005 and a global training initiative was undertaken in September 2005. Global ChM deployment was completed in early 2006 with the establishment of over 100 Change Advisory Boards (CABs). These CABs meet weekly to review nearly 2,000 IT infrastructure and application changes that are deployed into production each week.

The creation of this structured, ITIL-based, enterprise-wide ChM program was advanced in an effort to more effectively manage the implementation of these changes. The stated purpose of the program was to "ensure that standardized methods and procedures are used for efficient and prompt handling of all changes in order to minimize the impact of any related incidents upon service" (General Motors [GM], 2006, p. 6). The net effect of better change management is to ensure a more stable IT operating environment.

Program Objectives

"The objective of change management is to take these state changes [within the IT infrastructure] through an organized and controlled set of processes" (GM, 2006, p. 6). The IT organization's ChM PDD version 2.0 lists several other business objectives, as well, that were deemed critical to the success of the program. These objectives are as follows:

- To define the…operating concepts to support the overall IT ChM process within a global multi-vendor model

- To define business and performance reporting metrics for IT Change Management
- To define integration and touch points with other ITIL disciplines and GM initiatives and tollgates…
- To leverage existing GM process (*sic*) where possible and enhance to include ITIL change and release procedures
- To align with and integrate with other GM processes currently being developed within other areas… (p. 7)

Program Benefits

Similar in some respects to the program objectives, but perhaps a bit more specific, are the benefits anticipated as a result of implementing a ChM program. These are described in the ChM PDD version 2.0 and are excerpted below:

> The benefits of taking a formal approach to Change Management include the following:
>
> - Reduced adverse impacts of changes on the quality of IT services and SLAs
> - Better estimates of the proposed change
> - Enhanced management information is obtained about changes, which enables better diagnosis of problem areas
> - Improved user productivity through more stable IT services
> - Improved IT personnel productivity, as they are not distracted from their planned work by urgent changes or back-out procedures
> - Better alignment of IT services to business requirements
> - Increased visibility and communication of Changes to business and service-support staff

- Improved risk assessment
- Better assessment of the cost of proposed Changes before they are incurred
- Fewer Changes that have to be backed-out, along with an increased ability to do this more easily when necessary
- Improved Problem and Availability Management through the use of management information relating to changes accumulated through the Change Management process
- An enhanced business perception of IT through an improved quality of service and a professional approach (p. 8)

Program Activities

The program includes six high level activities (Figure 2), as defined in the PDD v2.0 (GM, 2006). These core activities are: 1) Log Change; 2) Approve Change; 3) Build, Test & Implement Change; 4) Review & Close; 5) Facilitate Urgent Change; and 6) Process Quality Control.

The ChM Program is a resource intensive effort that requires the cooperation of GM's IT managers and supplier personnel to be effective. There are approximately 7 to 25 CAB members for each of the approximately 120 CABs currently in place. In addition, every Request for Change (RFC) has an associated IT supplier 'change owner' and a 'GM IT sponsor.' Every RFC must be thoughtfully planned and precisely documented (ChM.01 Log Change) in the corporate ChM system; approved by the GM IT sponsor (ChM.02 Approve Change); developed, tested, thoroughly reviewed at the CAB meeting, and implemented in a controlled fashion (ChM.03 Build, Test, Implement); and finally 'closed out' in the system (ChM.04 Review & Close).

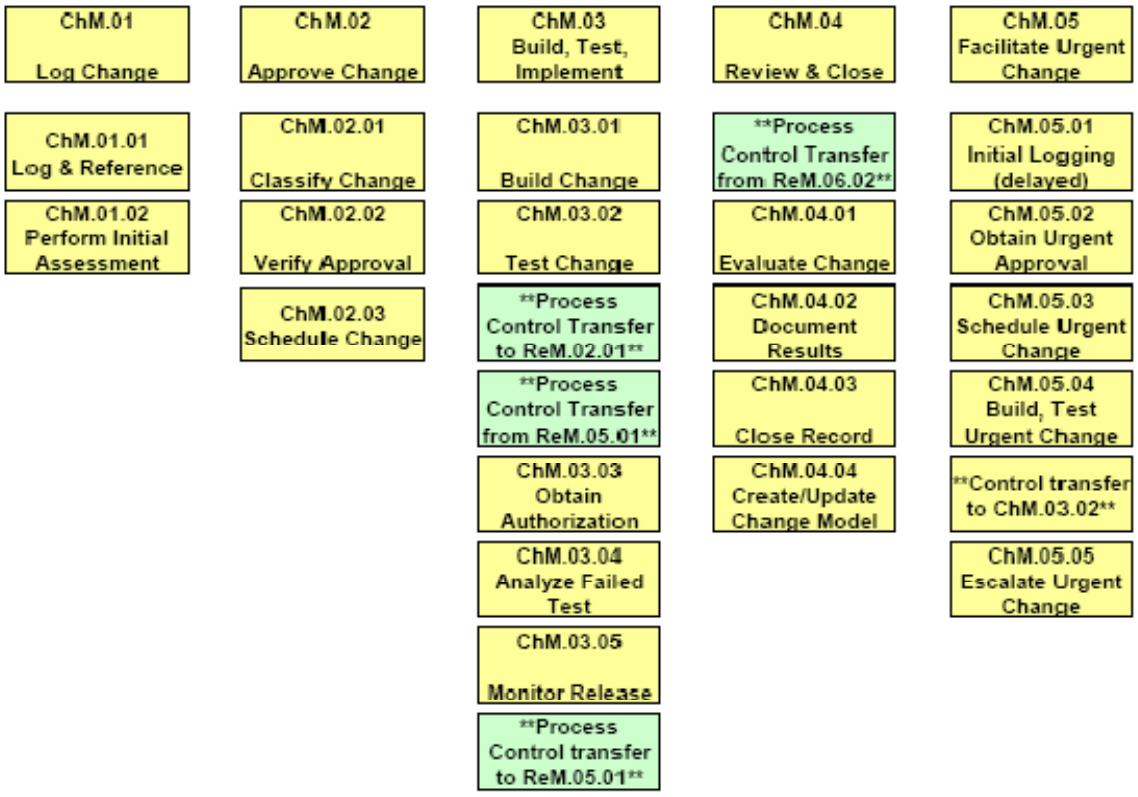

Figure 2: Change Management Process Decomposition
(GM, 2006, p. 14)

Change Advisory Board (CAB) meetings are very structured, in that there are specific rules, roles, and responsibilities required. The standard roles include the CAB Manager, CAB Coordinator, permanent (voting) CAB members, change owners, GM change sponsors, and IT supplier personnel. In preparation for the CAB meeting, a preliminary Forward Schedule of Change (FSC) or agenda is produced and distributed 48 hours before the meeting for review by all participants. Then, 24 hours prior to the meeting, a final FSC is prepared and distributed. During the meeting, each RFC is presented by the change owner using a standard script that includes information necessary for the board members to make an 'authorization for production implementation' decision.

A quorum of CAB members is required for every meeting and the meetings typically run for two to three hours every week. After the meeting is concluded, all decisions are logged and CAB meeting minutes are distributed, indicating the final disposition of all RFCs reviewed and any actions that the board required of the change owners. Once the changes have been implemented in production, the ChM system is updated by the change owner.

Change management metrics are captured in the ChM system database and are available for ad hoc and standard production reporting. Management reports are generated, distributed, and reviewed on a weekly and monthly basis. Using these metrics and management reports, program improvements can be identified and implemented as appropriate (Process Quality Control). Some of the metrics that are of particular interest to management are the total number of changes, the success rate of changes, the number and cause of change-related incidents, and the number of urgent changes.

Urgent changes, changes that must be deployed outside of the normal Change Management process cadence, follow an expedited path to implementation (ChM.05 Facilitate Urgent Change). The urgent RFC is submitted, approved, built, tested (where possible), and implemented as above; however, all on an accelerated path. The process allows for urgent changes since they are sometimes unavoidable, however, every attempt is made to minimize these types of changes due to their inherent risk to the production IT environment.

Problem Statement

The ChM Program went into full production use in early 2006. Since then there have been significant organizational and other changes, not the least of which was a wholesale re-contracting of IT services in June 2006. The introduction of standardized IT work processes (of which Change Management is one) and the transition of some IT work to non-incumbent

suppliers all had a major impact on GM's IT service delivery. Also, at the initial deployment of the ChM Program, an interim, supplier-proprietary, automated change management system was in use. This tool was subsequently replaced by GM's own enterprise ChM system in October 2006.

Due to the scope and complexities of the recent changes in the IT organization, and with nearly two years of experience using the ChM Program, the researcher believed there would be value in evaluating the program's overall effectiveness. Thus, the problem statement is to determine if GM's Change Management Program has met the originally stated objectives and whether or not it has delivered the anticipated benefits.

Purpose of the Study

As described in the problem statement above, the objective of this study was to evaluate the effectiveness of GM's recently implemented Change Management program. The purpose of this study, therefore, was to determine the current state of the program, identify the successes as well as any failures or areas in need of improvement. Several opportunities for improvement were discovered and the researcher has made recommendations for potential program improvements.

The intended audience for this study is GM's IT executive leadership, the Global Change Management Process Team, as well as other stakeholders who might have an interest in this program evaluation. In addition, the lessons learned from this study may have uses and/or implications to some of GM's other ITIL-based standardized work processes and programs, such as Release Management, Configuration Management, Incident Management, and Problem Management.

Research Objectives

In order to meet the objectives of this study, specific Program objectives have been identified for evaluation. They flow directly from the stated purpose and are summarized as follows:

- Has the corporation's ITIL-based ChM Program met its stated objectives?
- Has the program delivered the benefits that were initially identified?
- What unanticipated problems or failures has GM's IT department experienced related to the implementation of this program, if any?
- How does GM's program compare to similar Change Management programs at other large corporations?
- What improvements, if any, could or should be made to the program?
- Can the results of this study be applied to any of the corporation's other ITIL-based Standardized Work processes?

For the purposes of this study, the success of the program was evaluated against the program's progress in meeting initial business objectives and delivery of the expected benefits that were identified in the program's PDD v2.0. Failures in meeting objectives or delivering benefits have been further analyzed to determine if there may have been faulty assumptions when these objectives and/or benefits were first identified or if the program has, in fact, failed. Where it was determined that the program failed, conclusions were drawn to as to the cause of the failure and solutions have been proposed to correct the failure. Where there were faulty assumptions made at the outset of the program, suggestions have been made to bring the objectives or benefits statements into a more realistic focus.

Limitations

There were certain limitations that are important to note regarding this study. The first deals with limiting the scope of this study due to time and program complexity considerations. Therefore, even though GM has concurrently implemented a number of ITIL-based standardized work processes and supporting programs, only the Change Management Program was selected to be evaluated at this time.

It is also important to note that the UK's Office of Government Commerce (OGC) recently released, as of May 30, 2007, version 3 of the ITIL framework. GM's ChM Program was based entirely on ITIL version 2 and, as yet, has not been revised to include the concepts or other restructuring that are now part of ITIL v3. There were significant changes made to the ITIL framework, which the researcher has attempted to take into consideration where program improvements have been suggested as part of this program evaluation.

Some limitations involving the collection of data had the potential to impact this study, such as the 'cleanliness' (i.e. garbage in/garbage out) of the data obtained from the company's ChM system. Corporate ChM data from 2006 is, unfortunately, from two sources, the previous supplier-proprietary ChM System (January to mid-October 2006) and the current GM ChM System, which became operational beginning in mid-October 2006. To overcome potential data discrepancies introduced by gathering data from two disparate systems, this study was conducted using data only from GM's ChM system. To accommodate this, the data collection period selected was from January through December, 2007.

Lastly, not all of the benefits listed in the PDD were evaluated in this study. Those elements that were subjective in nature, such as business perception and IT alignment to business

needs, were not investigated. To properly analyze these, a survey instrument would have needed to be developed, which was outside the scope of this project.

Definition of Terms

The following terms, used throughout this document, may not be familiar to all readers; therefore, the researcher has compiled the following list of definitions to assist the reader's comprehension. The terms and their definitions are from the researcher's own knowledge of the subject matter or have been paraphrased from version 2 of GM's ChM Process Design Document (GM, 2006) and/or the *ITIL Glossary of Terms, Definitions and Acronyms* (OGC, 2007)[2].

Authorized Change - An authorized change is a change that has been reviewed and approved by an Authorization CAB for production deployment.

