AN ASSESSMENT OF THE QUALITY MANAGEMENT PRACTICES OF A SYSTEMS INTEGRATION SUPPORT ORGANIZATION WITH RESPECT TO THE OPERATIONS OF A LARGE–SCALE REQUEST FOR CHANGE (RFC) SYSTEM

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(ABSTRACT)

Using a prototype Total Quality Management (TQM) assessment methodology, this project accomplished an assessment of the quality management practices of the General Electric Company Management and Data Systems Operations (M&DSO) Division, Systems Integration Program Department (SIPD) with respect to the operation and management of a large–scale Request for Change System (RFC). In addition, guidelines were proposed for the planning, design, and implementation of a TQM system. These guidelines can be used by SIPD management if they chose to integrate a Total Quality Management System into the organization.

An agenda of enhancement opportunities for quality management practices was identified as a result of the assessment.

A complete description of the RFC system, a systems analysis of the RFC system, the assessment methodology, and the criteria used to evaluate SIPD's quality management practices is included.

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1.0 INTRODUCTION

1.1 Project Objectives

The Management and Data Systems Operations (M&DSO) division of General Electric Company is located in King of Prussia, PA. M&DSO is under contract with a customer to provide system integration support for the maintenance of a multi–faceted communications system. Within M&DSO, the Systems Integration Program Department (SIPD) is charged with this integration support task. The most important task of SIPD is to process Request for Changes (RFC'S) to the multi–faceted communications system.

The objective of this project is to assess the quality management practices of SIPD, with respect to RFC system operations, and to subsequently propose guidelines for planning, design, and implementation of an ideal TQM system for SIPD organization.

The Total Quality Management (TQM) methodology developed by Triantis, et al. [15] was used as the basis for this assessment of the SIPD quality practices. The methodology was augmented to be applicable to the service engineering system that is under investigation.

The project objective was accomplished by completing the following tasks:

1. The operation of the RFC system was divided into 4 component parts using a systems input/output analysis.

2. An assessment comprised of the following:

   a. The current quality documentation within the SIPD organization was reviewed to determine the current status of quality practices.

   b. A survey was developed and distributed to the SIPD personnel that are directly involved in the operations of the RFC system.

   c. The scoring methodology developed by Triantis, et al. [15] was applied to the responses that were received to the survey. The result of the application of the scoring methodology was an agenda of enhancement opportunities.

d. The data that was collected during this assessment was analyzed. In addition, there was an analysis of the data that is collected regularly on the outputs of the RFC system.

3. Guidelines were proposed for the planning, design, and implementation of an TQM system for for SIPD management.

4. A recycling approach for the assessment methodology was discussed. The assessment methodology must be enhanced, this was accomplished by determining the adequacy of the assessment results obtained in this project.

The assessment provided information that can be used during the strategic planning process. The enhancement opportunities identified during the assessment are evaluated and a selection is made to determine the best course of action for performance improvement of the management system.

A number of questions and issues, with regard to strategic planning, need to be addressed. The evolution of performance improvement within the SIPD organization requires detailed planning. For performance improvement efforts to be successful, there must be goals and objectives defined at the process level and worker level that are consistent with organizational goals and objectives.

The design of a TQM system requires SIPD to adhere to a logical systems engineering process. This is the same systems engineering process that is employed to design any operational system within the organization. Figure 1 shows a systems engineering process with feedback loops. The assessment identifies an agenda of enhancement opportunities which impact the systems engineering process in a number of steps. The agenda of enhancement opportunities is represented as a percentage of TQM awareness in a given area. This percentage is calculated by applying the scoring methodology developed by Triantis, et al. [15] to the stage development questions from the selected modules (Refer to section 1.3 for module definitions).

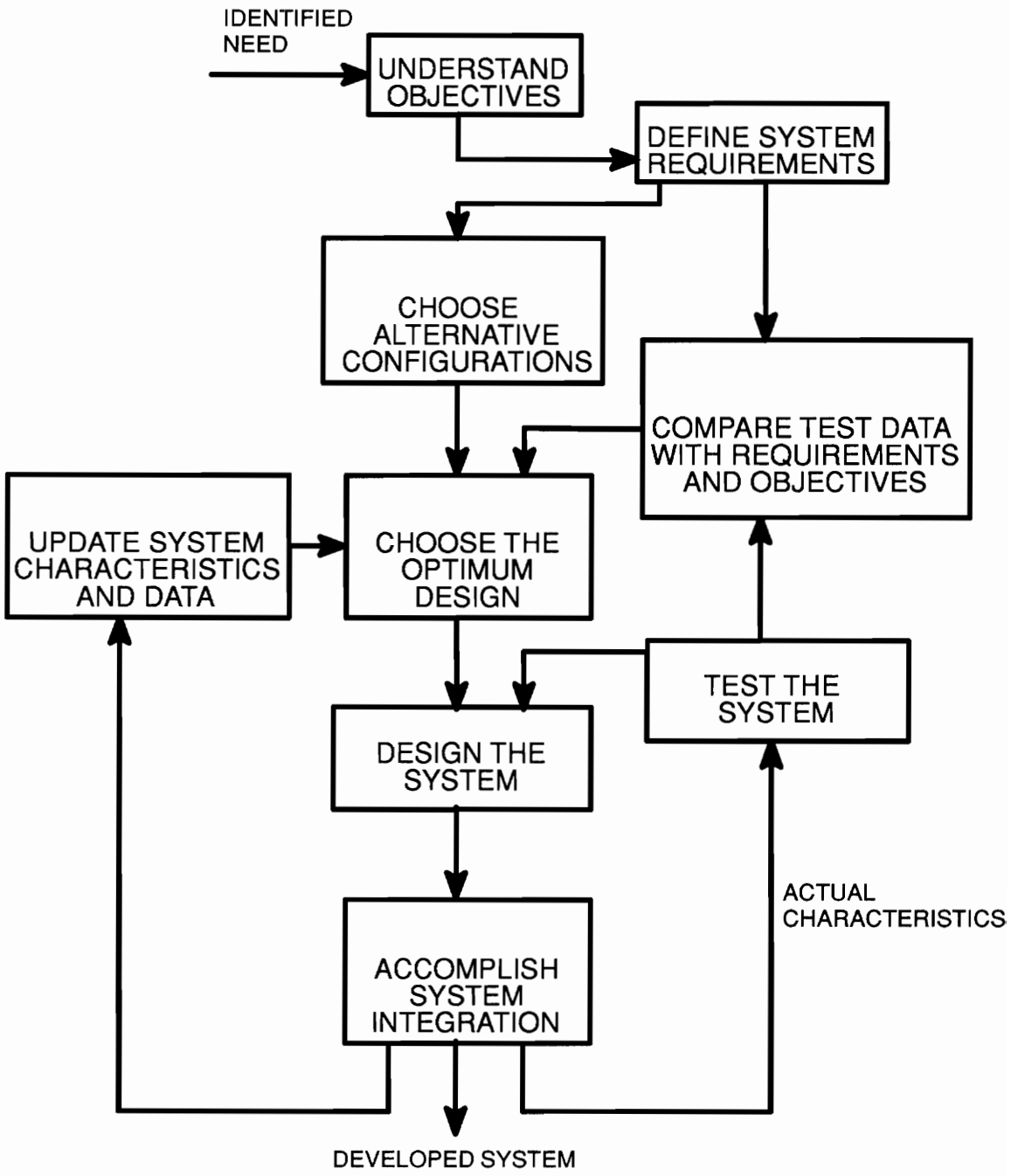

FIGURE 1: FEEDBACK NATURE OF SYSTEMS ENGINEERING PROCESS [1]

The first step of the systems engineering process impacted by the assessment is the definition of systems requirements. The requirements of the SIPD management system, in the operation of the RFC system, are defined to meet the expectations and needs of the customer. If the assessment indicates that quality management practices are deficient in any of the 15 module areas, the ability of the SIPD management to meet the requirements of the customer is effected. The requirements of the management system of SIPD are modified to improve the deficient areas of quality management. The choice of alternative configurations is effected by the change in requirements of the system. The configuration of the TQM system will change to meet the changing requirements. For example, the focus may switch from projects to improve Measurement and Control to Employee Involvement and Quality Education. Again, this shift in focus is determined as a result of the assessment.

The testing of the system refers to periodic assessments and determination of enhancement opportunities. The stage development questions can be modified and redistributed to the employees and the management. The scoring methodology can than be applied to determine the latest percentages for TQM awareness. The latest percentages can be compared with the previous values. This allows SIPD management to track the progress of the improvement projects over a period of time.

During the implementation planning stage, a system input/output analysis is completed for each TQM module that comprises the ideal TQM system. The system input/output analysis will be used to identify performance indicators used to track improvement efforts. Decisions on actions, goals, objectives, and responsibilities are made during the implementation planning.

Figure 2 identifies the steps required for a TQM systems development for SIPD. The objective of this research is to complete step 1 and to propose guidelines and recommendations for steps 2 through 4.

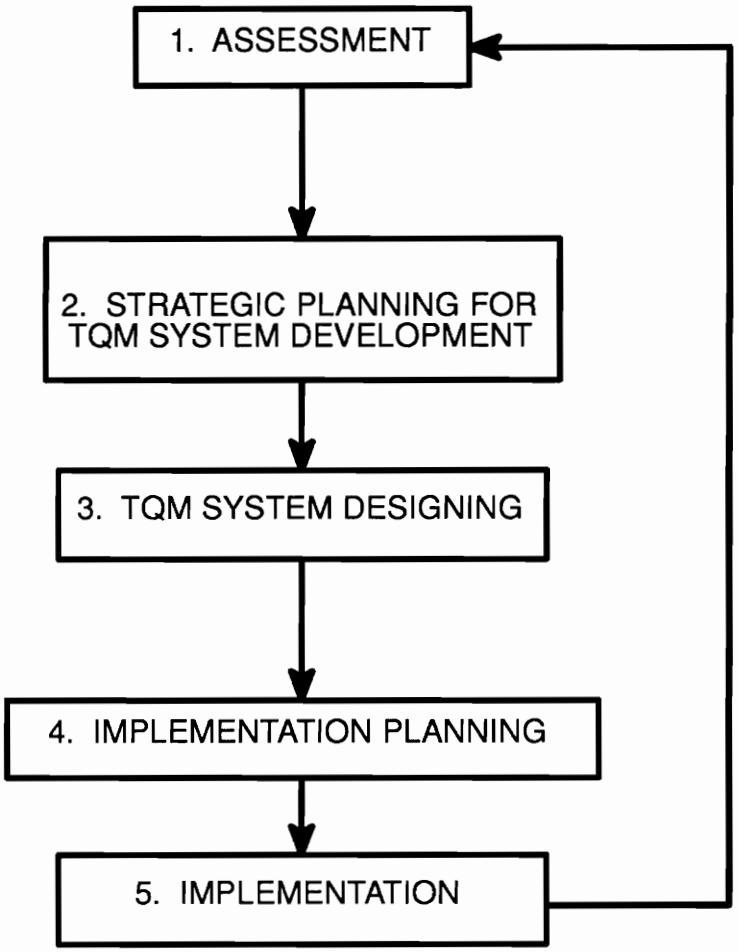

FIGURE 2: TQM SYSTEM DEVELOPMENT [15]

1.2 Background

GE CEO Jack Welch instituted a program three years ago to induce speed, simplicity, and self–confidence in each of the GE businesses. This program was called WORKOUT, and is the GE equivalent of a TQM improvement program.

The WORKOUT program initiated at corporate headquarters and was briefed to all the business groups. The Aerospace business group briefed the program to the M&DSO management, who then briefed the SIPD management. SIPD management was advised by M&DSO management to implement some effort to meet the WORKOUT objectives. SIPD management chose the RFC system as the focus of their WORKOUT program. The program was cancelled by SIPD management three months after it started.

The M&DSO management has pushed forward with WORKOUT. The results have been insignificant. M&DSO management is pressuring the SIPD management to implement quality improvements. M&DSO has published a goal of improving the quality of specifications and delivered products by a factor of five. The goal was placed on the SIPD operation of the RFC system. A significant output of the RFC system is the specifications for the muti–faceted communications system, and any changes to the specifications. The SIPD managements action in response to the direction by management is to form a performance action team to study the RFC system. This has been an annual event for the past five years.

The motivation for this research is to convince the management of the SIPD organization that the problems with the RFC system are a direct result of the inefficient quality management practices of the organization. The SIPD management is not going to "fix" the RFC system without using a structured approach to problem solving.

The complaints about the RFC system are generated both internally and internally to SIPD. Internally, many employees of SIPD are very disgruntled because they receive minimal direction from SIPD management.External frustrations arise from the customer,

who places a lower priority on RFC processing than the SIPD organization. These frustrations have a rippling effect throughout the whole program and are detrimental to the success of the organization.

A quality approach to management makes the SIPD organization more sensitive to competitive needs, the customer's point of view, and focused on continuous improvement. The M&DSO management is very interested in TQM, however, SIPD is apprehensive. This research provides SIPD management with an assessment of the quality management practices with regard to RFC operations. The assessment provides SIPD management with an agenda of enhancement opportunities as the focus of improvement projects. The assessment also impact any systems engineering design efforts focused on an ideal TQM system.

If SIPD management continues to search for a "quick–fix" to problems that are deeply rooted in the organization, they are significantly impacting their competitive posture. The competition continues to market themselves on the basis of quality.

1.3 Definitions, Terminology & Assumptions

The emphasis of this research effort is to assess the quality management practices of the SIPD management with respect to RFC operations. In addition, proposed guidelines for strategic planning, design, and implementation planning of an improved performance management system are provided.

This research identifies that the breakdowns occurring in the RFC system are the result of a management system that is not focused on quality. The assessment accomplished provides management with a source of information that serves as the groundwork for TQM understanding. However, the results of the research, if implemented, can not guarantee that the RFC system will be improved.

There are a number of internal publications circulating throughout the organization that try to explain TQM. Unfortunately, the definitions and methodology in print are not related to service engineering, they concentrate on manufacturing. This research provides SIPD management with an understanding of TQM methodology as it relates to service engineering systems. The following section attempts to give a clear understanding of the basic terms and assumptions that are necessary to follow the logic for TQM development.

ASSUMPTIONS

Key assumptions for the research include the following:

a. The organization has resources available for the development of a Performance Management System focused on quality.

b. The organization is familiar with the systems engineering methodology, or is at least willing to invest time to learn it.

c. The TQM management system can be modelled as a system with inputs, outputs, outcomes, activities, boundaries and feedback mechanisms.

d. The RFC system can be modelled as a system with inputs, outputs, outcomes, activities, boundaries, and feedback mechanisms.

The remaining assumptions are relevant to the current TQM paradigm. These assumptions are to be understood before proceeding with a quality improvement effort. The assumptions include [15]:

a. Quality is the primary goal of any organization. This implies that by improving quality, the organization is improving other performance measures such as productivity, efficiency, profitability, etc.

b. Stakeholders should determine quality and drive the performance requirements of organizations.

c. Management needs to embrace TQM philosophy and accept that the design of the TQM organizational system is a management responsibility.

d. Employees and management need to cooperate in enhancing the competitiveness of the organization.

e. The primary directive of management and employees is process improvement (continuous improvement). This implies that the service quality improves as a consequence of process improvements.

f. Employees must be trained, developed and supported emotionally and materially.

DEFINITIONS

The following definitions are provided to give the reader a knowledge base on the subject of TQM behavior. TQM modules are the elements of the organization's behavior that are required for successful quality management. A TQM module is a collection of TQM criteria that share common quality objectives and characteristics. A systems definition of each module has been provided in the research by Triantis, et al. [15]. Each of the generic definitions can be augmented and applied to the SIPD management system. A systems

analysis can be accomplished for each module. This assists in identifying performance indicators to track performance improvement projects. The activities of each module represent corresponding organizational processes. Attention must be given to the interrelationships of the activities of the modules as they combine to form a single optimum system. The author is serving as the assessor for this research. The following TQM modules were chosen as having the greatest value–adding effect on the quality management practices of the SIPD organization:

a. Leadership – The activity of guiding, facilitating, encouraging, and motivating given the organizational responsibility

b. Quality Policy – The conversion of the corporate philosophy into a set of rules and guidelines; the generation of a conceptual framework that strives for quality improvement so as to ensure an organized, systematic, and disciplined functioning of the organization.

c. Deployment of Quality Tasks, Reporting and Communications – This module is with the effective deployment, communication, and reporting of quality related tasks and information so as to facilitate the quality management of the organization in terms of quality control and improvement.

d. Quality Planning (Strategic and Operational) – A systematic approach to define what the organization needs to do and how it proposes to reach vision with respect to its quality performance both in the long–run and short–run as well as strategically and operationally.

e. Customer Relations/ Commitment to Customer – The practice participation of the customer in all of the organization's TQM activities so as to enhance customer cooperation and facilitate the organization's understanding of the customer's quality concerns.

f. Determining Customer Requirements, Expectations, Satisfactions – The systematic identification of customer preferences, needs, and expectations that facilitates the determination of customer satisfaction. This helps the organization manage customer relations more effectively and in so doing increases the potential for growth and competitiveness.

g. Measurement – The transformation of quality data and information into meaningful indicators that can give employees and managers the ability to control and improve the organization's processes and quality management system.

h. Employee Involvement – The encouragement of all employees throughout the organization to become involved both individually and in teams so as to solve quality related issues in a timely and effective manner.

i Quality Education and Training – The assessment, planning and incorporating of educational and training programs throughout the organization so as to increase the workforce's understanding and capability to deal with and improve quality.

j. Employee Well Being and Morale – Creating the environment that will in the long–run understand and improve employee well being and morale and the capability of the workforce to effectively solve quality related issues.

k. Behavioral Reinforcement/Recognition/Individual Performance Management – The purposeful behavioral reinforcement of all employees and managers so as to increase their motivation and their effectiveness in quality management issues.

l. Control – The analytical and systematic control of all processes so as to ensure conformance to design and production specifications, and identification of process capability.

m. Management of Data and Information – The classification, modelling, and storage of quality data and information so as to ensure effective communication and decision with respect to quality.

n. Documentation/Work Instructions/Quality Control Records – The documentation of the organization's quality procedures, methods and records so as to enhance the organization's communication abilities.

o. TQM System Assessment/Quality Evaluation – The establishment of quality performance baselines in terms of the organization's quality management capabilities and products/services so as to facilitate continuous improvement.

TERMINOLOGY

A final section is given on terminology to continue building a foundation of TQM knowledge before proceeding. These criteria are the key hallmarks of TQM and "Demingism" and are applicable to the quality management system of SIPD [3]:

1. Customer Satisfaction – A method must be developed by the SI to measure customer needs and expectations. This measurement data must be used to develop a process that improves service quality, and meets customer requirements. The attempt to develop a TQM system for the SIPD organization is ideal for satisfying customer requirements.

2. Individual Participation – The success of a quality improvement program is reliant on extensive employee involvement. Increased involvement will increase motivation and promote a feeling of ownership. CEO Jack Welch states, "Every employee is guaranteed the right to voice" [7].

3. Continuous Improvement – There must be a focused effort on continuous improvement to remain competitive. SIPD management must constantly evaluate their ability to satisfy customer requirements and feedback that information into the design of the management system. Additional measures to achieve continuous improvement are: (a) Reward employees (b) Create an environment that fosters creativity (c) Do things right the first time (d) Do not sacrifice long–term improvement for short–term profits.

4. Management Responsibility – Top management must be involved in a TQM effort in order to achieve success. Management must take an active role in quality management on a number of fronts, to include strategic and implementation planning, coordination, communication, and cultural change. The involvement of the management will legitamize the effort in the eyes of the employees.

5. Team–work – A successful method to assist in improving performance management in the organization is to institute performance action teams. The teams will focus on the design, development and implementation of the ideal TQM system for SIPD management in the operation of the RFC system. However, these teams will require some quality education and training (e.g. nominal group technique).

All of the above criteria are relevant to the problems that currently exist within the RFC system. TQM must be viewed as a complex system of performance management activities focused on the objective of improving key business indicators such as quality, productivity, and the ever important profitability [15]. The activities must be in the form of performance improvement projects focused om improving the principles listed above. Prior to instituting a program to improve the performance management system of the organization, a detailed assessment of the current quality practices must be completed. The assessment identifies and agenda of enhancement opportunities. Improving the performance of the quality management system of SIPD requires careful, detailed planning that includes setting goals and thus giving a strategic definition to the organization.

1.4 RFC System Operations within a TQM Framework

A complete description of RFC system operations and the interactions of the organizations involved in the operations is provided in section 3.0. The complex management interactions that occur within the RFC system include the following:

- Definitions of technical and system requirements
- Economic justification
- System impact of operational changes
- Generation of proposed changes
- Management effectiveness
- Configuration management and control of system requirements
- Scheduling of system milestones

The SI/Contractor and SI/Customer management relationships are of prime importance when considering performance improvement projects. There must be a focused effort on clearly identifying the requirements of the customer with respect to RFC processing. In addition, attention must be given to the cycle time of processing an RFC

versus cost.