Availability - Availability refers to the ability of a Configuration Item (e.g. application) or IT service to perform its function when required. Availability is determined by reliability, maintainability, serviceability, performance, and security. Availability is usually calculated as a percentage. This calculation is often based on agreed service time and downtime. It is considered best practice to calculate availability using measurements of the business output of the IT service.

Availability Management - The process responsible for defining, analyzing, planning, measuring and improving all aspects of the availability of IT Services. Availability

[2] Portions from "ITIL® Glossary of Terms, Definitions and Acronyms," (v3) by the Office of Government Commerce (OGC), May 2007. ITIL Glossaries/Acronyms © Crown Copyright Office of Government Commerce. Adapted with the permission of the Controller of HMSO and the Office of Government Commerce.

Management is responsible for ensuring that all IT infrastructure, processes, tools, roles etc. are appropriate for the agreed Service Level Targets for Availability.

Best Practice - Proven activities or processes that have been successfully used by multiple organizations. ITIL is an example of Best Practice.

Capacity Management - The process responsible for ensuring that the capacity of IT Services and the IT Infrastructure is able to deliver agreed Service Level Targets in a cost effective and timely manner.

Change - The addition, modification or removal of anything that could have an effect on IT Services. The scope should include all IT Services, Configuration Items, processes, and documentation.

Change Advisory Board (CAB or Authorization CAB) – The CAB is comprised of a group of people who provide expert advice to the Board on the implementation of changes, including risk assessments, scheduling concerns, and business priority. This board is likely to be made up of representatives from all areas within IT and may possibly include representatives from business units.

CAB Manager - The CAB Manager role is a permanent, voting member of the Authorization CAB. The CAB Manager has overall responsibility for conducting the

Authorization CAB and ensuring that only changes that are ready for deployment are authorized.

Change Coordinator - The Change Coordinator (or CAB Coordinator) role has administrative responsibilities within the Change Management process. The Change Coordinator will assist the Change Manager in their responsibilities for the authorization of changes.

Change Management (ChM) - The process responsible for controlling the lifecycle of all changes. The primary objective of Change Management is to enable beneficial changes to be made, with minimum disruption to IT Services.

Change Owner - The change owner is a role established within the Change Management process to reflect the activities undertaken by any supplier in response to a Request for Change. These activities may include logging the change, building and testing the change, and presenting the change before the CAB, and implementing the change.

Change Record - A record containing the details of a change. Each change record documents the lifecycle of a single change. A change record is created for every Request for Change that is received, even those that are subsequently rejected. Change records should reference the Configuration Items that are affected by the change.

Change Sponsor – The Change Sponsor is the corporate IT Manager who is responsible for a Request for Change. They ensure the change is properly documented, built and tested, and that is represented at the CAB for authorization prior to production deployment.

Change Window - The change window is the scheduled timeframe (sometimes referred to as the maintenance window) to perform the implementation of a Change or Release. The Change Window is from the scheduled start time through the Back-Out End time.

Configuration Item (CI) - The IT infrastructure is built from components. Every component of the infrastructure, under the management of the IT organization, is called a configuration item (CI). A CI may have any form of complexity or size and may vary from a complete mainframe to, for instance, a PC as well as a monitor, keyboard, or a floppy disk drive.

Configuration Management - The process responsible for maintaining information about the Configuration Items required to deliver an IT Service, including their relationships. This information is managed throughout the lifecycle of the CI.

Configuration Management Database (CMDB) - A database used to store configuration records throughout their lifecycle. The CMDB stores attributes of CIs, and relationships with other CIs..

Environment - A subset of the IT infrastructure that is used for a particular purpose. Examples include the Production or Live environment, Pre-Production environment, Model Office or Test environment, and the Development environment. Note that the ChM Program in this study concerns itself primarily with the Production environment.

Forward Schedule of Change (FSC) - The definitive schedule of all changes that are in the queue to be authorized or have been authorized by the appropriate CAB. The FSC contains the schedule date/time, summary of the change and a link to the change record. The changes could be grouped by Releases as well as viewable individually. All suppliers will use the FSC to determine how they plan their work. The FSC is the schedule from which communications to the customers and end users is based.

Impact (Change) - As it relates to Change and Release Management, Change Impact is the scope of CIs that may be affected by the change including sites, business units and sectors, and as well as related CIs. Impact is also a measure of the effect of an Incident, Problem or Change on business processes. Impact is often based on how Service Levels will be affected.

Incident - An unplanned interruption to an IT Service or a reduction in the quality of an IT Service. Failure of a Configuration Item that has not yet impacted service is also an incident. For example, the failure of one of the hard disk drives from a mirrored set.

Incident Management – Incident Management is the process responsible for managing the lifecycle of all incidents. The primary objective of Incident Management is to return the IT Service to users as quickly as possible.

Information Technology (IT) - The use of technology for the storage, communication or processing of information. The technology typically includes computers, telecommunications, applications and other software. The information may include business data, voice, images, video, etc. Information Technology is often used to support business processes through IT Services.

IT Infrastructure - All of the hardware, software, networks, facilities etc. that are required to develop, test, deliver, monitor, control, or support IT Services. The term IT Infrastructure includes all of the Information Technology but not the associated people, processes and documentation.

IT Operations - Activities carried out by IT Operations Control, including IT Operations Supplier management, service console management, job scheduling, backup and restore, and print and output management. IT Operations is also used as a synonym for Service Operation.

IT Service- A Service provided to one or more customers by an IT Service provider. An IT Service is based on the use of Information Technology and supports the customer's

business processes. An IT Service is made up from a combination of people, processes and technology and should be defined in a Service Level Agreement.

IT Infrastructure Library® (ITIL) – ITIL is a set of Best Practice guidelines for IT Service Management. ITIL is owned by the OGC and consists of a series of publications giving guidance on the provision of quality IT Services, and on the processes and facilities needed to support them. See http://www.itil.co.uk/ for more information.

Key Performance Indicator (KPI) – KPI is a metric used to help manage a process, IT Service or activity. Many metrics may be measured, but only the most important of these are defined as KPIs and used to actively manage and report on the process, IT Service or activity. KPIs should be selected to ensure that efficiency, effectiveness, and cost effectiveness are all managed. A KPI may also be referred to as a Critical Success Factor.

Lifecycle - The various stages in the life of an IT Service, Configuration Item, Incident, Problem, Change, etc. The Lifecycle defines the categories for status and the status transitions that are permitted. For example, the Lifecycle of an application includes Plan, Define, Design, Build, Test, Deploy, Operate, Optimize, and Retire.

Maintenance Window - A regularly scheduled timeframe, mutually agreed upon between the Performing Supplier and the client, where systems may be unavailable to the

users. Performing Suppliers may utilize these Maintenance Windows to perform authorized changes and/or maintenance activities.

Office of Government Commerce (OGC) - OGC owns the ITIL brand (copyright and trademark). OGC is a UK Government department that supports the delivery of the government's procurement agenda through its work in collaborative procurement and in raising levels of procurement skills and capability with departments. It also provides support for complex public sector projects.

Pre-Production Environment – This is the portion of the [corporate] IT environment that is used to perform User Acceptance Testing and System Integration Testing prior to any service (hardware, software, application, etc.) being deployed to production. Pre-production should mirror Production as closely as possible.

Problem Management – Problem Management is the process responsible for managing the lifecycle of all system problems in the IT environment. The primary objectives of Problem Management are to prevent incidents from happening, and to minimize the impact of incidents that cannot be prevented.

Production Environment - The portion of the [corporate] IT environment that is being actively utilized by [corporate] users in the performance of their day-to-day job functions. This is the environment that the Change Management and other ITIL-based Standardized Work programs are designed to protect.

Release - A collection of hardware, software, documentation, processes or other components required to implement one or more approved changes to IT Services. The contents of each Release are managed, tested, and deployed as a single entity.

Release Management (ReM) - The process responsible for planning, scheduling and controlling the movement of Releases to the Production environment. The primary objective of Release Management is to ensure that the integrity of the Production environment is protected and that the correct components are released.

Request for Change (RFC) - A formal proposal for a change to be made. An RFC includes details of the proposed change, and may be recorded on paper or electronically. The term RFC is often misused to mean a Change Record, or the change itself.

Risk - As it relates to Change and Release Management, risk is the probability of a change causing an incident or other negative consequence to the [corporate] IT environment.

Service Desk – Also referred to as a Help Desk, the Service Desk is the single point of contact between the Service Provider and the users. A typical Service Desk manages incidents and service requests, and also handles communication with the users.

Service Level Agreement (SLA) - An SLA is an agreement between an IT Service Provider and the customer. The SLA describes the IT Service, documents Service Level Targets, and specifies the responsibilities of the IT Service Provider and the customer. A single SLA may cover multiple IT Services or multiple customers.

Standardized Work - The documentation of work functions performed in a repeatable sequence, which are agreed to, developed, followed, and maintained by the functional organization.

Supplier - A Third Party responsible for supplying goods or Services that are required to deliver IT services. Examples of suppliers include commodity hardware and software vendors, network and telecom providers, and Outsourcing Organizations.

System - A number of related things that work together to achieve an overall objective; for example, a computer system including hardware, software and applications.

Urgent Change – An urgent change is a change that must be introduced as soon as possible; for example, to resolve a major incident or to implement a critical security patch. The Change Management process will normally have a specific procedure for handling Urgent Changes.

Workaround - Reducing or eliminating the impact of an incident or problem for which a full resolution is not yet available.

CHAPTER II

LITERATURE REVIEW

Introduction

Information is widely considered to be one of the most critical resources of businesses today. Corporate data detailing business strategies, product designs, proprietary manufacturing processes, and other vital corporate intellectual property must be securely protected if companies are to remain viable and competitive. IT organizations are increasingly under pressure to improve the availability, data integrity and security of the information systems they manage which collect, store, share, and protect this critical corporate data. As a means of accomplishing this goal, many organizations have adopted various IT governance models. In *The Journal of Investment Compliance* (2005, p. 45), Nick Robinson, Manager in Ernst & Young's Technology & Security Risk Services Practice, makes a compelling statement about the role of IT and the need for governance; stating:

> The pervasive nature of IT as a business enabler obscures some harsh realities about IT performance. Contrary to conventional wisdom, technology-driven increases in productivity have been meager relative to total expenditures. Lackluster IT performance is manifested in failed or aborted projects, missed deadlines, budget overruns, and poor returns on investment (ROI). Increasingly, these indications of low IT effectiveness are shining a spotlight on the need for IT governance as a vehicle for bolstering performance.

To address these systemic problems, IT organizations can leverage any number of the many governing bodies and standards organizations, such as the Capability Maturity Model Integration (CMMI) for systems development, the International Organization of Standardization

(ISO) and British Standards Institution (BSI), the Project Management Institute (PMI), American National Standards Institute (ANSI), and the Institute of Electrical and Electronics Engineers (IEEE) to name just a few. However, only a few organizations deal specifically with IT operations.

Two widely recognized industry standard frameworks for IT operations are ITIL and COBIT (Control Objectives for Information and related Technologies). "COBIT is an open standard for control over information technology and is independent of the software and hardware platform. It is maintained and refreshed on a four-year cycle by the IT Governance Institute" (Robinson, 2005, p. 48). COBIT focuses on control or governance of IT while ITIL provides guidelines for operational IT processes, and as such, they can be used together or separately. While IT governance is critically important in addressing the concerns Robinson described, so too, is strict control and standardization of everyday IT operational processes.

Recognition of this need has sparked an interest in ITIL by the U.S. over the last ten years or so. Even more recently, with the introduction of Sarbanes-Oxley (SOX) legislation in 2002, U.S. corporations have become increasingly interested in ITIL for guidance in managing their IT operations. Additionally, according to Steinberg & Goodwin (2006, p. 29):

> …another factor driving U.S. acceptance [of ITIL] is that companies are seeing more than two-thirds of their IT budgets being eaten up in new, nondiscretionary operating costs, over which they have very little control. It's rare to find an IT shop that can articulate how IT contributes to company's bottom line.

In 2004, when the Gartner Group surveyed some 164 Data Center Conference attendees, primarily from large U.S. firms, they found "that their awareness of and familiarity with ITIL had both increased from the previous year, and that 41 percent reported using the methodology to

some degree, up from 31 percent in 2003" (Worthen, 2005, p. 1). Although ITIL adoption by U.S. organizations still lags behind the U.K., the United States is certainly near the top among ITIL users worldwide. While the benefits of embracing ITIL can be significant, they don't come without a lot of hard work; including planning, marketing, communication, training, and perseverance.