All participating organizations will be affected by a change in quality management practices within the SIPD organization. Members from the different organizations should participate in the improvement process because they are significantly impacted by RFC system operations.

1.5 Project Methodology

For a TQM system in the SIPD organization to systematically evolve (improve), a series of events must first occur. The following activities are related to assessing the quality management practices of the SIPD organization that operates the RFC system:

1. Review of Documentation
2. Input/Output Analysis
3. Survey of RFC participants
4. Identification of an agenda of enhancement opportunities
5. Analysis of data collected during the assessment
6. A proposal of the guidelines to be used for strategic planning, design, and implementation planning of an ideal TQM system for SIPD management to operate the RFC system
7. Recycling of assessment methodology

Figure 4 is a flow diagram for the methodology that was used in this research. The product of this effort is an agenda of enhancement opportunities for SIPD to pursue. This product is to be combined with a systems engineering design process for an ideal TQM system.

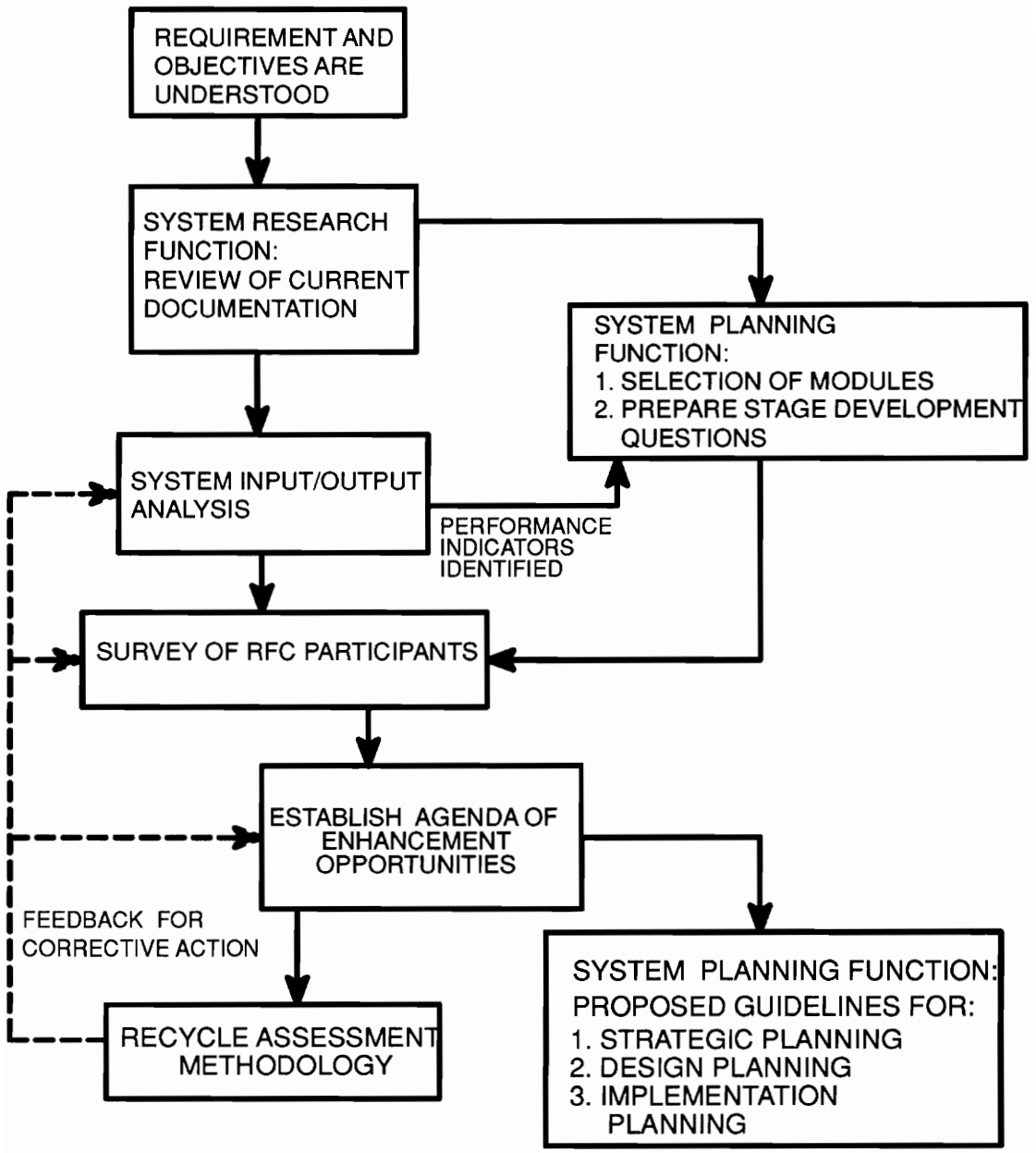

FIGURE 3: FLOW PROCESS OF METHODOLOGY

1.6 Organization of the Document

The first section has identified terminology associated with functions that occur in the development and evolution of a TQM system. Section 2.0 explains quality management, what it is and how it has been applied in the SIPD organization to date. There are a number of references that have been consulted for this research and the material from these sources are included in the expanded discussion of the assessment, along with the guidelines for strategic planning, design and implementation planning. Section 3.0 describes, in great detail, the RFC system currently in place. The section is divided into two parts. Part 1 provides a detailed description of the RFC system, a systems analysis, and a quick look at the problems that are plaguing the system. Part 2 examines the TQM project methodology and criteria for assessment. Section 4.0 contains the project results. Section 5.0 provides the lessons learned including conclusions, recommendations, and reflections.

2.0 TOTAL QUALITY MANAGEMENT

The following section attempts to explain Total Quality Management and how it has been applied in the M&DSO organization. A large number of organizations are attempting performance improvement projects utilizing TQM. Middle management is usually given the burden of implementing TQM in these organizations. These managers all run into the same roadblock, implementation. Although, there are numerous sources of literature in the market on the subject of TQM, very few go into any kind of depth regarding implementation strategies. The SIPD managers need service engineering definitions of quality management that are centered on RFC system operations. A short description of TQM is provided here along with a description of past and present TQM efforts within M&DSO.

2.1 TQM – What is it?

A straight forward academic definition of TQM is, according to Dr. Sink [12], "The management (planning, organizing, leading, controlling, innovating etc.) of performance at the five–key checkpoints (Refer to figure 4) in your organization. Failure of SIPD management to manage quality at the five key checkpoints is detrimental to any improvement effort focused on quality management practices. The five key checkpoints related to the RFC system include:

Q1: *Upstream Systems* are the organizations from which the SI receive inputs. For example, the customers and contractors. The goal at Q1 is to manage these upstream systems better in the future.

Q2: *Inputs* the SI utilizes to produce the service it provides to the customer. The goal for SI management is to ensure that the inputs to the RFC system meet

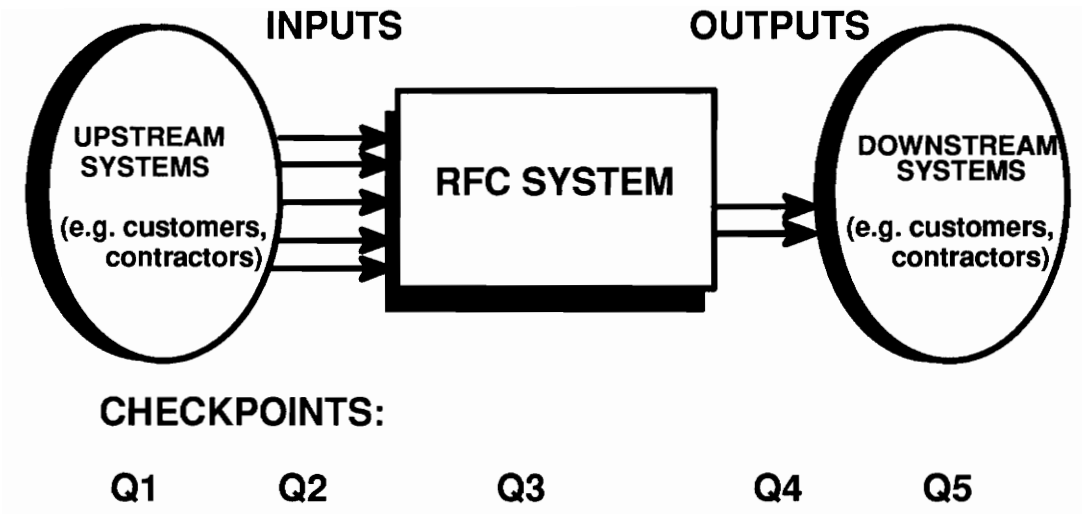

FIGURE 4: 5–KEY CHECKPOINTS TO QUALITY MANAGEMENT [12]

or exceed the following requirements: 1.) Timeliness 2.) Cost 3.) Quality.

Q3: *Value Adding Processes* that the SI uses to convert inputs to outputs. The goal is to ensure that these internal processes to the system are effective, efficient, and meet or exceed quality requirements.

Q4: *Outputs* of the RFC system. These outputs should meet or exceed customer's requirements

Q5: *Downstream Systems* are the organizations that receive the outputs of the RFC system. Once again, the contractor and the customer. The SI should meet or exceed the wants, desires, demands, and requirements of the customer.

The definitions listed above place functional requirements on the management of the organization, these include: planning, organizing, leading, and controlling. These are unfamiliar terms to SIPD management. SIPD bases their management style on micro–management, therefore, the functions listed above receive a minimal amount of attention. The result of such action is an organization that is in a continual state of flux or chaos. An organization that is in a state of chaos can not overcome the natural onset of entropy. Therefore, there is a wave of confusion and misdirection that propagates through the entire unit within SIPD. Employees become disgruntled, frustrated, and demotivated. The management of SIPD is currently going through a drill to change the organization of each program throughout the entire M&DSO. Within SIPD, there has been no interaction with employees in trying to arrive at the new organizational structure. Communication between the management and employees is virtually non–existent. This breakdown in communication effects successful quality management at three out of five quality checkpoints.

In the case of the RFC system, it is vital for SIPD management to understand the expectations and requirements of the customer. This is managing quality at checkpoint Q5. Once the requirements of the customer are understood, SIPD management can determine

which factors of the RFC system directly effect customer requirements. The assessment assists SIPD management in determining an agenda of enhancement opportunities to improve the quality practices with respect to the operation of the RFC system. Deming states clearly that improvement efforts must be aimed at anticipating the customers future needs, and organizations should change to meet the changing customer requirements [3]. Measurement cannot be forgotten, an organization cannot manage something that cannot be measured.

There are a number of interdependent actions required for successful TQM. Sink offers two such examples [12]:

1. Decisions and actions should be strategically thought through, comprehensive and well integrated.

2. Clearly communicate and mobilize coordinated action at all levels of the organization

Quality Improvement efforts in any organization must have the support of the top decision makers in order to be successful. To improve quality, requires comprehensive management on a number of fronts. Specific examples of the fronts relevant to the RFC system include: project management, culture, technology, and interfacing. The following is a summary of issues that Dr. Sink [12] feels are necessary for TQM efforts to succeed:

1. Gain support, involvement and legitimization of the organization effort from the appropriate level of top management.

2. The existence of a comprehensive, fully coordinated strategic plan.

3. Effective implementation plans

4. Focus on making the strategic plan a "Living Plan" that can help ensure continual improvements and adjustments to offset entropy.

5. Realize that a TQM design , development, and implementation effort is a five

to ten year process.

6. Successful TQM requires tremendous amounts of integration, coordination, communication and conflict management.

7. Overcome the number one roadblock to improvement, "Resistance to change".

8. Plan for modifications to the improvement effort. Continuous recycling, always search for areas to improve.

Problems inherent in the RFC system are the result of limited quality management practices on the part of SIPD management. If management neglects their responsibilities, as outlined above, any effort focused on performance improvement will not succeed. The SIPD management does neglect their tasks as they have adopted a policy of micro–management. A change to the RFC system is going to occur through enhancements to the quality management system of SIPD. System Engineering techniques can be utilized to develop enhanced management capabilities. Enhancements must occur in the following areas: 1.) Planning 2.) Measurement 3.) Rewarding Contributors 4.) Problem Solving 5.) Decision Making 6.) Management of Culture. These six areas represent a cross section of the 15 TQM modules used for the criteria in the assessment. To make the enhancements successful, there must be carefully planned action in the form of a logical process, involving a broad base of the organization's employees [4]. Emphasizing the openness and sharing of information is important for the success in the quality arena. This openness will instill a greater feeling of self–worth in the employees, causing them to take a greater interest in their jobs, thus allowing them to become more productive and efficient. CEO Jack Welch is trying to create a boudaryless environment for the General Electric organization. This program is based on the ideas discussed above. SIPD management must break down the barriers that are preventing the employees from completing the quality work that the customer demands.

This section provided some specific examples of what is required for TQM to succeed within an organization. The next section explores the past and present TQM efforts in the SIPD organization.

2.2 TQM within the SIPD Organization

The WORKOUT program was discussed briefly in section 1.2. The following section is an expanded discussion of the program, starting with the goals and objectives.

1. Primary Objective – To have 300,000 people with different career objectives, different family aspirations, different financial goals, to share directly in the company's vision, the information, the decision making process and the rewards. To build a more stimulating environment, an enjoyable workplace, incentives tied directly to what people do.

2. Practical Goal – To get rid of thousands of bad habits accumulated since the creation of GE.

3. Intellectual Goal – Begins by putting the leaders of each business in front of 100 or so of their people, 8 to 10 times a year, to let them hear what people think about the company, likes and dislikes about their work, performance evaluations. WORKOUT! will expose the leaders to the vibrations of their business opinions, feeling, emotions, resentments, not abstract theories of organization and management.

M&DSO attempted to implement a version of the workout program that satisfied the business objectives as outlined in the M&DSO vision statement. The mission statement is provided at this time. Discussion of the assessment results provide specific examples of SIPD procedures that contradict this statement.

M&DSO Mission Statement:

Be the premier contractor for sophisticated customer command, control and information systems as the architect, integrator, developer and systems operator

Customer Satisfaction: Is our number one objective. That means meeting all commitments, driving to be the lowest cost, highest quality producer of reliable systems and services, demonstrating continuous process improvement in pursuit of this objective.

Teamwork: with customers, subcontractors and fellow employees working toward common objectives is our way of doing business.

People: are the critical ingredient in meeting commitments to our customers and the company. They depend on and deserve an environment of:

- *open communication*
- *mutual respect and trust*
- *equal opportunity*
- *challenge and dedication*

We will encourage entrepreneurial leadership and reasoned risk taking. Our concern for each other extends beyond the workplace. We will act responsibility towards the community and the environment As a citizen of GE, we share the challenge of achieving corporate success and excellence.

The M&DSO WORKOUT program was a three phase implementation plan for each of the programs within SIPD, including SIPD. The phases consisted of the following:

Phase 1 – Initial Town Meetings

- Eliminate unnecessary work
- Build confidence in the WORKOUT! process

Phase 2 – Process

- Improve quality and productivity by improving processes
- Boost customer and Employee satisfaction
- Integrate TQM

Phase 3 – Culture

- Achieve speed, simplicity and self–confidence as a way of life.

The three phase plan was cancelled by SIPD management after the completion of Phase 1. The SIPD management felt that the rewards from the WORKOUT effort were not substantial. SIPD management is nervous about spending funds on improvement efforts for

quality. They are repeatedly quoted as saying, "WE must cut our overhead to improve our competitive posture". The most logical approach to improve an organization's competitive posture is to institute a program of continuous improvement. The SIPD management must look closely at the employee benefits they are cutting to remain competitive. This action by SIPD is degrading the quality management practices that need to be improved to sustain improvements in the RFC system.

The initial meetings in Phase 1 were a poor attempt at trying to determine the causes of problems within the M&DSO business. The problems addressed at these town meetings were only symptoms of larger problems. The town meetings were just a day and did not result in any significant changes. M&DSO management promised responses, no later than 60 days after the meeting, to any problem that surfaced in these town meetings. Phase 2 was for the teams to follow action processes in solving problems associated with the business. The final bullet under Phase 2 of the WORKOUT plan is to integrate TQM. M&DSO management is unaware of the tailoring that is required for a TQM methodology to be applicable to the business. The M&DSO have petitioned for assistance from the aircraft engine group of GE and from Xerox. These organizations are manufacturing in nature and are plagued by a different type of quality problem.

CEO Welch is very serious about a team concept and has vowed to remove any manager who is not a team player. This is probably the reason behind the recent removal of the Vice President of the Aerospace group. The corporate pressures are going to effect all levels of the M$DSO division, including SIPD.

3.0 REQUEST FOR CHANGE SYSTEM DEFINITION

Section 3.0 is broken into two distinct parts. Part 1 describes the RFC system in detail, a flow diagram is provided in appendix A. In addition to the discussion of the system, a complete systems input/output analysis is provided. The final section in part 1 is an overview of the problems with the RFC system based solely on the interaction of the author with the system. Prior to assessing the quality management practices of the organization that operates the RFC system, it is necessary to completely understand the RFC system.

Part 2 discusses the methodology for the assessment of the quality management practices of the SIPD organization, with respect to the operation of the RFC system.

PART 1

3.1 Detailed Description of System

The request for change process (RFC) is an arduous, seven week process that is laden with bureaucracy. Before beginning the assessment of the quality management practices of the SIPD organization, a detailed description is required of the process. The management of SIPD has constructed a system that is more responsive to political issues than to technical issues. The description begins shortly, first is a discussion of the participants in the RFC system.

PARTICIPANTS

The number of organizations that participate in the system vary depending on the particular RFC. Representation from the following organizations is expected:

a. Customer

b. GE M&DSO (Systems Integrator)

c. Contractor

d. A varied number of Segments (Support Organization's) depending on the RFC.

The Engineering Review Board (ERB) is an internal SIPD review board. It is comprised of the following members:

a. ERB Chairman

b. ERB Secretary

c. Program 607 Representative

d. Program 613 Representative

e. Program 617 Representative

f. Advanced Studies Representative

g. Scheduling Representative

h. Communications Representative

The above members of the ERB comprise one program within the SI group of M&DSO. The Configuration Review Board (CRB), also internal to GE, has the same representatives listed above with the addition of the "B" level managers from each of the groups. The "A" level manager also attends and co–chairs with the ERB Chairman. The end of the entire seven week process leads to a Configuration Control Board which is run by the customer. This board is conducted at the customer's facility and attended by the ERB chairman and the "A" level manager of the program. The customer review board is comprised of their senior management. This board is also attended by the engineer working the RFC if the GE management feels it is necessary.

DESCRIPTION

This description is accompanied by a flow chart in Appendix A. Any request for

change to this multi–faceted system that is under control of the customer must endure this system. Engineering Change Proposals (ECP's) pass through this board before being negotiated by the customer. The focus of this report is just RFC's, those generated internally by the SI and those generated by the contractor. The process is slightly different for ECP's. Some RFC's are presented to the board to gain acceptance for an ECP to be submitted. The process will be broken down into week long activities and proceed through seven weeks to the Configuration Control Board. The reader is encouraged to follow the flow in Appendix A.

The cycle begins with a generation of the RFC. As stated previously, the RFC can be generated by the SI or by the contractor. If the RFC is generated by the contractor, it is mailed to the ERB/CRB secretary, who attaches a pink sheet to the RFC to begin the internal distribution routing. The Pink sheet has the ERB members names on it. The responsible engineer, assigned by the ERB/CRB secretary, is responsible for making sure that the internal distribution is completed. If the RFC is generated by the SI, the RFC is sent from the engineer to the ERB/CRB secretary for pink sheet and internal distribution. In addition to beginning both RFC's on internal distribution, the ERB/CRB secretary schedules the RFC's on ERB agenda. For the RFC generated internal to GE, the ERB/CRB secretary assigns an RFC number. The responsible engineer ensures that the RFC package contains the following items:

a. Faceplate – describing the change, why it is required etc.

b. Change pages from the specifications and procedures that are effected by the change.

c. Precis Sheet – Summary Sheet that includes information on the coordination of the RFC with the externals once it is released from the SI organization. Comments from all segments are included along with a coordination date.

d. History sheet – In depth explanation of change, summary of technical evaluation, cost impacts, unresolved issues. This sheet is not included in the RFC package when it is distributed externally. It is only for internal GE management use.

e. Pink Sheet with "B" level approval – The "B" level manager of the responsible engineer must first sign the pink sheet releasing it for internal distribution.