Benefits of ITIL

ITIL was developed to address the fact that "business has increasing dependency on information technology (IT) to deliver services to customers" (Zeng, 2007, p. 24). This was true back in the 1980's when ITIL was initially developed, but the necessity of stable and effective IT systems, processes, and innovations to maximize competitive advantage has significantly increased in recent years. Businesses require "IT service providers and information system managers to ensure that service-affecting incidents do not occur, or that efficient and effective remediation" steps are taken to quickly restore service if they do (Zeng, p. 24). Effective IT service management, based on the best practices given by ITIL, can be beneficial in helping IT organizations meet these needs.

The benefits that can be realized by organizations adopting ITIL's guidance include "reduced costs, improved IT services through the use of proven best practice processes, improved customer satisfaction, standards and guidance, improved productivity, and improved use of skills and experience" (Office of Government Commerce [OGC], n. d.). Further, in an article appearing in *CIO* magazine, Ben Worthen wrote that MeadWestvaco, a Virginia-based paper and pulp company, has reduced IT costs by over $100,000 a year and increased systems operational stability by 10% through the implementation of an ITIL program (2005).

Similar benefits were noted in the *Manufacturing Business Technology* journal (2006) regarding Bombardier, a Montreal-based manufacturer. They reported “fewer IT-related problems” due to ITIL, and Lars Holmberg, their service delivery manager, stated that “if an accident occurs, we can restore services 40 percent faster than before. The new approach also has cut IT costs by about 10 percent" (“Squeezing the most value from IT may require learning the definition of ITIL,” 2006).

Another benefit of adopting ITIL is that it provides a standard way to communicate, both within the IT organization and in communications with the business, as they too become familiar with IT’s standardized ITIL processes. Zikmund (2003, p. 599), in *Business Research Methods*, states that a “message is communicated only if there is enough common experience,” to enable comprehension between the parties who are communicating. When the State of Michigan began rolling out ITIL-based processes in January 2004, they found that “the ITIL terminology gave the Michigan team a common language and set of concepts, which was the foundation for the next step: looking at the gap between current practices for a given process and those ITIL recommends” (Cox, 2004, p. 60).

Lucent Technologies recognized a need to fill gaps in their current IT processes when the federally mandated Sarbanes-Oxley (SOX) legislation was enacted. They began their process evaluations and implementation of ITIL-based Service Management processes in 2003. Shelia Bridge, Director of IT Controls at Lucent, presented at the 2006 itSMF Conference in Salt Lake City, and cited the following benefits from ITIL (Bridge, 2006, p. 19):

- More responsive to business needs
- Central repository for CI’s facilitates better control, increased visibility and improved efficiency in managing operations

- Decreased amount of rework in organization
- Proactive monitoring decreased response time, increased overall system availability and reduced downtime
- Facilitated consolidation and decommissioning of older servers

Another corporation, Finisar, a manufacturer of computer hardware, adopted ITIL in 2002 and standardized their service desk function. Because of this, they claim that "customer satisfaction rates have risen from 33 percent to 95 percent" and they have reduced their IT spending "from 4 percent of revenue to 2.4 percent" (Worthen, 2005, p. 1).

These companies have undoubtedly implemented ITIL in different ways, using different tools and methodologies, but the bottom line is that they have realized significant, quantifiable benefits. Current literature appears to support this, in that examples of companies that have realized benefits from ITIL are shown to have utilized various approaches in their implementation of ITIL's best practices

ITIL Implementation

Typically IT organizations choose to implement ITIL in phases rather than to take a 'big bang' approach. It is not uncommon for organizations to start with Incident Management because that is where the pain of uncontrolled IT operational processes is most evident. However, more recently, Change Management has been targeted as a primary process area to begin with. This may be seen as a more proactive approach than Incident Management because changes are often found to be the culprit behind incidents (Johnson, 2007).

Travis Greene, Chief Service Management Strategist for netiQ, an IT systems and security management solutions company, concurs that implementing change management will help to "ensure that standardized methods are used for efficient and prompt handling of all

Changes and minimize Change-related Incidents" (Greene, 2006, p. 2). Another reason to implement change management processes, given by change control manager Bob Paniagua of AutoNation, was "specifically to get in front of auditor requirements in Sarbanes-Oxley regulations" (Dubie, 2005, p. 20).

However, adopting the best practices set forth in ITIL is not an easy task. CEO's should treat the implementation as a major project, similar to an Enterprise Resource Program (ERP) implementation that will take years to complete (Worthen, 2005, p. 1). It is important to note that ITIL only provides guidance; it does not give step by step procedures for implementation. It is left up to the organization to decide on the best course of action to take when embarking on this journey.

Purdue University used a pilot approach to implementing ITIL in their organization. For their pilot, they chose four disciplines to start with: Change Management, Configuration Management, Incident Management, and Service Level Management. They employed a strict project management approach, using PMI's Project Management Book of Knowledge (PMBOK) methodology as a basis, and used the pilot results to determine their next steps (Cumberland & Knowley, 2006).

The toll on the IT organization implementing ITIL can be significant. Dubie (2005, p. 8) found that "adopting a best practices framework is hard, time-consuming and challenging to even the best leader trying to compel IT staff to comply with enterprise-wide process change."

Joe Lithgo, Director of the Operational Excellence Program for the State of North Carolina, has summarized "four key challenges" to implementing ITIL in an organization (2006, p. 3). They are organizational "resistance to change, obtaining and sustaining Executive

stakeholder buy-in, sustaining momentum amid competing priorities, and ensuring that your organization truly improves services rather than merely 'implements ITIL.'"

These same implementation challenges are reiterated many times in the literature. For example, Bob Paniagua of AutoNation, found that "comprehensive upfront work could help reduce the inevitable pushback many IT organizations experience when rolling out massive changes companywide" (Dubie, 2005, p. 20). He would try to understand the concerns being expressed because, in order to be successful, he had to gain the cooperation of the departments and have them document "the processes that would work based on their jobs and incorporate that into the overall framework" (p. 20).

Similar to the Lithgo's experience in North Carolina, executive buy-in was also found to be critical at Lucent Technologies, where IT Director, Shelia Bridge found that the implementation of ITIL guidelines "was contingent on the total commitment of leadership and resources. Buy-in from senior executives was necessary from end to end, as well as top to bottom" (ITSM Project Drives Long-Range Vision, 2007, p. 18).

At Progress Energy, an energy utility company in North Carolina, one of the keys to their successful ITIL implementation was communication, at all levels, by all means. For example, they created an internal website featuring ITIL and Program reference materials for their employees. They sponsored technology briefings, brown bag lunch presentations, focus groups, and they developed and distributed various printed materials (Cassidy, 2006).

Implementation challenges aside, the longer term benefits have demonstrated an increase in IT operational performance. However, during the initial phases, performance and operational efficiency typically decline until the organization can come to grips with the new processes. Alternatively, according to Murray & Mohamed (2007, p. 23), doing nothing, or opting "to

continue business as usual, means a steady loss in the ability to compete and ultimately being rendered irrelevant."

Change Management Programs

In *The Visible Ops Handbook*, Behr, Kim, and Spafford (2005) state that a goal of successful Change Management, based on ITIL best practices, is to "reduce the amount of unplanned work as a percentage of total work done down to 25% or less. Organizations that are in a constant firefighting mode can have this percentage at 65 percent or even higher." Achieving his would be a significant productivity boost for IT departments that do not have changes under control.

As Brian Johnson, one of the original authors of ITIL states, "if incidents related to changes are not brought under control, IT and the business itself can spiral out of control. IT becomes locked in a never-ending, reactive cycle where the number of incidents increases and reacting to them leads to more incidents". He goes on to say that "As more companies strive to align IT with the business goals and objectives and show quantifiable business value, change management has surfaced as the ITIL guidance that will help proactively manage change, prevent incidents and ensure continuous business operations".

To further drive home the idea of improving business performance by reducing change-related incidents (CRIs), Gostick (2006) states that "this ability to control change is the major contributor to business value. In firms with poor change-control processes, IT staff were spending more than half of their time on unplanned work. Simply put, without change control IT performance will not advance." He states that by reducing the effort expended on unplanned work, IT productivity and efficiency are increased, thereby satisfying one of the primary goals of establishing an ITIL program.

It is estimated that poor change control practices can account for up to 70% of all CRIs (Spafford, 2005). While an exact number of change-related incidents, industry-wide, is probably not feasible to ascertain, some industry estimates put it at about 80% (BMC Software, 2006). Implementing a change management program will not eliminate all CRIs, but it will provide an opportunity to substantially reduce the risk. "Trying to implement a process with the goal of eliminating [the] risk [of change-related incidents] will result in a slow, costly process that may not be warranted" (Spafford, 2005).

Exact quantification of the positive effects of a change management program may not always be possible; however, improvements can still be identified. For the State of Michigan, Cox (2004, p. 60) found that, as of his writing, there were "no overall savings estimates, but ITIL has dramatically reduced the number of changes gone bad. All changes now are scheduled and visible, and changes are only approved if they have a "back-out plan"- a process for restoring the system to its original state if the change fails for any reason."

ITIL Implementation Benchmark Studies

While there was limited published data quantifying the results of companies that have implemented ITIL-based Change Management programs, there was one study published in 2007 by the Information Technology Process Institute (ITPI) that provided a comprehensive analysis of industry-wide ITIL implementation results. This study, entitled *Change, configuration, and release performance study: identifying IT best practices that predict the highest levels of performance,* was "based on data from 341 IT organizations and 11 executive interviews" and provided an excellent set of relevant industry benchmark statistical data (IT Process Institute [ITPI], 2007, p. 1).

The ITPI study targeted 30 ITIL-based change, release, and configuration management best practices which were found to be statistically significant predictors of IT performance. The Institute was able to document variations in the implementation of these best practices and correlate them to "top-, medium-, and low-performing IT organizations" (ITPI, 2007, p. 2). The key findings from this study indicated that IT organizations should focus heavily on the following areas: Release Management, the disciplined use of ITIL processes, standardized configurations of production IT systems, controlling access to production systems, and implementation of a Configuration Management Database, or CMDB (ITPI).

The ITPI benchmark data that are relevant to this study for comparative analyses will be discussed further in Section IV, Data Analysis. The ITPI study went well beyond, but nevertheless substantiated, the non-empirical ChM program implementation evidence found during the course of this research project.

Another benchmark study, entitled *ITIL Change Management Maturity Benchmark Study* was published in July 2006 by Evergreen Systems, an ITIL and IT process improvement consulting firm. They surveyed "one hundred (100) IT managers, directors and executives from 77 companies, organizations and institutions" at a "series of ITSMF [IT Service Management Forum] Regional Conferences" and found that:

> Regular use of a single, enterprise-wide Change Management policy and system is a key indicator of early process maturity. Today, only 58 % of respondents have achieved this level of maturity. However, as organizations increase their use of Change Management in a variety of ways, it is clear that Change Management has become a common workflow engine and a critical component in transforming IT from operating like a collection of technical silos to operating as a single enterprise.

> Today nearly half see the Change Management application as their IT workflow tool, with another 24 % moving in that direction. A similar percentage use Change Management applications to plan and execute Release Management activities. This is noteworthy, as Release Management is arguably the most complex and risky Change Management activity. 70 % integrate or plan to integrate Change Management with their Project and Portfolio Management tools, displaying a clear understanding of the workflow role of Change in executing the organization's most significant projects. (p. 3)

The Evergreen Systems researchers further state that only 44% of respondents "use Change Management as an informal risk assessment process" (Evergreen Systems, 2006, p. 1). They conclude that more work is necessary to formalize the change management governance process and fully integrate it into the corporate IT lifecycle.

A Look Ahead

The UK's Office of Government Commerce (OGC) released version 3 of the ITIL framework on May 30, 2007. This updated version "promises more real-world examples, best-practice models and metrics, and emphasizes the entire IT lifecycle and ROI issues, as opposed to narrow operational issues" (Weil, 2007).

In the 3rd edition *of ITIL® Refresh News*, Editor Sue Downey (2007) differentiates between ITIL version 2 and version 3 as follows:

> In general, v3 makes the link between ITIL's best practice and business benefits both clearer and stronger. The main development is that v3 guidance takes a lifecycle approach, as opposed to organizing according to IT delivery sectors. ITIL is now based on five core lifecycle titles:
>
> - Service Strategy

- Service Design
- Service Transition
- Service Operation
- Continual Service Improvement.