Week One Activities

The first week activities are filled with administrative details and internal coordination. The responsible engineer (RE) will coordinate any comments to the RFC with the pink sheet members. The RE is required to have signatures from each person on the pink sheet prior to the ERB that occurs on the following Tuesday. The RE will make any red–line changes to the RFC package if appropriate. The RE also makes view graphs of the red–lines for ERB presentation. For an RFC that is generated by the contractor, any minor changes are red–lined in the RFC package. Major discrepancies are placed on view graphs and brought to the ERB for a decision.

Week Two Activities

This week starts with continued coordination in preparation for the ERB on Tuesday where the RFC is presented. The ERB secretary presents the faceplate and the history sheet. The RE has the view graphs of the red–lines and discrepancies. The ERB chairman assists in resolving any concerns that still remain. If there is complete concurrence, the chairman signs the pink sheet. If the RFC is not signed by the chairman, it is rescheduled and the RE works the issues with the chairman. Once the issues are resolved, the pink sheet cycle begins again and the RE coordinates for another ERB. This is for an RFC that is generated by the SI. If the RFC is generated by the contractor and there are discrepancies that remain after presentation at the ERB, the SI must confer with the customer and contractor concerning delaying the RFC. If there is concurrence that the RFC must be delayed, it will be reworked

and then begin the pink sheet coordination cycle again.

Assuming now that the RFC's are signed by the ERB chairman, the rest of week two activities are concerned with finalizing the RFC. These activities by the ERB/CRB secretary involve:

a. Scheduling the RFC for the CRB which occurs on the following Wednesday. The RFC may go to the CRB during the same week as the ERB if a short cycle is deemed necessary. If it is a contractor RFC, there is a 10 day restriction placed on the SI to release the RFC for external segment coordination. Therefore, the scheduling will accommodate this 10 day requirement.

b. The customer configuration control board (CCB) date is assigned.

c. A customer approved external distribution list is attached

The RE begins preparations for the CRB. The RE drafts a standard transmittal letter for RFC's generated by the SI. For a contractor generated RFC, the RE prepares a letter of SI comments/concerns. In addition, the RE obtains the rest of the signatures on the pink sheet. These signatures are the "B" level managers within the SI program. Backup charts are also prepared as necessary for the presentation to the "A" level manager at the CRB.

Week Three Activities

The RE continues to work the coordination of the RFC for the CRB. The RFC can not be brought to the board without the Pink Sheet signed in its entirety. A CRB takes place every single Wednesday of the month with occasional schedule changes for holidays and schedule conflicts. The ERB/CRB secretary presents the faceplate and the history sheet. The RE has supporting view graphs as the chairman scrutinizes the RFC. This is usually the first time the "A" level has seen the RFC so there are a number of questions expected. The "A" level reviews the background of the RFC using the history sheet, this includes a discussion of cost impacts. If this is a contractor RFC, it is decided if a ROM (Rough Order

of Magnitude – Cost of instituting the change) is required. If there is a ROM required, the RE notifies the customer representative to expect a ROM to be submitted by the contractor. The chairman ("A" level manager or ERB chairman) of the CRB signs the RFC's to be distributed externally if all issues have been resolved. If discrepancies remain on an internally generated RFC, it is rescheduled. The RE reworks the RFC with the ERB chairman and the pink sheet coordination begins again. If this is a contractor RFC, the SI confers with the customer and the contractor to discuss impacts of delaying the RFC. If a delay is agreed upon, the RFC is reworked by the RE with the ERB chairman and the pink sheet coordination cycle begins again. If a delay is not agreed upon, the RFC is signed by the CRB chairman and released externally. A letter of SI concerns accompanies a contractor generated RFC. If the RFC is generated by the SI, and no discrepancies remain, a standard transmittal letter is included.

Week Four Activities

The RFC is mailed out by the ERB/CRB secretary by Thursday of week three. The RFC takes approximately one week to reach the segments on the distribution list. This begins what is termed preliminary week activity.

Preliminary Week Activities

The ERB/CRB secretary contacts all segments near the end of week four to ensure receipt of the RFC package. The Precis sheet is updated to reflect the status of each segment. The updated precis sheet is provided to the RE by NLT (no later than) COB (close of business) on Thursday of this week. The RE reviews the precis sheet for accuracy and provides it to the ERB/CRB Secretary NLT COB Monday.

Week Five Activities

This is still preliminary week activities. The ERB/CRB secretary updates the precis

sheet as a result of comments by the RE. Tuesday of week 5 is the preliminary week ERB. The ERB/CRB secretary has view graphs of the precis sheet and history sheet for the chairman to review. The RE is not required to attend the ERB during preliminary week. The ERB/CRB secretary provides the precis sheet to the RE by COB on Tuesday. The RE makes any required changes to the precis sheet and returns it to the ERB/CRB secretary NLT 11 a.m Wednesday. The ERB/CRB secretary attends the preliminary week CRB on Wednesday. The precis sheet and history sheet are presented on view graphs. The ERB/CRB secretary, prior to the board, has started preparation on an RFC notebook for the CRB chairman. This notebook contains status on all active RFC's and their current state in the system. Each RFC in the notebook is accompanied by a precis sheet and a history sheet. The completion of the CRB on Wednesday marks the beginning of interim week.

Interim Week Activities

The ERB/CRB secretary will contact all segments to determine any impacts as a result of the RFC. The information is passed to the RE NLT Thursday afternoon along with an updated precis sheet. The RE coordinates the comments received by the ERB/CRB secretary with the appropriate segment. If a change is agreed upon, the RE either includes it as a precis modification (mod) or prepares a modification package. A modification package must go through the same cycle as a regular RFC, however, the process can be shortened by having the package go to ERB and CRB in the same week. A precis modification is a change to the RFC that will be noted on the precis sheet. This precis modification will be circulated to all segments on the precis sheet. The segments will base their recommendation on the RFC and the modification. If a modification package is put together, the modification package number must be noted on the precis sheet along with a note stating that a recommendation is based on agreement with the modification package. The updated history sheet is passed to the ERB secretary NLT COB Monday.

Week Six Activities

Week six is still interim week. On Monday the ERB/CRB secretary updates the precis sheet based on input from RE. Each segment that has not turned in a recommendation should be contacted on the Monday before the ERB at the latest. The ERB/CRB secretary makes view graphs of the precis sheet and the history sheet for presentation at the interim week ERB. The responsible engineer attends the interim week board if there are a lot of questions and the segments are not making a recommendation, or if there has been a modification package released. At the ERB on Tuesday morning, the ERB/CRB secretary presents the precis sheet and the history sheet. The RE is present to discuss the status of a modification package or any issues. The RE makes changes to the precis sheet and pass it to the ERB/CRB secretary NLT 11 a.m. Wednesday. The Interim week CRB occurs on Wednesday afternoon. The RE is in attendance if modifications have been prepared or there are unanswered questions. The ERB/CRB secretary updates and send issues sheets to the customer.

Final Week Activities

The ERB/CRB secretary continues to contact the segments and inquire about recommendations, update the precis sheet and provide to RE NLT COB Thursday. The RE resolves any issues that are still outstanding. There is usually a flurry of activity at this time because all the segments are waiting until the last minute. The RE must update the precis sheet and provide it to the ERB/CRB secretary NLT COB Monday.

Week Seven Activities

The SI holds a Video Tele–conference (VTC) with the customers on the Monday of final week. The SI receives recommendation from the customer on the RFC. If issues are outstanding, it is the RE's job to coordinate with the customers during final week.

The ERB/CRB secretary updates the precis sheet based on the inputs from the RE. The RE makes sure that the customer representative has cost data available and notifies CRB chairman on Wednesday of the availability. The final week ERB will be on Tuesday a.m.. Once again, the ERB/CRB secretary presents view graphs of the precis sheet and the history sheet. The precis should have a recommendation from each segment at this time. If all the recommendations are in, the RE does not have to attend. After the ERB, there is a VTC to discuss all recommendations with the contractor and the customer CM for the upcoming Customer CCB. There is one more chance to resolve any outstanding comments or concerns prior to the CRB on Wednesday afternoon. The CRB chairman will be greatly disturbed if all recommendations have not been received. The RE has to attend if all issues were not resolved. At the completion of the CRB, the ERB/CRB secretary begins to prepare the final RFC package, including the final precis and recommendation. He/She transmits the package to the customer facility NLT noon on Thursday. Configuration management specialists at the customer facility prepare a duplicate notebook to the one that resides at SI headquarters for the CRB chairman. The ERB/CRB secretary supports the configuration management personnel from the customer on the VTC discussing preparation for the CCB that occurs on Monday.

Week Eight Activities

The CRB chairman travels to the customer facility the Sunday prior to the CCB. Monday morning, the chairman reviews all the RFC's that are scheduled for the board with the senior director of the customers. The CCB is held Monday at 1 p.m.. The RFC's that were generated by the SI are presented by the CRB chairman. The RE may be requested to attend. If the RFC was generated by the contractor, the customer representative who manages the particular item in question presents it to the board. A decision is made by the senior director of the customers whether to accept the RFC, reject it, or defer it to gain more

information.

This is the process that is currently in place. There is a current effort in place to try to improve the process. A team was selected by management and they have had one meeting to date. This system is a contractual line item on the contract that exists between the customer and the SI. In order for the SI to change the process, they must generate an RFC to be approved by the CCB. It almost resembles a "Catch 22" situation.

3.2 System Analysis

The following section breaks the process that was just described down into inputs, activities, outputs, and outcomes. This system methodology is important to explore the benefits of evolving TQM system modules to improve the quality practices of SIPD management. The input/output analysis assists in identifying performance indicators to track performance efforts over a period of time.

Inputs:

- ERB/CRB Chairman authority
- ERB/CRB members
- Management culture in all the organization's involved in the process/ Management processes
- Program Structure
- Capabilities of each organization
- System and schedule impacts
- Technical evaluations
- Organizational culture
- Assumptions of customer's expectations, indicators of satisfaction
- Cost analysis data
- System requirements

- Award Fee information

Activities:

- Documentation of the change required to include:
    1. Need for change
    2. Publications and Specification effected
    3. Technical Impact
    4. Cost Implications
- Internal coordination of the RFC within GE, obtaining pink sheet signatures.
- Preparation of materials for each board, view graphs etc.
- Internal Engineering Review Board. Include Preliminary, Interim, and Final Week Boards for each RFC.
- Internal Configuration Review Board. Include Preliminary, Interim, and Final Week Boards for each RFC.
- Distribution of RFC to external Segments and customers. Includes transmittal letter drafting by RE and preparation by ERB/CRB secretary.
- Preparation of a letter of SI concerns for contractor generated RFC's.
- Solicit input from external segments.
- Continual update of precis sheet.
- Updating the history sheet to keep the ERB/CRB chairman informed.
- Preparation of an RFC notebook for the CRB chairman that is continually updated.
- Ensure customer representative is notified if a ROM is required
- Preparation of a modification package if required. This modification package will include comments from segments.
- Preparation of final RFC package to be transmitted to customers facility.
- VTC with customer.
- VTC with contractor.
- VTC for customer CM personnel supported by ERB/CRB secretary.