The changes reflect the way ITSM has matured over the past decades. For example:

- Where V2 talked about Business and IT Alignment, V3 emphasises Business and IT Integration;
- Where V2 talked about Value Chain Management, V3 emphasises Value Network Integration;
- Where V2 talked about Linear Service Catalogues, V3 emphasises Dynamic Service Portfolios;
- Where V2 talked about Collection of Integrated Processes, V3 emphasises Holistic Service Management Lifecycle. (p. 3)

This latest version offers a full lifecycle approach to Service Management and promises to address some of the deficiencies that have been identified in version 2 of ITIL. Some of these improvements include more guidance for implementation, a clearer linkage to business value, better measurements of business value, and built in continuous improvement practices (ITIL v3, 2007). The ITIL v3 "Service Lifecycle," shown below in Figure 3, graphically depicts the relationships between the five lifecycle core guidance areas. It represents a central flow from Service Strategy to Design, Transition, and Operation, with a Continual Service Improvement feedback mechanism (Axios Systems, 2007). The cyclical nature of the model and inter-

relatedness of the processes allows for improved communication, timely corrective actions, and process improvements.

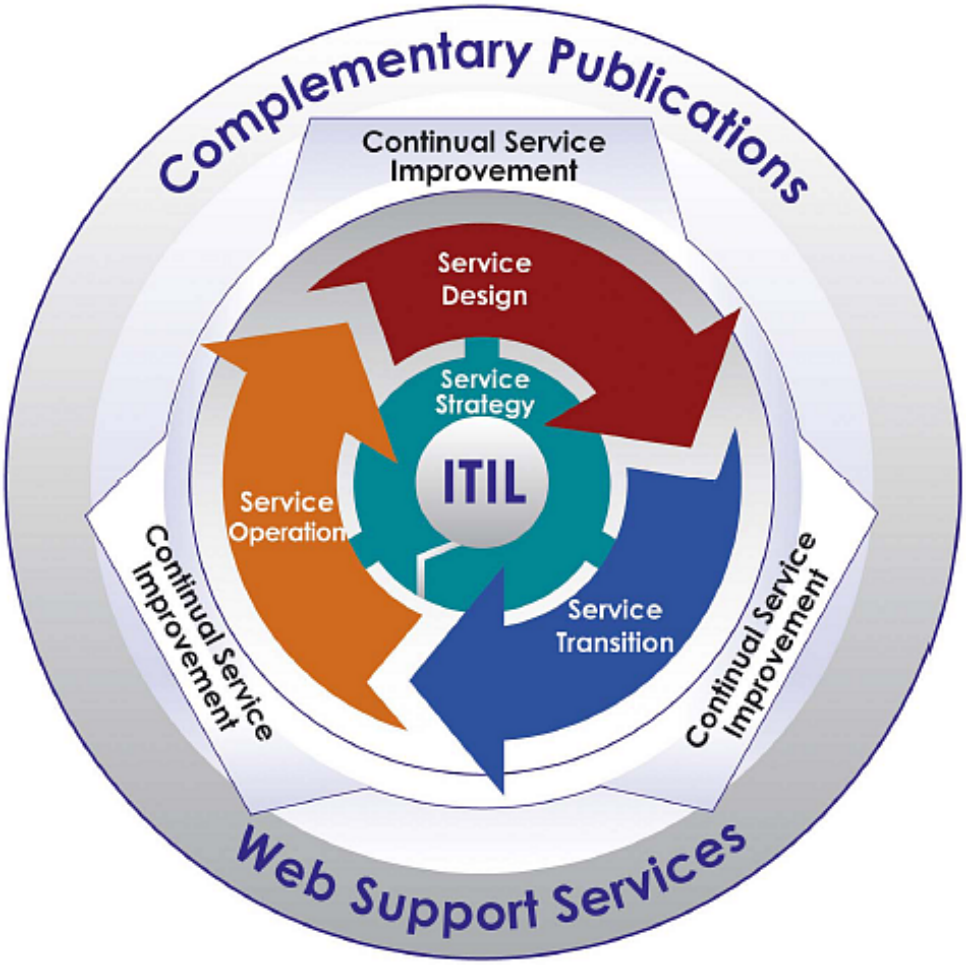

Figure 3: ITIL v3 Service Lifecycle
(Axios Systems, p. 5, 2007)

The Service Transition core guide, which covers Change Management, as well as Release and Deployment, and Configuration Management, is focused on delivering IT services in a manner that ensures understanding and adding business value. The tightly coupled change and release management processes support business value attainment through "delivering changes at optimized speed, risk and cost, and offering a consistent, appropriate and auditable

implementation of usable and useful business services" (itSMF, 2007, p. 27). The Release and Deployment process spans the entire change development through deployment phases and therefore ensures a holistic approach to change implementation.

Due to the tight integration of change management and IT system configuration management, the Service Transition discipline supports Configuration Management Database (CMDB) updates, knowledge transfer, and decision support (itSMF, 2007, p. 24). In addition, the formal, consistent, and comprehensive change management framework of ITIL v3 makes it easier for IT organizations to "adopt and manage change, standardize transition activities ...and ensure [that] new/changed services will be deployable, manageable, maintainable [and] cost-effective" (ITIL v3, 2007, p. 68).

Summary

Interest in and adoption of ITIL is increasing in the US and elsewhere. There is a growing need for more IT governance and control due in part to the increasing dependency of businesses on IT. In order to meet that requirement, IT organizations must implement standard, consistent, and repeatable IT operations processes.

This standardization is one of the primary benefits of ITIL. Other benefits that IT organizations realize by adopting ITIL best practices include increased system availability; reductions in the number, severity, and business impact of change-related incidents; cost reductions; improved productivity; increased customer satisfaction; and a standard way of communicating about IT service management.

There are many ways to approach an ITIL implementation, but many organizations are now choosing to start with change management, as a proactive means to more quickly show a return on investment. The most widely claimed reasons for implementing a change management

program were to gain control of changes to the IT environment, to minimize change-related incidents, improve system availability, reduce unplanned work and thereby improve productivity, and to address corporate audit concerns such as SOX compliance.

Implementing ITIL is a non-trivial endeavor. It is often seen as overwhelming, but if it is approached as a large IT project, similar to deploying a large enterprise software project like ERP, it can be manageable. Some of the common challenges include securing unwavering executive leadership commitment, managing organizational resistance to change, and ensuring that an appropriate level of business value or ROI is attained.

Looking ahead to the next release of ITIL promises to provide even greater efficiencies and a more holistic approach to IT Service Management. ITIL v3 addresses the entire IT Service lifecycle and provides a tighter integration to business value creation and measurement, as well as providing a mechanism for continuous improvement. ITIL v3 is expected to ease the implementation challenges by providing more guidance and enable IT organizations to justify and realize a greater return on their investment.

CHAPTER III

METHODOLOGY

Research

The intent of this study was to analyze the Change Management Program at General Motors in order to draw conclusions about the relative success of GM's ChM program implementation. A 'program evaluation' typological approach, specifically an evaluation of the *effectiveness* of the program was performed.

As such, the methodology used in evaluating the effectiveness of General Motor's ChM Program included a comparison of specific operational indicators (performance metrics) to established performance criteria (stated program objectives and expected benefits). Specific performance metrics were defined along with an explanation of how those metrics translated into measurable indicators of program effectiveness. The researcher then gathered empirical evidence, in the form of metrics data collected from GM's ChM System and other internal data sources, to perform the analysis.

A statistical analysis of GM's ChM data was conducted to determine data trends, variability of program data, and the correlation of these data to specific program variables. This analysis formed the basis for evaluating the progress of the program against the stated program objectives and the expected program benefits.

Additionally, comparison of these data to data from other corporation's Change Management programs, in the form of IT industry ChM benchmark data, provided a basis for the validity of the data and the evaluation model employed by this study. This allowed the researcher to draw conclusions regarding the effectiveness of GM's program compared to industry norms.

Performance Criteria

The performance criteria upon which the ChM Program was evaluated included the stated program objectives and the anticipated program benefits which were developed and updated throughout the project initiation and early implementation phases. The program objectives state that all IT application and infrastructure changes will be managed through a standardized Change Management process. They further state that this process will define the operations of Change Management within a global, multi-supplier IT support model and will leverage and/or integrate with GM's existing processes and initiatives, as well as other ITIL disciplines. Additionally, the ChM Program will be responsible for providing improved business and performance reporting metrics (GM, 2006).

Collection of business and performance metrics provided the data necessary to evaluate the Program. These data were analyzed in order to make a determination about whether the ChM Program had delivered the business benefits that the program designers forecasted. The program benefits determined to be most readily able to be evaluated by the specific metrics being captured included the following (GM, 2006, p. 8):

- Increased IT system stability and system availability
- Improved planning and communication of changes
- Reduced adverse impact of changes on the quality of IT services and on SLAs
- Improved IT and end user productivity
- Improved change management metrics and reporting capabilities

Overall, the program objectives and benefits seemed to be realistic, achievable, and in line with the researcher's literature review. The objectives centered largely on the program implementation and how it would become ingrained into the corporate IT operational fabric over

time. They included a built-in mechanism to track progress, via ChM metrics, as well as a process step to make adjustments to the program should they be necessary. By evaluating these metrics and developing reasonable operational or performance indicators, a judgment on the program's effectiveness was possible.

Operational Indicators

There are many data elements that are stored in the automated Change Management System database; however, only a few of the fields were considered as Key Performance Indicators (KPIs) for this study. The data elements that could be translated into measurable factors that directly related to the established performance criteria were established as the KPIs utilized in this study.

GM's IT Services Production Control organization reports Change Management Program metrics on a weekly, monthly, quarterly, and yearly basis. The KPIs that are tracked and used by the organization to manage the program deal primarily with the number, type, and status of changes, as well as change-related incidents and process compliance metrics. These metrics are used to measure the performance of GM's Performing Suppliers, Regional Process Areas, Business Process Areas (BPA), functional areas within BPAs, and even individual CAB performance.

Using the expected benefits and program objectives as a basis, critical performance criteria were identified that could be analyzed using these Change Management metrics. These performance criteria are shown below in the left column of Table 1. Measurable Change Management factors that directly impact these performance criteria are shown on the right-hand side of Table 1.

Table 1: Measurable ChM Factors Influencing Performance

Performance Criteria	ChM Factors Influencing Performance
Managing All IT Changes	Unauthorized Changes
System Stability & Availability	Change Success Rate, Urgent Changes, CRIs
End User Productivity	Change Success Rate, Urgent Changes, CRIs
IT Productivity	Number & Type of RFCs, CRIs, Change Success
Planning & Communication	Change Success Rate, Urgent Changes, Unauthorized Changes, CRIs

ChM–Change Management; RFC–Request for Change; CRI–Change Related Incident

Examples of how these ChM factors can be interpreted as performance indicators might be as follows. Stable IT systems with high availability would typically exhibit the following attributes: a relatively low number of overall changes made to it; few, if any, urgent or urgent break/fix changes; and no Change-Related Incidents (CRIs). Conversely, an IT manager's productivity level would be negatively impacted by having to manage a high number of system changes, including many urgent changes. In addition, due to the instability of the environment, there would most likely be several IT service impacting CRIs with which to deal. All of these traits translate into an environment or system that is problematic, prone to failure, IT resource draining, and more than likely does not meet the Service Level Agreement (SLA) that the business customer requires.

Data Collection

The ChM factors correlate to the following data elements: Request for Change (RFC) Status, CRIs, and Change Request Category. These RFC data attributes and many more are recorded and tracked for every RFC record in GM's enterprise ChM System. In other words, every IT system, application, and infrastructure change that is made to the production IT

environment is logged, categorized, and has its status updated throughout the change lifecycle. If the change causes an incident, either a system outage or other IT service disruption, that CRI is assigned a tracking number and a reference to the associated RFC record is logged in a separate system called the Problem Ticket Tracking (PTT) System. Additional information is gathered and analyses are performed for CRIs, due to their direct negative impact on GM's production IT environment. These data are captured in a separate database, referred to as the CRI Application.

The corporate data sources (databases), key data elements, and their corresponding relationship to the performance criteria are shown in Table 2. By correlating these data elements with the program's performance criteria, the researcher was able to make a determination regarding the progress, success, or failure of the ChM Program in meeting its goals.