- Configuration Control Board. Presentation of RFC's by CRB chairman. Includes a pre–brief in the morning before the board.

Output:

- The status of the RFC, deferred, rejected , or approved.
- Follow–up work of CM people to institute the change.
- Approval for ECP submittal.

Outcome:

- Customer satisfaction.
- Generate Engineering Change Proposal.
- Proper specification of requirements. Logical flow of requirements from system level to segment level thru interfaces.
- Ease in contracting for new hardware, software, and equipment etc.

3.3 Problems Inherent in the System

Many problems exist within the RFC system. The following list is a result of observation. The majority of these problems is attributed to the lack of quality practices by SIPD management. The problems include:

1. The RFC cycle delays are due to bureaucracy and an unwillingness to change. There is a culture within the SI that is afraid of change. The culture is set on anticipating the customer needs and requirements, and neglecting room for improvement

2. The cost of a single RFC is approximately $10,000 . [1] This is very expensive for an ineffective system.

3. Under the current system, there is a waste of engineering time and knowledge. This has disgruntled the employees. There is too much emphasis placed on presentation and not enough on technical expertise.

1 This cost is a rough estimate based on man–month costs for SIPD personnel.

4. The management of the SI tries to assume customer requirements. There is no attempt to thoroughly understand customer requirements, document them, and share them with all the employees.

5. There are a number of RFC's that require extensive technical evaluations and a lot of engineering time. There is no system to reward the employees for significant contributions. The only performance rating system in place to evaluate the employee, is a yearly performance appraisal. The employees do not even get to make the presentation of the change to the customer configuration board.

6. This multi–faceted system requires operational expertise on the part of the integrator to succeed. There is minimal attempt by the SI management to understand the operation of the system. This is surprising as a number of the RFC's involve operational issues.

7. Everyone in the SI and the customer organization disregard long–term strategies. Short term programs are what is considered important. The idea is to judge costs today regardless of what needs may arise in the future. It is important to consider life cycle approaches for hardware and software in satisfying short and long–term goals.

8. The review boards internal to GE, the ERB and CRB, are concerned mainly with presentation and not technical merit. The procedures for reviewing an RFC are not responsive to the change being considered. The bi–annual award fee gives the customer the upper hand, SI management will not jeopardize the award fee even if it means sacrificing technical merit.

9. A lack of coordination and teamwork by the engineers, within the SI is perpetuated to the contractor and the customer. The SI, due to an inherent culture, erect a boundary between themselves and the contractor. This eventually becomes apparent to the customer and lowers the rating of both organizations.

PART 2

Part 2 proceeds with the methodology for the assessment of the quality management practices of SIPD management with respect to the operation of the RFC system. The role of SIPD in the operation of the RFC system is defined in the above description. The

methodology begins with a systems definition of a Total Quality Management System for SIPD.

3.4 TQM System Definition

A TQM system can be defined as a union of all TQM modules. Refer back to section 1.3 for the definition of the TQM modules. The modules serve as the criteria in the assessment of the quality practices of SIPD in the operation of the RFC system. Each module defined in section 1.3 represents an important piece of the organization's behavior for successful TQM and can be individually analyzed as a system. There are three objectives for analyzing TQM modules as systems [15], these include:

a. The first is to systematically identify the value–adding activities of the modules that comprise the TQM system.

b. The second is to identify the interrelationships of the modules of the TQM system.

c. The third is that the systematic analysis of the modules will assist in defining performance indicators which help track the results of continuous improvement activities.

Each module can be broken into one of three stages depending on the level of TQM maturity within the organization. The definitions of the stages are:

Stage One: This stage is defined by those activities that represent TQM awareness within the organization.

Stage Two: This stage is defined by those activities that represent the primary TQM tasks. These include: initiating the quality planning process, the formation of quality action teams, The identification of quality problem areas, data collection and analysis, etc.

Stage Three: This stage is defined by those activities which implement the quality improvement and enhancement objectives, identify the results of the improvements

and subsequently use these results to plan the next TQM system evolution.

Stage development questions for each module stage are included in the research by Triantis, et al. [15].

Successful TQM implementation requires flexibility on the part of SIPD management. The resistance to a change in the way of doing business is the SIPD's greatest obstacle and the most detrimental to any TQM design and development effort.

3.5 TQM System Assessment Methodology

The result of the assessment is the identification of an agenda of enhancement opportunities. The criteria used to judge the quality management practices of the SIPD organization, with respect to RFC system operations, is the 15 modules defined in section 1.3.

The author, functioning as the assessor, selected the stage development questions for each module. The stages were not the same for each module. SIPD is further along with regard to certain quality management practices. The stage development questions provided in the research by Triantis, et al. [15], were modified to be applicable to the SIPD organization.

The assessment methodology included the following:

1. A review of current quality documentation
2. A survey of SIPD personnel involved in the RFC system,
3. Identification of an agenda of Enhancement Opportunities
4. Proposal of guidelines for strategic planning, designing, and implementation planning for an ideal TQM system for SIPD management

3.5.1 Review of TQM Documentation

There are no documented quality procedure in the SIPD organization. The following

review was centered at the M&DSO level. This discussion assists in identifying the barriers that exist between SIPD management and the M&DSO management.

There is a sharp distinction between the manner in which the division approaches TQM and the way that SIPD approaches TQM. Planning is occurring at the division level and not within SIPD. A problem exists with communication between the division level management and the SIPD management. Section 2.2 provided a background on TQM within the organization. Phase three of that initial program, Business System Initiative (BSI), began in October 1991. M&DSO has named the ERB/CRB cycle as a focal point for the BSI effort. There are two goals placed on the organization by M&DSO GM, Ken Swimm, that are expected as a result of the BSI effort. These include:

- Shorten the average new acquisition cycle by two years
- Improve the quality of specifications and delivered products by a factor of five. [2]

For the following technical functions, BSI is focusing on the RFC's for the source of Quality Improvements.

1. Requirements Definition
2. Product Design
3. Product Development
4. Installation Checkout and Test

From the above list, requirements definition is the responsibility of SIPD. The BSI teams went on to outline a plan for achieving improved quality:

1. Use TQM to assess cycle time and how well functions are now being performed.
2. Define the improved performance levels to achieve the goals listed above.

2 There is no clear definition of the meaning of the word five.

3. Once quantified improvement goals are identified, the BSI will focus on developing candidate approaches to achieve them.

3.5.2 Survey of RFC Participants

The survey questions that were administered to the SIPD employees were comprised of the stage development questions selected above. A complete listing of the survey questions is provided in Appendix B. The survey questions were administered to a thirty–five person unit within SIPD that is very intensive in RFC Processing. Responses were received from only ten out of the thirty–five personnel in the unit. The focus of the questions was the quality management practices of SIPD with respect to the operation of the RFC system.

3.5.3 Data Analysis

A complete set of statistics is kept on the RFC system. There is data dating back to the time when SIPD first began as the systems integrator. The data is kept in categories based on the outcome of the RFC. All RFC's processed are placed into one of the following categories:

1. The RFC can be approved as submitted to the board.
2. The RFC can be approved with a floor modification (real–time change at the customer CCB).
3. The RFC can be approved as submitted based on a specific SI recommendation.
4. The RFC can be approved as submitted based on an SI recommendation with a floor modification at the CCB.
5. The RFC is withdrawn during the cycle at some point
6. The RFC can be rejected by the customer CCB.
7. Miscellaneous.

A typical sampling of data for a three year period (1988–1990) is represented below.

CATEGORY	No. OF RFC'S
1	114
2	27
3	252
4	60
5	18
6	18
7	62

The following information can be derived from the above numbers:

1. Total percentage of RFC's approved at the customer CCB equals 82%

2. Percentage of RFC's approved by the customer based on SI recommendation equals 56%

3. Percentage of RFC's that were rejected/withdrawn equals 14.5%

The results of the RFC's are a direct reflection of the quality management by SIPD of the RFC system. These low numbers calculated above are not consistent with the expectations of the customer. The failure to meet customer expectations is the result of deficient quality management practices on behalf of SIPD management.

3.5.4 Proposal for the Guidelines for Strategic planning, Design, and Implementation Strategies

As part of the project methodology, this section provides information to SIPD management on how to proceed at the conclusion of the assessment. The assessment provides an agenda of enhancement opportunities for the improvement of the quality management system of SIPD. The opportunities must be evaluated and planned for. The resulting selection requires a change to the configuration of the management system and this change must be implemented.

STRATEGIC PLANNING

The following discussion provides guidelines for the strategic planning of quality

improvements in the management system of SIPD. In reference to figure 4, it is important to plan for quality management at each of the five checkpoints. In planning for total quality management, the organization must consider the past, present, and future to include: 1.) What has been done in the past to manage quality? What have been the successes and failures? 2.) What is the current TQM effort? Is it working or not? 3.) What is the quality strategy for the next two to five years? Answers to each set of questions provide data for a grand strategy for continually improving quality with respect to RFC system [12].

The system assessment provides valuable information on past and present activities with respect to TQM. As the result of the assessment, the organization must develop a quality strategy to evolve the TQM system for RFC processing to the next level. Recent economic conditions have made the quality planning process almost obsolete. Management refuses to spend funds on improvement planning as they have said that it increases overhead costs and makes the organization less competitive. The SIPD management must realize that a planning horizon of two to five years should be used for a successful program.

The steps involved in the strategic planning process are identified in Figure 5. The flow diagram is showing that performance measurement is feeding back into an ongoing evaluation and review, which is used to identify areas for continuous improvements.