Table 2: Performance Criteria Mapping to KPI Data Sources

	Key (Operational) Performance Indicators (KPIs)	
Performance Criteria	Data Source	Data Elements
Managing All IT Changes	ChM System, CRI App	RFC Status
System Stability	ChM System, PTT, CRI App	CRI, RFC Status, Category
System Availability	ChM System, PTT, CRI App	CRI, Category
End User & IT Productivity	ChM System, PTT, CRI App	CRI, RFC Status, Category
Planning & Communication	ChM System, PTT, CRI App	CRI, RFC Status, Category

PTT–Problem Ticket Tracking; RFC–Request for Change; CRI–Change Related Incident

To further explain the data, Table 3 shows the specific data values and how they are combined to generate the individual Change Management metrics that the Global Production Control organization tracks and reports out to IT Management on a regular basis. The same breakdown was used by the researcher in this study to perform the program evaluation analysis,

thereby maintaining consistency with the recognized and accepted interpretation of these data fields.

Table 3: Measurable Values for Key Performance Indicators (KPI)

KPI Tracked Metric	Measurable Value
Successful Changes	RFC Status: Deployed Successfully, Deployed with Issues, Pending Evaluation
Unsuccessful Changes	RFC Status: Unsuccessful, Backed-Out
Changes Not Deployed	RFC Status: Cancelled, On Hold, Deferred, Rejected
Urgent Changes	Change Request Category: Urgent
Urgent Break/Fix Changes	Change Request Category: Urgent Break/Fix
Unauthorized Changes	RFC not authorized or no RFC was logged
Backed-Out Changes	RFC Status: Backed-Out Successfully / Unsuccessfully
Change-Related Incidents	PTT/CRI App. determined that change caused incident

RFC – Request for Change; PTT – Problem Ticket Tracking System

Finally, with respect to the comparative analysis of this ChM Program with those of other corporations and industry benchmarks, a literature review was conducted to collect data from secondary data sources. The researcher found a fair amount of generalized, high level industry benchmark data that were somewhat subjective in nature; however, one recent study, published by the IT Process Institute (2007), provided a solid industry benchmark analysis of Change, Release, and Configuration Management Program implementations at 341 corporations.

As indicated previously, the scope of this study was limited to the change management metrics that are relevant to the KPIs that can provide insight into the success of GM's ITIL-based ChM Program. The sample population of data under consideration was, from a geographic perspective, the entire global corporate ChM data set. The data collection time period used was for one full year, from January 2007 through December 2007. This sample period was chosen to

ensure optimum data consistency by using ChM data from a single data source. It was also selected in order to use the most recent and relevant ChM data available. Note that it was necessary to collect CRI data from multiple data sources due to 'data crossover' between the ITIL disciplines of change management, incident management, and problem management.

Due to the large number of changes that GM implemented in 2007, it was determined that this data set was large enough to provide a statistically valid sample size while also encompassing a timeframe that allowed the researcher to adequately evaluate trends in GM's ChM program. The researcher had no preconceptions regarding the effectiveness of GM's ChM Program, but was eager to discover the answers that this study had the potential to provide. Extreme care was taken to be as objective as possible regarding any segmentation of the study's sample population and in drawing conclusions based on the analysis of the data.

Validity and Reliability

This program evaluation was conducted as objectively as possible by using data from reliable, unbiased internal and external data sources. From an internal data source perspective, data collection began at a point in time when all ChM data (except CRI data) came from a single database, the corporate enterprise ChM System, rather than using data from both the 'pre-October 2006' supplier-proprietary ChM System and GM's current enterprise ChM system. This eliminated the potential for data conversion mapping inaccuracies and ensured data consistency throughout the sample population.

External data sources were carefully evaluated to ascertain the reliability of the source by excluding data from non-expert sources, biased individuals or organizations, and other data sources of questionable quality. Data were only accepted into the study if they could be shown to be from reliable sources such as scholarly journals, recognized IT or business journals,

reputable IT experts with relevant experience, or from unbiased organizations such as the Office of Government Commerce and the IT Process Institute.

Other data quality issues such as the 'cleanliness' of the data, data entry or programmatic translation errors, as well as data omissions or misrepresentations, have been clearly identified and communicated. These data were either discarded completely or had strict conditions placed on their usage in the study.

Data Analysis

A performance evaluation model was built using the ChM factors influencing performance (Table 1) and relating them to the tracked KPI metrics identified in Table 3. This model was used to draw conclusions about the performance of the ChM Program against program objectives and benefits. The researcher confirmed that this evaluation model was a valid measure of program effectiveness based on the literature review and by validation with GM's Global Production Control organization. Indeed, many of the same predetermined metrics that were evaluated in this study were found to have also been used by the IT Process Institute in their 2007 benchmark study.

Based on the results of this analysis, conclusions were able to be drawn regarding the effectiveness of GM's Corporate Change Management Program. By statistically analyzing the KPI metrics using the measureable values described in Table 3, the researcher was able to reach these conclusions with a relatively high degree of confidence.

Further analysis, based on data from external data sources, was performed comparing GM's internal corporate results to industry benchmarks. This provided an overall picture of GM's Change Management Program's effectiveness from both an internal and external perspective.

CHAPTER IV

DATA ANALYSIS

Statistical Analysis of GM Internal ChM Data

Change Management Program metrics data were collected from multiple data sources in order to perform the analyses described in the previous section. These data sources were identified and validated by the Global IT Production Control organization, the owners of GM's ChM process, as being the primary system of record for the data collected. Therefore, the data used for this analysis were validated to be the most accurate information available to the researcher. All data discrepancies or errors that were discovered as a result of this study have been communicated to the appropriate data owners for correction. These discrepancies have been adjusted for use in this study as appropriate in order to maintain data integrity and consistency. Wherever any data needed to be adjusted for this study, the adjustments and why they were made have been explained in detail.

As discussed previously in Table 3, the KPI metrics that were evaluated included all of the following: successful changes, unsuccessful changes including backed-out changes, changes not deployed, urgent changes, urgent break/fix changes, unauthorized changes, and change-related incidents. With the exception of unauthorized changes and CRIs, all data for the remaining KPI metrics were retrieved by querying GM's ChM System database for all RfCs with an end date between January 1 and December 31, 2007. Data for unauthorized changes and CRIs were retrieved from multiple sources including the ChM System, PTT, weekly incident review meeting minutes, and the CRI Application database. These data are published in report format and reviewed weekly by the Global Production Control team and is summarized in

Annual ChM Metrics Executive Summary reports. Appendices B and C provide a summary of the monthly ChM data for reference.

To better comprehend the ChM metrics being evaluated, it is important to understand how GM defines the various Request for Change (RFC) Status values. Therefore, the definitions of all RFC Status values used in GM's ChM system that are pertinent to this study are given in Table 4. These were excerpted from the Weekly Change Activity report (GM, 2008).

Table 4: RFC Status Definitions

RFC Status	Definition
On Hold	The RFC has been reviewed by the CAB (Approved) and deemed justified however the change is being delayed pending the resolution of associated issues (budget constraints, etc).
Deferred	The RFC has been removed from the proposed release and is waiting to be rescheduled to another release.
Cancelled	The RFC has been authorized; however, due to business or technical reasons the RFC will not be deployed on the authorized implementation date & time.
Pending Evaluation	The RFC has been deployed into the GM IT environment and is scheduled for a post-deployment evaluation.
Deployed Successful	The change was implemented as planned. No issues were encountered during deployment. All objectives for the change were met. All impacted services are operating within required service levels.
Backed-Out Successful	The change was implemented, issues were encountered during the deployment and the change was backed-out. The back-out plan was executed with no issues encountered during back-out. All impacted services were returned to their previous state and are operating with required service levels.

Table 4: RFC Status Definitions (Continued)

RFC Status	Definition
Deployed with Issues	The change was implemented as planned however issues were encountered during deployment. The issues were determined to be acceptable and deployment continued. All impacted services are operating within required service levels however not all objectives of the change were met. This is considered a successful change.
Backed-Out Unsuccessful	The back-out plan was executed however severe issues were encountered causing negative consequences to the users. Impacted services fell below required service levels during or after the change.
Unsuccessful	The change was implemented as planned however some or all impacted services fell below required service levels during or after the change. The change was not backed-out.
Status Not Updated	The RfC end date has passed, however, the change is still in Pending Authorization or Authorized status. These are counted in the totals.
Inactive Status	The RfC end date has passed, however, the change is still in a Pre-CAB Status (any status before Pending Authorization, i.e. Incomplete, Pending Approval, New, Accepted, Approved, Assigned, Pending Assessment, or In Pilot or Preproduction). These are NOT counted in the totals.

Successful Changes

Overall, from January through December 2007, there were 84,207 changes deployed to GM's production IT environment out of a total of 92,965 requests for change (RFCs), representing 90.58% deployed to requested changes. The average number of deployed changes per month was 7017, with a median value of 7289, a range of 3273 (min=4520, max=7793), and a standard deviation of 898.

The remaining 9.42% of submitted RFCs that were not deployed were further subdivided into not deployed, but 'Active' (identified as 'On Hold,' 'Cancelled,' 'Deferred,' or 'Rejected')

or ‘Inactive.’ The active RFCs made up 9.19% while the inactive RFCs comprised the remainder at 0.23%.

Based on Program guidelines, a successful change is one that has an RFC Status of ‘Deployed Successfully,’ ‘Deployed with Issues,’ or ‘Pending Evaluation.’ Of the 84,207 deployed changes, 81,728 were deemed to be successful, representing a 98.03% success rate for the year. (Note that 834 of the 84,207 total deployed changes were tagged as not having their final RFC Status updated [referred to as ‘Status Not Updated’ or ‘SNU’]. Therefore, the total deployed changes metrics used in the analysis of Change Success Rate do not include these SNU records). The monthly mean of successful changes was 6811, with a median value of 7106, a range of 3186 (minimum = 4378, maximum = 7564), and a standard deviation of 880.

The maximum number of successful changes in the range was 0.86 standard deviations from the mean while the minimum was 2.76 standard deviations from the mean. The data distribution curve is negatively skewed with a skewness value of -2.13. However, these descriptive statistics tests are more relevant to the total number of deployed changes than they are to change success rate. The correlation coefficient between the total number of successful changes and the total deployed changes minus SNU is 0.9996 with a coefficient of determination of 0.9991. Based on the critical values of the Pearson Correlation Coefficient for a sample size of n = 12, and for degrees of confidence of 95% and 99% equaling 0.576 and 0.708 respectively, there is a significant positive correlation between successful changes and total changes at the 95% confidence level (Triola, 2001). This indicates that as the number of deployed changes increases or decreases, the number of successful changes will increase or decrease at the same rate and that variances in change success rate can be explained, by nearly 100%, by variances in the number of total changes deployed.

To illustrate this further, the maximum number of total deployed changes minus SNU had a range of 3289 and the maximum value of 7745 was 0.88 standard deviations from the mean (compared to 0.86 standard deviations for successful changes). The minimum value of 4456 was 2.76 standard deviations from the mean, the same as it was for successful changes.

The calculated linear regression formula, or 'best fit' straight line through the data points, for this sample population is given by the following: $y = 33.6 + (0.975)(x)$. In this equation, 'y' is the number of successful changes and 'x' is the total number of deployed changes minus SNU. Due to the high positive correlation between these two variables, this linear regression equation could be used to estimate GM's change success rates based on the number of changes deployed, however, as the number of deployed changes approaches zero, the accuracy in predicting successful changes will decrease.

The statistical data described above are summarized in Table 5. The annual sum refers to the sum of all data for the specified change metric for the entire year of the study period, while the remaining statistics to the left in the table describe the monthly statistics. 'Range SD Min' and 'Range SD Max' refers to the number of standard deviations the minimum and maximum range values are away from the mean. 'Skew,' short for skewness, is the measure of the "symmetry of the data distribution. The distribution of data is skewed if it is not symmetric and if it extends more to one side than the other" (Triola, 2001, p. 63). The negative skewness values indicate that a greater percentage of the data points fell to the left of the median, which is also evidenced by the larger absolute values of the Min Range SDs compared to the Max Range SD values.

For consistency in comparing statistics across of all the ChM Program KPIs used in this study, the researcher has standardized the tabular format for all of the internal GM ChM metrics

analysis. As such, the above column heading clarifications apply to all of the remaining statistical summary tables which follow.

Table 5: Successful Changes to Total RFCs and Total Deployed Changes

Change Metric	Annual Sum	Mean	Median	SD	Range	Range Min	Range Max	Range SDs Min	Range SDs Max	Skew
Total RFCs	92965	7747	8054	1021	3733	4919	8652	-2.77	0.89	-2.14
Deployed Changes	84207	7017	7289	898	3273	4520	7793	-2.78	0.86	-2.18
Deployed – SNU	83373	6948	7238	902	3289	4456	7745	-2.76	0.88	-2.12
Successful Changes	81728	6811	7106	880	3186	4378	7564	-2.76	0.86	-2.13

Change Metric	% KPI to Total	Correlation Coefficient	Coefficient of Determination
Deployed Changes to Total RFCs	90.58%	1.00	1.00
Successful to Deployed – SNU	98.03%	1.00	1.00

SD–Standard Deviation; SNU–Status Not Updated; KPI–Key Performance Indicator

Urgent Changes

Urgent changes are changes that, due to various circumstances, are fast tracked through the ChM authorization process prior to implementation into production. There are two types of urgent changes, or ‘emergency’ changes as they are referred to in ITIL. They are ‘urgent’ and ‘urgent break/fix’ changes. Urgent break/fix refers to changes that are made to resolve an ongoing incident or to mitigate an incident. Urgent changes typically refer to changes that must be expedited due to immediate business need, problem mitigation, or other time sensitive requirement necessitating the change’s implementation prior to the next scheduled CAB meeting.

Urgent break/fix changes are usually unavoidable and for that reason do not have the same negative connotation that urgent changes do to overall ChM program metrics. The total number of urgent break/fix changes for 2007 was 11,406, or 13.55% of total deployed, and the monthly mean was 951 with a standard deviation of 110. The median value was 976 with a range of 443 where the minimum value was 674 and the maximum was 1117.

The maximum number of urgent break/fix changes in the range was 1.5 standard deviations from the mean while the minimum was 2.5 standard deviations from the mean. The data distribution curve is negatively skewed with a skewness value of -1.26. These tests show that the variance for urgent break/fix changes trend towards the lower end of the distribution curve. This is an indicator of a more stable IT production environment since urgent changes, both break/fix and others, are expedited through the ChM process and thus receive less pre-deployment review.

There were fewer urgent changes for the year than urgent break/fixes, at 8491, representing 10.08% of total changes deployed. The average number of urgent changes per month was 708 with a median of 735 and a standard deviation of 116. The range for urgent changes was 432 with a high value of 914 and a low of 482.

The maximum number of urgent changes in the range was 1.78 standard deviations from the mean while the minimum was 1.94 standard deviations from the mean. The data distribution curve is more symmetrical as compared to urgent break-fix changes and only slightly negatively skewed, with a value of -0.51. These tests suggest that there is less variance for urgent changes than for urgent break-fix changes and the trend is closer to a normal distribution curve, but still favors the lower values. This is also indicative of a stable IT production environment as was indicated above for the urgent break-fix changes, however, the

more normal distribution and tighter variance of urgent changes may also indicate better IT management of these types of changes.

As shown in Table 6, the correlation coefficient for urgent break/fix changes to the total deployed changes is significant at 0.75 which indicates that as the number of deployed changes increases, there will be a corresponding increase in urgent break/fix changes. However, based on the coefficient of determination of 0.56, the total number of deployed changes explains only 56% of the variation in urgent break/fix changes as the number of deployed changes varies. This analysis suggests that there are other factors impacting the variances that are not accounted for.

On an intuitive level, this makes sense in that if there is increased change in an IT environment, it follows that there would be an increase in many, if not all, of the different subtypes of changes comprising the overall change. This is true as long as there is a statistical correlation between each of the change subtypes and the overall change rate. For variables that do not exhibit a correlation to the total number of changes, the above will not hold true. This is demonstrated below for unauthorized changes.

Table 6: Urgent and Urgent B/F Changes to Total Deployed Changes

Change Metric	Annual Sum	Mean	Median	SD	Range	Range Min	Range Max	Range SDs Min	Range SDs Max	Skew
Deployed Changes	84207	7017	7289	898	3273	4520	7793	-2.78	0.86	-2.18
Urgent Changes	8491	708	735	116	432	482	914	-1.94	1.78	-0.51
Urgent B/F	11406	951	976	110	443	674	1117	-2.50	1.51	-1.26

Change Metric	% KPI to Total	Correlation Coefficient	Coefficient of Determination
Urgent to Deployed Changes	10.08%	0.75	0.56
Urgent B/F to Deployed Changes	13.55%	0.70	0.48

SD–Standard Deviation; B/F–Break-Fix; KPI–Key Performance Indicator

Unauthorized Changes

Unauthorized changes are defined by the ChM Program as changes that are deployed into the production environment without proper authorization. Investigations are undertaken weekly on changes that CABs have rejected or have marked as unauthorized. Additionally, unauthorized changes are identified by change-related incidents where the change was not documented in the ChM system.

The total number of unauthorized changes for 2007 was 39 with an average and median value of three (3) per month. There is a high amount of variability in the monthly totals due to the unstructured nature of unauthorized changes, i.e. ChM process deviation, human error, or similar causes. As such, the monthly standard deviation was four (4) and the range was 11. There were four months where no unauthorized changes occurred and two months, May (11) and August (8), accounted for 19 of the 39, or 49% of the year's total.

Given that the total number of changes deployed in 2007 was 84,207 and only 39 (0.046%) of these were unauthorized, it is evident that GM's ChM process does meet the stated objective of managing all IT changes. Further, this is a clear indication that unauthorized changes are the exception in GM's production IT environment.

Table 7 shows a summary of the statistical data calculated for all unauthorized changes in 2007. Note that there is no significant correlation (-0.30) between the total number of deployed changes and the number of unauthorized changes. This is as expected since unauthorized changes are unanticipated abnormalities of the ChM process. Since there is no statistical correlation between deployed changes and unauthorized changes, they cannot be predicted using linear regression analysis.

Table 7: Unauthorized Changes to Total Deployed Changes

Change Metric	Annual Sum	Mean	Median	SD	Range	Range Min	Range Max	Range SDs Min	Range SDs Max	Skew
Deployed Changes	84207	7017	7289	898	3273	4520	7793	-2.78	0.86	-2.18
Unauthorized	39	3	3	4	11	0	11	-0.90	2.21	1.06

Change Metric	% KPI to Total	Correlation Coefficient	Coefficient of Determination
Unauthorized to Deployed Changes	0.05%	-0.30	0.09

SD–Standard Deviation; KPI–Key Performance Indicator

Backed-Out Changes

Deployed changes may be backed-out for a variety of reasons, but in most cases it is due to encountering unforeseen issues during change implementation. For the purposes of this analysis, the researcher has not differentiated between successfully and unsuccessfully backed-out changes; however, GM's ChM Program does track metrics for both.

The total number of deployed changes that were backed-out during the 2007 study period was 876, representing 1.05% of total changes deployed minus SNU (SNU = 834 changes where RFC Status was not updated). The monthly mean was 73 and the median was 72, with a standard deviation of 17. The range was 73, varying from a minimum value of 33 to a maximum value of 106.

Table 8 shows a summary of the statistical data calculated for all changes that were backed out in 2007. Note that there is a significant positive correlation (0.78) between the total

number of backed-out changes and the number of deployed changes for this data set. This indicates that for a given number of deployed changes within the specified range shown, one can expect that the number of changes that would need to be backed out can be predicted using the linear regression model of $y = 0.015x – 29.5$, where y is the predicted number of backed-out changes and x is the number of deployed changes. However, a slightly less accurate, but easier, rule of thumb guide would be to use the 1.05% of backed-out to deployed changes ratio. As a comparative analysis tool, significant departures from this rule of thumb may indicate greater or lesser performance against the 2007 benchmark for backed-out changes.

Table 8: Backed-Out Changes to Total Deployed Changes

Change Metric	Annual Sum	Mean	Median	SD	Range	Range Min	Range Max	Range SDs Min	Range SDs Max	Skew
Deployed – SNU	83373	6948	7238	902	3289	4456	7745	-2.76	0.88	-2.12
Backed–Out	876	73	72	17	73	33	106	-2.34	1.93	-0.52

Change Metric	% KPI to Total	Correlation Coefficient	Coefficient of Determination
Backed–Out to Deployed – SNU	1.05%	0.78	0.61

SD–Standard Deviation; SNU–Status Not Updated; KPI–Key Performance Indicator

Change-Related Incidents

Change related incidents (CRIs) are defined as incidents, or disruptions to the IT production environment causing negative business impact or a reduction in IT service levels, that are directly caused by the introduction of change into the environment. CRIs are identified by

performing a post-incident root cause analysis (RCA). At General Motors, every high severity production IT incident must undergo an extensive evaluation including RCA and corrective action analysis. If the incident is determined to be change related, then the ChM process is evaluated, lessons learned are documented, and corrective actions are recommended and tracked to completion.

The total number of high severity incidents that occurred in 2007 was 971, with a monthly mean of 81, a median of 82, and a standard deviation of 11. The range was 37, with a minimum monthly value of 65 and a maximum value of 102. These figures have been slightly adjusted due to data discrepancies between the systems used to track incident data and CRI data. The PTT system reported 953 total incidents while the CRI application reported 971. Since this study focuses on ChM and therefore only the change-related incidents, the researcher chose to use the CRI Application data, which is the data source used by the Global Production Control organization for CRI metrics. In order to perform the statistical analysis on the monthly incident data, the additional 18 incidents (arrived at by subtracting 953 from 971) were spread evenly across the 12 month research period, adding two incidents to each of the six months with the most incidents and adding one to each of the remaining six months. This adjustment only impacted the descriptive statistics of total incidents, not CRIs, and was therefore determined to be non-impacting to the outcome of this study.

The total number of high severity CRIs, as documented in the CRI Application, was 175, representing 18.02% of all high severity incidents. The monthly mean was 15, with a median value of 14, and a standard deviation of 4. The range was 16 with a minimum monthly value of 9 and a maximum of 25. There was not a significant statistical correlation between these two variables, as evidenced by a correlation coefficient of only 0.26. This indicates that change-

related incidents are not dependent on the total number of incidents, but are independent and cannot be predicted based on the number of total incidents.

There were 25 CRIs that were implemented as urgent changes, representing 14.29% of all CRIs, averaging two (2) per month with a median of one (1) and a standard deviation of one (1). The range of urgent CRIs was 10, from a high value of 10 in October 2007 to a low value of zero in three of twelve months. The correlation coefficient for urgent CRIs to total CRIs was calculated to be 0.63 and the coefficient of determination was 0.39. This signifies a positive correlation between urgent CRIs and total CRIs. However, the coefficient of determination (0.39) indicates that only 39% of the variation in urgent CRIs can be explained by the total number of CRIs; the remainder is due to other factors outside of the regression model. Therefore, while one might rightly expect the number of urgent CRIs to increase as the total number of CRIs increase, other influencers are contributing to this increase in urgent CRIs as well, making definitive predictability difficult at best.

Another perspective in analyzing CRIs was to compare the number of change-related incidents to total changes deployed. As previously mentioned, there were 175 CRIs out of a total number of deployed changes of 84,207, equating to 0.21%. There was no significant correlation described by the data between these two variables, since the correlation coefficient was -0.34, however, the percentage of changes causing incidents is very small. Table 9 provides a summary of all the change-related incident statistical data.

Table 9: Change-Related Incidents to Total Deployed Changes

Change Metric	Annual Sum	Mean	Median	SD	Range	Range Min	Range Max	Range SDs Min	Range SDs Max	Skew
Deployed Changes	84207	7017	7289	898	3273	4520	7793	-2.78	0.86	-2.18
Total Incidents	971	81	82	11	37	65	102	-1.39	1.84	0.14
Total CRIs	175	15	14	4	16	9	25	-1.25	2.33	-1.02
Urgent CRIs	25	2	1	3	10	0	10	-0.75	2.85	2.40

Change Metric	% KPI to Total	Correlation Coefficient	Coefficient of Determination
CRIs to Total Deployed Changes	0.21%	-0.34	0.11
CRIs to Total Incidents	18.02%	0.26	0.07
Urgent CRIs to Total Incidents	14.29%	0.63	0.39

SD–Standard Deviation; CRI–Change-Related Incident; KPI–Key Performance Indicator

Benchmark Data Comparative Analysis

The most recent, relevant and comprehensive ChM benchmark study found by the researcher was the IT Process Institute's "*Change, Configuration, and Release Performance Study: Identifying IT best practices that predict the highest levels of performance.*" This study was based on surveys performed in March/April 2007 of 341 corporate and government IT organizations, based primarily in North America, with annual revenues of greater than $100M (ITPI, 2007).