It can not be stressed enough how crucial it is for management to be actively involved in the planning process. SIPD management at all levels must be involved for the quality improvements of the RFC system to succeed. Involvement enhances ownership, commitment, and more successful implementation. SIPD management involvement in the development of plans for quality builds teamwork, shares valuable information, shares power, enhances coordination, improves communication, and elevates critical issues to a level where they can be dealt with most efficiently. Involvement of key decision makers results in an excellent plan that can be implemented [12]. The SI management is too busy

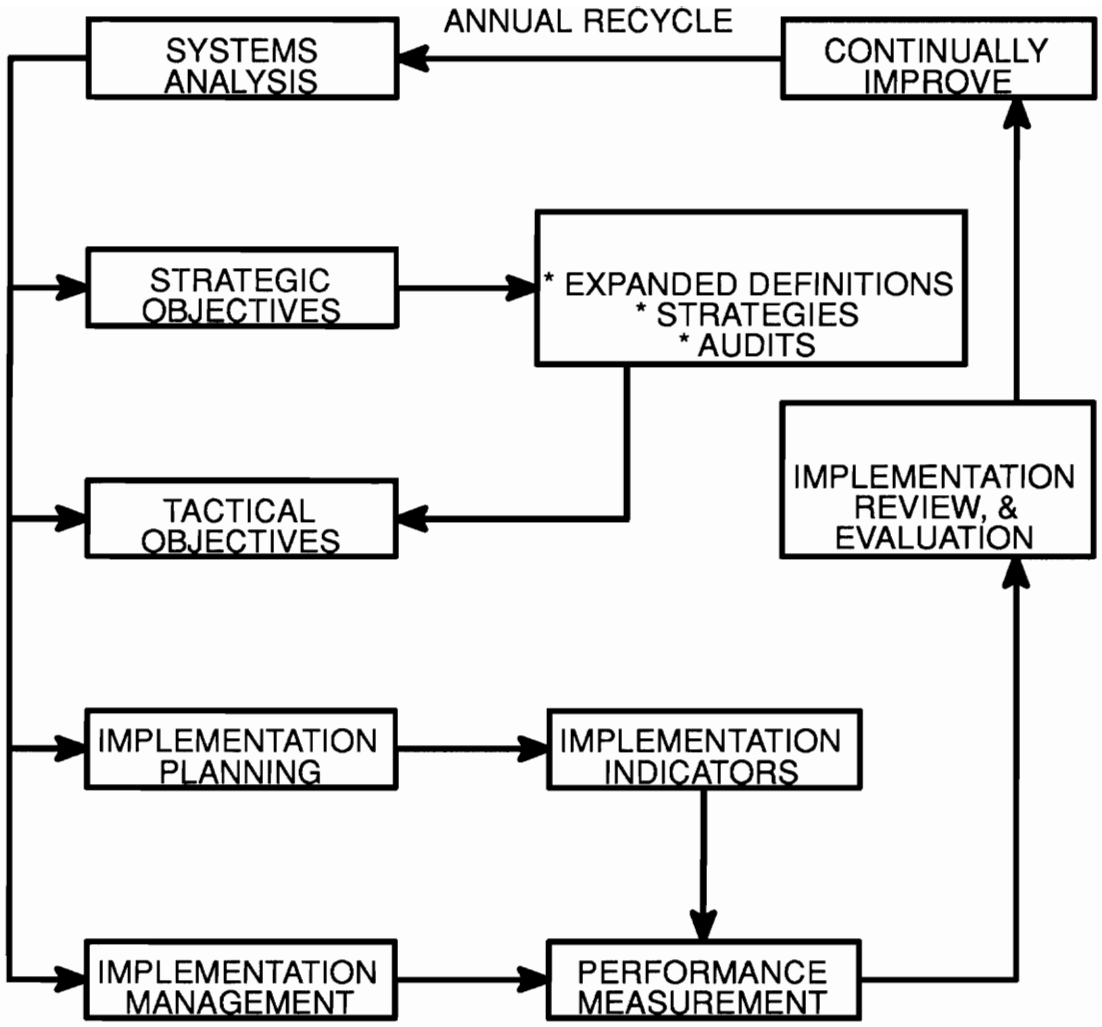

FIGURE 5: STRATEGIC PLANNING PROCESS [3]

looking for a "quick fix" to the RFC system. System Engineering Management Plans should be developed that outline the objectives and the responsibilities of each member of the organization in the effort to improve quality practices.

SIPD management must be looking down the road long–term. The elements which must be addressed in long–term TQM system developmental strategic planning include [15]:

1. **System Standards** (the ideal)

   In planning for TQM system enhancement it is important to establish a long range goal of achieving the ideal configuration. This element of the strategic plan establishes a working definition of the ideal TQM system.

2. **Development Motive** (rationale for development)

   The rational justification which provides the motivation for maintaining and further developing TQM system capacity/program capabilities.

3. **System Profile** (current system practices)

   There must be a clear and accurate understanding of the organization's current TQM system (configuration). This system assessment can be used to update this critical understanding.

4. **Assigned Mission** (system responsibility)

   This element describes what is expected with respect to TQM by the SIPD management.

5. **Management Vision** (system evolution expectations)

   This element is the personal vision of the management team on the subject of the TQM system and related management practices, and what these may become as the evolution continues throughout the strategic development period (five to seven years).

6. **System Objectives** (system development intentions)

   This element describes what the management team expects the organization to accomplish by the end of the strategic development period, with respect to the completion of planned module enhancements.

7. **Guiding Principles** (operational culture)

   The SIPD's guiding principles are those beliefs and values, with respect to work, organization, interactions, communication, etc., and which are commonly held by most of the organization's employees.

8. **Development Strategy** (developmental program methodology)

   This element describes "how" TQM system development is going to be accomplished. The overall approach (performance logic) for carrying out the developmental program should be explained.

9. **Program Organization** (responsibility/accountability)

   This element is a plan of organization for the ongoing program of TQM system development activities required to ensure that all human resources can interact efficiently and effectively as team members.

10. **Implementation Tactics** (projects/teams)

    This element includes specific and detailed work plans for each project that is undertaken to implement the changes required to advance one system module one further stage in the overall system development process.

Planning for TQM system evolution requires the answering of a number of questions. To include [1]:

1. What is the RFC system to accomplish in terms of operations and performance characteristics?

2. What are the customer requirements? When is the RFC system needed?

3. How is the RFC system to be utilized?

4. How is the RFC system to be distributed and deployed?

5. What effectiveness requirements should the RFC system exhibit?

Planning is required to expand performance capabilities within the organization. There must be a focused effort on continuous improvement to remain competitive. The RFC system is the main activity for the SI and is the chief cause for customer interfacing.

There must be objectives in place that explain how the requirements and expectations of the customers are being satisfied. Performance Improvement will not be achieved through a "quick–fix".

DESIGN PLANNING

The RFC process is service in nature. The factors that the customers use to evaluate the performance of the system are very different then the factors used in a manufacturing environment. The factors include: customer satisfaction, responsiveness, cycle time of an RFC, assurance etc. These are the factors that determine performance improvement. Performance improvement in a service industry is achieved through performance improvement projects evolve the TQM modules. The TQM modules, each a system in themselves, combine together to form a design of a TQM system for SIPD management that impacts the operation of the RFC system. The design process will be attempting to produce the ideal TQM system. The modules are systematically analyzed with respect to the RFC system to define performance indicators which track the results of continuous improvement efforts. The projects are modified to evolve certain indicators, attention is given to the interrelationships of the modules. The performance improvement project center on the

modules that are deemed to be the most important to the organization relevant to the RFC system. These modules are ranked based on the following: 1.) How well does the module satisfy the strategic objectives. 2.) Ease of implementing a new way of doing business into the organization.

There is a direct correlation between the quality management practices of the organization and the performance of the RFC system. This correlation is identified by examining the RFC system and the TQM system modules. For example, an improvement in quality leadership impacts the quality of the RFC's processed by the system.

The following guidelines for TQM system design developed by Triantis, et al. [15], are to be followed upon completion of the development strategy and precedes the implementation planning. These TQM system guidelines are as follows [15]:

1. **Develop an organizational TQM system definition** : The TQM system definition provided earlier in the section is a baseline from which SIPD can develop its own definition. TQM modules can be added, deleted, and augmented. Additionally, stage definition can change depending on the recommendations of the strategy for TQM system evolution. The organizational TQM system definition needs to be revisited every time the organization chooses to evolve its TQM system configuration.

2. **Select the TQM design specifications for the next TQM system evolution** : The results of the assessment and the strategic objectives defined by the development strategy are used by the design team to decide the TQM configuration of each TQM module. These decision are passed on to the implementation planning team that plan "how" each TQM module configuration will be achieved.

3. **Decide the relative design and implementation importance of each TQM module :** Based on general guidelines on a balanced evolution of the TQM system, the design team members need to decide on the relative design and implementation importance of each TQM module. this will ensure that the evolution of the TQM system as a whole is consistent with the objectives outlined

by the development plan.

4. **Develop a scheduling plan for the TQM system evolution** : Based on the preference ordering found from step 3, the TQM system design team needs to develop a scheduling plan for the TQM system evolution.This scheduling plan can than be given to the implementation planning teams for each TQM module so that they can coordinate their implementation planning efforts.

IMPLEMENTATION PLANNING

The objective of implementation planning is to develop guidelines to plan the implementation effort required to further develop each TQM module according to the organization's overall strategy for TQM system evolution [15]. The research by Triantis, et al. [15] indicates that there are five steps in the implementation planning process. These include:

1. Preliminaries
2. TQM module system analysis
3. Planning
4. Development of long–run implementation goals
5. Development of implementation operational objectives

A brief description of the activities involved in each step of the implementation planning process is provided in this section. This provides SIPD management with an indication of what is required for successful TQM implementation planning.

1. Preliminaries :
   - Assignment of planning task to an appropriate team
   - Decide on membership of team (executive management, middle managers, customers, employees etc)
   - Select a facilitator familiar with group processes and coordination of team activities

2. TQM System Analysis :
    - Establish vision/ mission for each module. Conclusion must be reached on long–term applications
    - Complete an input/output analysis of each TQM module with respect to the RFC system
    - Complete an assessment for each module
    - Determine the impact of organizational factors. Identify strengths and weaknesses in a number of organizational factors for each TQM module. What organization structures are involved with activities of each module?
3. Planning Assumptions :
    - Use a structured group technique to solicit assumptions for which to base planning
4. Development of long–term goals for each TQM module :
    - Assume a two to three year horizon
    - Establish long–term goals consistent with achieving higher stages of maturity. Use the nominal group technique to determine long–term goals.
    - Each goal should be ranked in terms of relative importance
    - Goals need to be consistent with TQM module system analysis and planning assumptions
5. Development of operational objectives :
    - Development of short–term operational objectives (12 to 18 months), use NGT to derive short–term objectives and make sure they are consistent to long–term objectives
    - Criteria to judge projects:
        a. Economic justification
        b. Risk of Failure of project
        c. Impact of each module in terms of evolution of TQM system

4.0 DATA COLLECTION AND ANALYSIS

The following section outlines the data collection and analysis efforts involved with the assessment of the quality management practices of the SIPD organization with respect to RFC system operations.