The focus of this study was to determine which commonly implemented ITIL best practices in the Change, Release and Configuration Management disciplines were, by statistical measure, the best predictors of IT performance excellence. The ITPI researchers condensed their findings and categorized them into seven sets of related practices, comprising 30 different individual practices (ITPI, 2007). Of these 30 individual best practices, five were found to match the KPIs used in this evaluation of GM's Change Management program. These five ITPI best

practice performance indicators were change success rate, emergency change rate, unauthorized change rate, release impact rate, and release rollback rate. The ITPI study defined these KPIs as follows:

- Change Success Rate - changes that met functional objectives and were completed during planned time
- Emergency Change Rate - changes are tracked, but do not get standard review before they are implemented
- Unauthorized Change Rate – percentage of changes that are unauthorized; changes made without being tracked by the standard change/release process
- Release Impact Rate - percentage of production releases that cause a service outage or incident
- Release Rollback Rate - percentage of production changes in the last 12 months that were rolled back

These KPIs and their definitions are consistent with the specific KPI metrics within GM's ChM Program. Table 10 shows the ITPI performance indicators and the researcher's mapping of them to corresponding GM Change Management Program KPIs.

Table 10: ITPI Study to GM ChM Program KPI Mapping

IT Best Practice KPI		GM ChM Program KPI
Change Success Rate	==>	Successful to Deployed – SNU
Emergency Change Rate	==>	Urgent to Deployed Changes
Unauthorized Change Rate	==>	Unauthorized to Deployed Changes
Release Impact Rate	==>	CRIs to Total Deployed Changes
Release Rollback Rate	==>	Backed-Out to Deployed – SNU

ITPI–IT Process Institute; KPI–Key Performance Indicator

One note regarding the distinction made between the KPIs used in the ITPI study and GM's Change Management program KPIs is that ITPI considers impact rate and rollback rate to be Release Management functions while GM includes these measures as part of their ChM metrics. This variation can be attributed to differences in the actual implementation of the ITIL guidelines by organizations since ITIL v2 only provides guidelines not definitive implementation procedures. Another reason for this difference may be that ITIL v3, which was the basis for the ITPI study, emphasizes Release Management (ReM) over Change Management as a more holistic approach to managing changes to the Production IT environment.

Since GM's initial ITIL implementation was based on ITIL v2, these KPIs were established under GM's Change Management process, which by design includes some elements of, and is tightly integrated with, Release Management. In fact, the ReM best practice metrics that ITPI analyzed are captured, from a GM perspective, in GM's ChM System (i.e. backed-out changes and CRI data). The salient point in all this is that the KPIs are the same for both GM and ITPI and are, therefore, well suited for comparative performance analysis.

Table 11 compares GM's performance to the ITPI study ranking of top-, medium-, and low-performing IT organizations for these five best practices. Top performers are defined by ITPI as the IT organizations performing in the top 20th percentile of all survey respondents (ITPI, 2007). It was found that GM performed better than the average of the top-performers in all of the best practice areas except for Emergency Change Rate (Urgent Changes), where GM (at 10.08%) had more urgent changes on average then the top-performers (at 7.10%) but less than the medium-performers (at 12.70%). Or put another way, GM was higher than the top-performer's mean emergency change rate by 41.97%, as shown in Table 12.

Table 11: Comparison of GM ChM Program Performance to ITPI Study KPIs

IT Best Practice KPI	General Motors	ITPI Study Performance Ranking Top	Medium	Low
Change Success Rate	98.03%	96.40%	92.50%	81.30%
Emergency Change Rate	10.08%	7.10%	12.70%	22.90%
Unauthorized Change Rate	0.05%	0.70%	3.20%	11.40%
Release Impact Rate	0.21%	2.90%	5.60%	11.10%
Release Rollback Rate	1.05%	3.30%	3.80%	8.50%

ITPI–IT Process Institute; KPI-Key Performance Indicator

Table 12 summarizes the percent differences for all comparative analysis metrics between GM and the ITPI study's top-performer and is shown below. The percent difference of GM's overall change success rate in 2007 to ITPI's top-performers equated to better performance by GM by 1.69%, at 98.03% compared to the top-performer's rate of 96.40%. GM's unauthorized change rate of 0.05% was lower by 93.38% than ITPI's top-performers at 0.70%. GM also fared better by 68.16%, at 1.05%, for release rollback rates (backed-out changes) than did the top-performers with their overall rollback rate of 3.30%. For change-related incidents, the analysis indicates that GM had a release impact rate that was 92.83% lower (at 0.21%) than the top-performer's rate of 2.90%.

Table 12: GM ChM Performance to ITPI Study Top Performers

IT Best Practice KPI	General Motors	ITPI Study Top Performers	GM to ITPI Difference	GM to ITPI % Differ.
Change Success Rate	98.03%	96.40%	1.63%	1.69%
Emergency Change Rate	10.08%	7.10%	2.98%	41.97%
Unauthorized Change Rate	0.05%	0.70%	-0.65%	93.38%
Release Impact Rate	0.21%	2.90%	-2.69%	92.83%
Release Rollback Rate	1.05%	3.30%	-2.25%	68.16%

ITPI–IT Process Institute; KPI-Key Performance Indicator

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

General Motors implemented a global, enterprise-wide Change Management Program, based on the IT Infrastructure Library (ITIL) best practice guidelines, in 2006. Since then the Program has stabilized and is considered to be one of the most mature ITIL standardized work processes in use throughout GM. This study was undertaken to perform a current evaluation of GM's Change Management Program. The purpose of the study was to determine how effectively the ChM Program had met its originally stated objectives and expected benefits, as well as to offer recommendations for program improvement, as appropriate.

The methodology employed was to identify several key ChM program operational performance indicators that could be statistically analyzed and compared to measureable program objectives and expected benefits. The selected KPIs included metrics data for total RFCs, total deployed changes, successful changes, urgent changes, urgent break/fix changes, backed-out changes, unauthorized changes, and change-related incidents. A raw data extract of all production IT changes for the period January 1st through December 31st, 2007 was retrieved from GM's enterprise ChM system for the purposes of this analysis.

The ChM Program performance criteria, distilled from the program objectives and expected benefits, were identified by the researcher for comparison with these key performance indicators and included the following:

1. Managing all IT changes
2. Increased IT system stability and availability
3. Maximizing end user productivity

4. Maximizing IT staff productivity
5. Improved planning and communication

In addition to the examination of GM internal ChM metrics data against objectives, a comparative analysis of GM's ChM Program KPIs against industry benchmark KPIs was performed. One study, performed by the IT Process Institute (ITPI) in 2007, was particularly well-suited for this comparative analysis. The results of this analysis place GM solidly among the top industry performers studied (those in the top 20th percentile) with respect to the implementation of an enterprise-wide ChM program. In fact, GM had better ChM performance results in 2007 than the average of the top performers in four of the five best practice KPI categories.

Based on the statistical analysis of KPIs to program objectives, the researcher is of the opinion that GM has met its ChM program objectives and has derived many of the expected benefits. As with most large enterprise-wide corporate initiatives, the ChM program at GM is undergoing continuous process improvement, and as business drivers and objectives change over time, so must the processes that support them.

Conclusions

As the world's largest auto manufacturer and #3 on Forbes Fortune 500 list for 2007, GM has unique requirements for managing its global IT resources. Therefore, it is not surprising that GM must effectively manage a very large number of changes to its production IT environment. In 2007, GM deployed over 84,000 changes which, on average, equates to one production change implementation every six minutes! This was accomplished with a change success rate of over 98%. Clearly this level of enterprise-wide change management performance could not have been attained by mere chance.

However, does this change success rate signify that GM's ChM Program has met all of the objectives set forth at the program's inception? Has GM realized all the expected benefits from the ChM Program that were originally proposed? In order to arrive at definitive conclusions about the effectiveness of GM's ChM Program, the performance criteria and the corresponding measureable ChM factors influencing performance, depicted in Table 1, were evaluated yielding the following results.

For the "Managing all IT changes" criterion, the key performance indicator was the number of unauthorized changes which was determined to be 0.05% of the total number of changes deployed. This translates to an unauthorized change rate at GM that is 93% better than the ITPI Study rate of 0.70% for top performers. Therefore, it can be stated with a high degree of confidence that GM's ChM Program does effectively manage all changes to its IT environment.

The System Stability and System Availability performance criteria were analyzed based on the number of deployed changes, change success rate, urgent change rate and the number of CRIs. Taking them individually, the number of deployed changes was 84,207, which is a lot of change. However, when one considers the complexity of GM's IT systems, with over 2600 applications, 7000 servers, numerous data centers, and a global telecommunications network, this large number of changes appears to be justified.

Even with the large number of changes, GM had a change success rate of 98.03%, which was higher by nearly 2% than the 96.4% change success rate of the top-performers in ITPI's industry benchmark study. However, the percentage of urgent (emergency) changes (10.08%) was somewhat higher than the top-performers at 7.10%, but was still below the medium-performers urgent change rate of 12.70%. This would place GM's ranking at a medium-high

level of performance for urgent change rates. As another point of comparison, Evergreen's ChM maturity study provided evidence that 40% of their respondents reported a 26% or higher emergency change rate (Evergreen Systems, 2006, p. 1).

For the last ChM performance indicator of system stability and availability, the change-related incident rate, defined as the percentage of changes causing high severity incidents, was 0.21% for 2007. This signifies a performance level that was 92.83% better than the average of ITPI's top-performers, who had a CRI impact rate of 2.90%. In other words, the ITPI top-performers would expect nearly three (3) service impacting incidents for every 100 changes, while GM would experience one (1) incident for every 500 changes deployed to production.

While this aspect of CRI performance looks very good, it is important to note that 18.02% of all high severity incidents were determined to be caused by changes made to the production IT environment. So while the ratio of CRIs to deployed changes is very low, the ratio of service impacting incidents caused by change at GM is nearly one in five. This is, however, still significantly below some industry estimates which state that 80% of service interruptions are caused by change (BMC Software, 2006, p. 5).

Another point to consider is that the CRI to total incident ratio can be misleading due to the variability of the number of incidents for any given period. For example, if the number of overall incidents decreased while the number of CRIs remained the same for a given evaluation period, it would appear that CRIs are more significant, perhaps, than they really are. Additionally, the correlation coefficients for both CRIs to total incidents and CRIs to total changes deployed were not statistically significant. This means that as the number of total incidents or the number changes deployed varies, the number of CRIs will not vary linearly with either, with any significant degree of predictability. It would be necessary to develop a multiple

regression analysis model to understand more about the relationship between changes, CRIs and incidents; however, this was outside the scope of this study.

Considering the extremely low CRI to deployed change rate and the moderate CRI to total incident rate, one could conclude that GM's ChM Program has delivered on its objective to ensure IT system stability and system availability as these objectives relate to change management. However, it is evident based on the ratio of CRIs to total incidents, that there is still room for improvement in the area of CRI reduction.

The third ChM performance criterion analyzed, "Maximizing End User Productivity," was evaluated by looking at the same performance factors as above for system stability and availability. From a business perspective, if the system that an end user requires in order to perform their job function is available when it is expected to be available, then their productivity is not impacted. If, on the other hand, the system is experiencing an outage due to a change-related incident, their productivity would be impacted. Similarly, if their requested system enhancements are not implemented when they were scheduled to be implemented due to an unsuccessful change, their productivity may be negatively impacted.

All of the same arguments hold true for the fourth program objective, "Maximizing IT Staff Productivity," with the added caveat that system instability or unavailability will undoubtedly increase the IT staff's workload because they are responsible to get the system stabilized or back online. Additionally, increases in the number of failed or unsuccessful changes, urgent changes, backed-out changes, and CRIs, translate into more work for the IT staff. More work, and in many cases re-work, due to any of these factors is unproductive and of little or no value to the organization. Since all of the KPIs relating to these factors have been

shown to be within high performance levels, it appears that the ChM program has met both the end user and IT productivity objectives as well.

The last program objective evaluated was "Improved Planning and Communication" as related to change management. While there were no metrics that specifically address these, the fact remains that GM did not have an enterprise-wide ChM process or a single enterprise ChM tool before the implementation of this program. Prior to 2005, change management at GM was handled in a multitude of different ways, with many disparate ChM tools, across the globe. There is now one common, global, enterprise-wide Change Management Program and supporting enterprise ChM system; both critical to IT change planning and communication. As the Evergreen Systems research (2006, p. 3) indicated, only 58% of the respondents in their study exhibited this "key indicator of early process maturity," which is the "regular use of a single, enterprise-wide Change Management policy and system".

Communication of changes to GM's production IT environment occurs on a regular basis via the CAB process, ChM reports, and the online enterprise ChM system. ChM metrics collection, evaluation, and distribution in the form of management reports are integrated into the ChM process to facilitate program monitoring and allow for continuous process improvement. In fact, the researcher could not have collected the metrics data necessary to perform this study without this common, global process and the enterprise ChM system.

Based on the results of the statistical analyses and on comparisons with industry benchmark data, there is significant evidence to conclude that the implementation of the ITIL-based Change Management Program at General Motors has, in fact, met the stated program objectives and has realized many of the expected benefits as set forth at the program's inception. There are, however, specific areas within the program that could be improved and future

program modifications will be necessary as business requirements change, and as other industry and environmental factors dictate. To that end, the researcher has developed some recommendations for program improvement.

Recommendations

Several opportunities for overall ChM program improvement were identified as a result of this study. These include taking steps to reduce the occurrence of change-related incidents and to minimize the number of urgent changes. Improving performance in these two areas is critical given that the primary goal of change management is to provide a structured process for deploying changes to the production IT environment without causing unanticipated service disruption (GM, 2006).

It will not be possible to eliminate change-related incidents; however there are ways to reduce their occurrence. Many methods are in use at GM to combat CRIs, but perhaps more focus, communication and planning would help to drive the incidence of CRIs down. Performing more rigorous risk assessments during the change planning phase, especially in the area of determining all potentially impacted configuration items, is key to understanding risk. A CMDB is critical to accomplishing this aspect of risk management and GM is currently in the beginning stages of CMDB implementation. Another improvement that would go a long way towards reducing CRIs is to better integrate the Incident, Problem and Change Management tools so that the data are consistent across systems, reliable, and readily available for use as a knowledge base to learn from prior incidents. Both of these recommendations will take time and commitment to implement, but in the long run, should provide desired results.

Minimizing urgent changes boils down to better planning. Working closely with the business process areas to help them plan their system changes and incorporate them into releases,

as well as designing systems that are flexible enough to allow end users to better manage and manipulate their data without IT intervention are a few methods that would limit 'emergencies.' Communicating to both IT personnel and the business about the potential risks to systems due to increased urgent change rates is a key step in addressing this challenge, as is gaining management support to press for rational oversight of urgent change requests.

Another opportunity for improving ChM performance would be to move the IT organization more quickly towards a more formal and disciplined Release Management program. Findings from the ITPI study state that "change tracking and change oversight practices are necessary but not sufficient to achieve performance improvement on their own" (ITPI, 2007, p. 18). They further state that "release management should be the destination for those organizations wanting to achieve performance gain from standardizing on ITIL change and release practices" (ITPI, 2007, p. 22).

Release management offers an additional framework for planning and communicating change (via releases) through the entire systems lifecycle of initial planning and implementation, future enhancement strategies, maintenance and operational activities, and eventual system retirement. By planning system releases well in advance, the risk of negatively impacting the production IT environment is lessened due to better preparation and, if the release strategy is adhered to, there should be a reduced need for urgent changes.

GM's IT organization is currently engaged in deploying a formal Release Management program; however, it is not nearly as mature a process as ChM. The ReM program has encountered some implementation challenges, not the least of which is organizational resistance to change. This is not unique to ReM but is relatively characteristic of new program deployments within large organizations. However, ReM may be somewhat more challenging in

this regard due to the need for highly integrated activity between the systems development teams, IT operations, and the business functional areas. For this reason, it is imperative that management at all levels and across all of these organizations be fully engaged and embrace the strategy for deploying ReM. Creating an environment that actively supports the adoption and disciplined use of release management practices will greatly increase the effectiveness of the ReM program. This would have the effect of strengthening the relationship between change and release management and lead to overall process improvements in managing changes to the IT environment.

Another challenge is to address the complexities of standardizing the release management process, yet allowing the process to be flexible enough such that it still meets the functional needs of the business. As with the implementation of GM's ChM Program, working through these challenges will most likely be accomplished through an iterative process improvement cycle, much like ITIL v3 advocates.

Therefore, the final recommendation, which complements improving ChM performance in the areas of CRI and urgent change reduction, and driving towards a more robust ReM program, is to begin the transition from the current ITIL v2 mindset to ITIL v3. Since ITIL v3 is emphasizes a full lifecycle approach to IT service methodology, with built-in process improvement feedback loops, it is well-suited to the task of improving overall change and release management performance at GM.

If the decision is made to move forward with the transition from ITIL v2 to ITIL v3, it is recommended that it be managed as an IT project with appropriate resources to ensure a successful outcome. With that premise in mind, the following high level action plan is recommended:

- Secure Executive IT leadership and support for transition activities
- Appropriate budget for ITIL v3 program implementation
- Establish an ITIL v2 to v3 bridge/gap training program for IT staff
- Establish a cross-functional IT Services project team to manage the transition
- Publish and communicate a Plan of Intent to all key stakeholder organizations
- Gain program initiation approval and commitment from key stakeholders
- Initiate a 'Plan & Define' project for requirements and strategy definition
- Review and update existing ITIL-based Process Definition Documents
- Initiate next project phases based on output from the Plan & Define
- Develop training and communication plan for program deployment
- Deploy ITIL v3 using a phased, structured approach

Key factors that are deemed critical to the successful implementation of an ITIL v3 Standardized Work Program update include executive sponsorship, robust communication and training plans, and key stakeholder engagement throughout the project. Then, once the transition to ITIL v3 is under way, it is expected that GM would realize additional benefits beyond those already discussed.

Based on literature reviews, these generalized ITIL v3 program benefits would include an increased focus on delivering and measuring IT value to the business, stronger linkages between the other ITIL-based standardized work processes at GM, overall performance improvements in IT service delivery, and continual IT service process improvements. Actualization of these benefits would translate into a more stable and effective IT environment upon which GM's business depends to be competitive, a reduction in operating costs, productivity improvements, increased revenue generation, and an improved ability to achieve business objectives.

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Appendix A

List of Acronyms

ANSI - American National Standards Institute

BPA - Business Process Area

BSI - British Standards Institution

CAB - Change Advisory Board

ChM - Change Management

CI - Configuration Item

CIO - Chief Information Officer

CMDB - Configuration Management Database

CMMI - Capability Maturity Model Integration

COBIT - Control Objectives for Information and related Technologies

CRI - Change Related Incident

ERP - Enterprise Resource Program

FSC - Forward Schedule of Change

IEEE - Institute of Electrical and Electronics Engineers

ISO - International Organization of Standardization

IT - Information Technology

ITIL - IT Infrastructure Library

ITSM - IT Service Management

itSMF - IT Service Management Foundation

KPI - Key Performance Indicator

OGC - Office of Government Commerce

PDD - Process Definition Document

PMBOK – Project Management Book of Knowledge

PMI - Project Management Institute

PTT - Problem Ticket Tracking System

ReM – Release Management

RFC - Request for Change

ROI - Return on Investment

SLA - Service Level Agreement

SNU – Status Not Updated

SOX - Sarbanes-Oxley

UK - United Kingdom

US - United States

v2 - Version 2

v3 - Version 3

Appendix B

GM ChM Program Data and Analysis by Month

CHANGE MANAGEMENT METRICS ANALYSIS BY MONTH (YEAR = 2007)												
Month	Changes Deployed	Changes Deployed - SNU (x)	Successful Changes	Successful to Changes Deployed - SNU	Urgent Changes	Urgent Changes to Total Changes Deployed	Urgent B/F Changes	Urgent B/F Changes to Total Changes Deployed	Backed Out Changes (Successful & Unsucc.)	Backed Out Changes to Total Changes Deployed - SNU	Total Unauthorized Changes	Total Unauthorized to Total Changes Deployed
JAN	6494	6463	6330	97.94%	530	8.16%	1060	16.32%	71	1.09%	0	0.00%
FEB	7438	7387	7255	98.21%	649	8.73%	885	11.90%	80	1.08%	0	0.00%
MAR	7793	7745	7564	97.66%	704	9.03%	1117	14.33%	73	0.94%	0	0.00%
APR	7140	7089	6956	98.12%	737	10.32%	985	13.80%	70	0.98%	5	0.07%
MAY	6658	6593	6469	98.12%	668	10.03%	959	14.40%	79	1.19%	11	0.17%
JUN	7598	7531	7366	97.81%	767	10.09%	971	12.78%	90	1.18%	0	0.00%
JUL	7655	7601	7473	98.32%	800	10.45%	889	11.61%	71	0.93%	2	0.03%
AUG	7586	7531	7375	97.93%	914	12.05%	981	12.93%	106	1.40%	8	0.11%
SEP	7560	7469	7313	97.91%	733	9.70%	982	12.99%	73	0.97%	1	0.01%
OCT	7025	6959	6830	98.15%	745	10.60%	1008	14.35%	65	0.93%	3	0.04%
NOV	4520	4456	4378	98.25%	482	10.66%	674	14.91%	33	0.73%	5	0.11%
DEC	6740	6549	6419	98.01%	762	11.31%	895	13.28%	65	0.96%	4	0.06%
TOTAL	**84207**	**83373**	**81728**	---	**8491**	---	**11406**	---	**876**	---	**39**	---
MEAN	**7017**	**6948**	**6811**	**98.04%**	**708**	**10.09%**	**951**	**13.63%**	**73**	**1.03%**	**3**	**0.05%**
STD DEV	**898.08**	**902.32**	**880.26**	**0.0019**	**115.99**	**0.01**	**110.47**	**0.01**	**17.08**	**0.002**	**3.55**	---
CORRELATION COEFFICIENT			---	**0.99988632**	---	**0.74749324**	---	**0.69546186**	---	**0.77944588**	---	**-0.30100247**
COEFF. OF DETERMINATION			---	**0.99977265**	---	**0.55874614**	---	**0.4836672**	---	**0.60753589**	---	**0.090602485**

Appendix C

GM CRI Data and Analysis by Month

CHANGE RELATED INCIDENT (CRI) ANALYSIS BY MONTH (YEAR = 2007)								
Month	Changes Deployed (x)	Total SEV1 & Alpha Incidents*	Total Incidents to Changes Deployed	CRI Application Total CRIs	CRIs to Total Incidents	CRIs to Total Changes Deployed	CRI App. Urgent CRIs	Urgent CRIs to Total CRIs
JAN	6494	84	1.29%	15	17.86%	0.23%	1	6.67%
FEB	7438	80	1.08%	9	11.25%	0.12%	2	22.22%
MAR	7793	102	1.31%	16	15.69%	0.21%	3	18.75%
APR	7140	65	0.91%	9	13.85%	0.13%	4	44.44%
MAY	6658	89	1.34%	11	12.36%	0.17%	0	0.00%
JUN	7598	71	0.93%	13	18.31%	0.17%	0	0.00%
JUL	7655	68	0.89%	15	22.06%	0.20%	1	6.67%
AUG	7586	90	1.19%	13	14.44%	0.17%	1	7.69%
SEP	7560	79	1.04%	13	16.46%	0.17%	0	0.00%
OCT	7025	85	1.21%	25	29.41%	0.36%	10	40.00%
NOV	4520	91	2.01%	19	20.88%	0.42%	2	10.53%
DEC	6740	67	0.99%	17	25.37%	0.25%	1	5.88%
TOTAL	**84207**	**971**	---	**175**	---	---	**25**	---
MEAN	**7017**	**81**	**1.18%**	**15**	**18.16%**	**0.22%**	**2**	**13.57%**
STD DEV	**898.08**	**11.43**	**0.0031**	**4.46**	**0.05**	**0.0009**	**2.78**	**0.15**
CORRELATION COEFFICIENT			-0.1918614	---	0.26492	-0.3380651	---	**0.62647932**
COEFF. OF DETERMINATION			0.0368108	---	0.070183	0.11428801	---	**0.39247633**

* Adjusted Monthly PTT Counts to match CRI Application Total Incidents