4.1 Results of Documentation Review

As was stated in the previous section, there is no documentation on quality procedures within the SIPD organization. Therefore, there are no results obtained from the documentation review. There are however, two distinct observations that need to be made as a result of reviewing M&DSO documentation. The first observation is that this research effort appears to be on track with the requirements of M&DSO management. The second observation is that a significant breakdown in communication is occurring between SIPD management and M&DO management.

4.2 Results of Survey

The results of the survey given to the RFC participants were excellent, and they confirmed a number of the assumptions that have been discussed previously. The following discussion outlines the enhancement opportunities that were a result of the survey.

In the area of procedures and documentation, participants were in agreement that changes were necessary. Engineers are confused by the RFC system, CM people feel they are doing too much of the engineers administrative work, and little to no guidance is provided by management. There was a need expressed for clear, concise procedures that are focused on objectives to satisfy the goal of the system. A few individuals felt they understood the goals and objectives of the system, but these individuals could not expound upon their ideas. In addition, there was confusion as to the difference between objectives

of the system and the requirements of the customer. The participants felt that the requirement of the customer, a quality product, was the objective of the system. The goal of the system may be a quality product, but the objectives should explain how to achieve the goal. This confusion of the participants on the goals and objectives of the system, and the requirements of the customer is due to the fact that management is spending too much time micro–managing and not enough time managing. The lack of clear procedures and the SIPD management's failure to communicate the requirements of the customer are the cause of significant problems in the RFC system.

There was a question included in the survey that was from GE CEO Welch [7]. Welch assures that everywhere in the GE organization management gives the employee the right to voice and they demand responsibility from them. The participants feel that SI management actually takes away their right to voice. This occurs when the program manager briefs all the RFC's to the customer. Management also attends all the working group meetings as the voice of the SIPD. This is in direct conflict with the statement by Welch and the M&DSO Vision statement that was presented in section 2.2. If you take away the right to voice, the employees are going to lose incentive and motivation.

The next significant area in need of improvement is the empowerment of the people. Remarks for this area are similar to the ones above. There are no attempts by SIPD management to encourage individualism on the part of the employee. This again is in direct conflict with the mission statement of M&DSO in section 2.2. All participants in the survey responded with a resounding "no" to this question on employee involvement. Examining the responses revealed a common theme–management is actually decreasing this authority to act. This is accomplished by discouraging communications with the customers, second guessing an engineers evaluation in front of the customers, and making decisions without current information. The problems are relevant to a number of TQM modules and can be improved through selected performance improvement projects.

On the subject of quality, there was a lot of confusion. All participant are unaware of any improvement programs in place at the M&DSO division level. There was an interest expressed in quality education and training, but the employees new that management would not be receptive to the idea.. A lack of awareness at the SIPD level perpetuates the breakdown in communication between the SIPD management and the M&DSO management. To remain competitive, M&DSO is going to have to educate the employees on the benefits of quality management and invest some resources. There must be a focused effort on continuous improvement.

There was agreement between the respondents that a need exists to shorten the cycle time of the RFC system. Because the cycle is 45 days, the engineers and CM personnel are working more that one customer CCB at a time. The CCB's are scheduled every two weeks. The rest of the organizations are only working to one CCB. This causes a conflict in procedures and results in a breakdown of coordination and teamwork.

Table 1 shows the resulting scores for each module's development questions. The score is given in percentage of TQM awareness for that particular module within the SIPD organization.

5.0 SUMMARY OF RESULTS

5.1 Enhancement Opportunities

The agenda of enhancement opportunities for the quality management practices of SIPD management is identified in table 1. Table 1 shows the results of the application of the scoring methodology developed by Triantis, et al. [15] to the responses of the survey. The TQM maturity level represents the maturity level of the SIPD organization with respect to 15 distinct TQM module areas. The TQM maturity level is displayed in a percentage of the existing quality management practice of the SIPD organization in each individual module. The mechanics of the scoring methodology is presented in the next section.

TABLE 1: SCORING OF TQM MODULES

TQM MODULE	TQM MATURITY LEVEL
LEADERSHIP	35%
QUALITY POLICY	20%
DEPLOYMENT OF QUALITY TASKS, REPORTING AND COMMUNICATIONS	30%
QUALITY PLANNING (STRATEGIC AND OPERATIONAL)	12%
CUSTOMER RELATIONS/ COMMITMENT TO CUSTOMER	40%
DETERMINING CUSTOMER REQUIREMENTS, EXPECTATIONS, SATISFACTIONS	20%
MEASUREMENT	30%
EMPLOYEE INVOLVEMENT	30%
QUALITY EDUCATION AND TRAINING	10%
EMPLOYEE WELL BEING AND MORALE	5%
BEHAVIORAL REINFORCEMENT	35%
CONTROL	30%
MEASUREMENT OF DATA AND INFORMATION	5%
DOCUMENTATION	16%
TQM SYSTEM ASSESSMENT	25%

5.2 Scoring Methodology

This scoring methodology developed by Triantis, et al. [15] was used to calculate a percentage of TQM awareness for each module as displayed in table 1. A brief description of the scoring methodology is provided.

There must be a maximum percentage of completion value assigned to each stage for each module, the value assigned to each stage does not have to be the same for each module. The maximum percentage of completion value is the maximum value that can be distributed amongst the questions in the stage. The total for the stage cannot exceed the maximum percentage of completion value. The scoring criterion used in the assessment is the following:

Score 1:

Stage 1: 0–35%, therefore, the maximum percentage completion value is 35
Stage 2: 36–65%, therefore, the maximum percentage completion value is 30
Stage 3: 66–100%, therefore, the maximum percentage completion value is 35

The purpose of a scoring methodology in support of the assessment of quality practices is to determine an agenda of enhancement opportunities within the SIPD organization with respect to the individual modules. Improvement efforts can be planned, monitored, and the progress tracked by repeating the scoring methodology at another point in time and then comparing the assessment results to the previous results [15].

The assessment questions were based solely on the authors' opinion. The author possesses a theoretical knowledge of TQM and has studied the modules for an extended period of time. To use the assessment as a methodology in determining enhancement opportunities, the variables (assessor, relative significance of assessment questions, and the method to assign a numerical score) must be maintained. If the SIPD management are

interested in pursuing the approach toward performance improvement, there may be the need to repeat portions of the assessment to remove any biases that the author may have imposed.

6.0 LESSONS LEARNED

6.1 Conclusions

The investment in the improvement of quality management practices by the SIPD management is a major project. The project requires the application of the systems engineering methodology in the design, development, and implementation of enhanced performance management capabilities. This systems engineering project has determined an agenda of enhancement opportunities for SIPD quality practices.

The SIPD management have been confused on the subject of TQM. They have been searching for a "quick–fix" to the RFC system, and have been ignoring the shortfalls of their quality management practices. The personnel who responded to the survey attributed the RFC system problems to management. The percentages in table 1 indicate a number of areas that should receive attention. The following recommendations to improve the quality management practices of SIPD have a significant effect on the performance of the RFC system:

1. There must be a focused effort on employee involvement. The employees are disgruntled because they are not receiving any support or direction from the management. The management is too involved with the activities that should be handled by the employees. Steps must be taken to increase employee morale and motivation.

2. There must be significant steps to improve communication both internally and externally. This breakdown has serious repercussions throughout the whole program. An attempt to improve communication improves coordination and the movement of materials and information from organization to organization.

3. The SIPD management must become active in the improvement efforts of the organization.

4. There needs to be goals set for the TQM system evolution. The importance of strategic planning cannot be over stressed. The roles and responsibilities of each

member of the organization must be documented in a coordinated improvement effort. The vehicle to accomplish this is a systems engineering management plan.

The M&DSO management is going to continue to pressure SIPD management on the subject of TQM. The structured systems engineering approach to designing enhance quality management systems is an acceptable solution to satisfy M&DSO requirements. The assessment conducted here is going to impact the defining of the system requirements and the choice of alternative configurations. The ability for SIPD to satisfy customer requirements with the operation of the RFC system is dependent on the level of quality management practices.

6.1.1 Summary of Deliverables

The following deliverables are a result of this systems engineering project:

1. A systems definition of TQM as it relates to service engineering. The TQM system is comprised of a combination of TQM modules as identified in the initial assessment.

2. A complete systems analysis of the RFC system, accompanied by a detailed description and flow chart. These items are requires for the successful improvement of the quality management practices of SIPD with respect to RFC operations.

3. The research has provided a complete TQM assessment which identifies an agenda of enhancement opportunities. The results are summarized in table 1.

6.2 Recycling of Assessment Methodology

The research provided the initial assessment of the quality management practices of SIPD with respect to the operation of the RFC system. If the design of the SIPD management system is changed using the systems engineering methodology, the scoring methodology should be repeated at periodic intervals. The percentages of TQM awareness can be

compared with the previous values each time the scoring methodology is applied. Each time the assessment methodology is applied, there should be a recycling effort to ensure that adequate results are obtained.

An example of recycling the assessment methodology would be to increase the dissemination of the survey. Responses should be obtained from the customers and contractors. These organization's are extensively involved in the processing of RFC's. this would assist the SIPD management in managing quality at checkpoint 5. Another example is to evaluate the selection of the stage development questions each time the survey is applied. A determination should be made on the particular stage for each module. In addition, consider expanding the number of modules used in the assessment. The identification of performance indicators through the systems input/output analysis changes as the module configuration changes.

This recycling of the assessment methodology is a logical process in striving for continuous improvement.

6.3 Reflections

The goal of improving the quality practices of any management organization in any business should be a top priority. There is a possibility that an improvement in quality will result in improvement in productivity, profitability etc. An increase in these performance indicators is straight forward in a manufacturing environment. Calculations can show that improvement is realized with a decrease in scrap and an adjustment in the quality control limits on production. For a service engineering organization, the improvement is not that clear. The indicators are usually in the form of subjective criteria that are hard to quantify. There is extreme difficulty in convincing management that that an effort to improve quality is worth the allocation of resources.

The project that was conducted here was plagued with problems. SIPD management did not see a reason for the assessment, they just want to fix the RFC system. Some of the SIPD employees did not take the survey seriously because it was not sanctioned by management, it was difficult to receive response from these individuals. Those employees who did respond were confused by a number of question and were very brief in their responses. this is why the scores were so low in table 1.

When introducing an effort that is new to an organization, one should gain the support of management before proceeding to the employees. The assessment conducted here is going to be made available to SIPD management, however, there are no significant ramifications expected.

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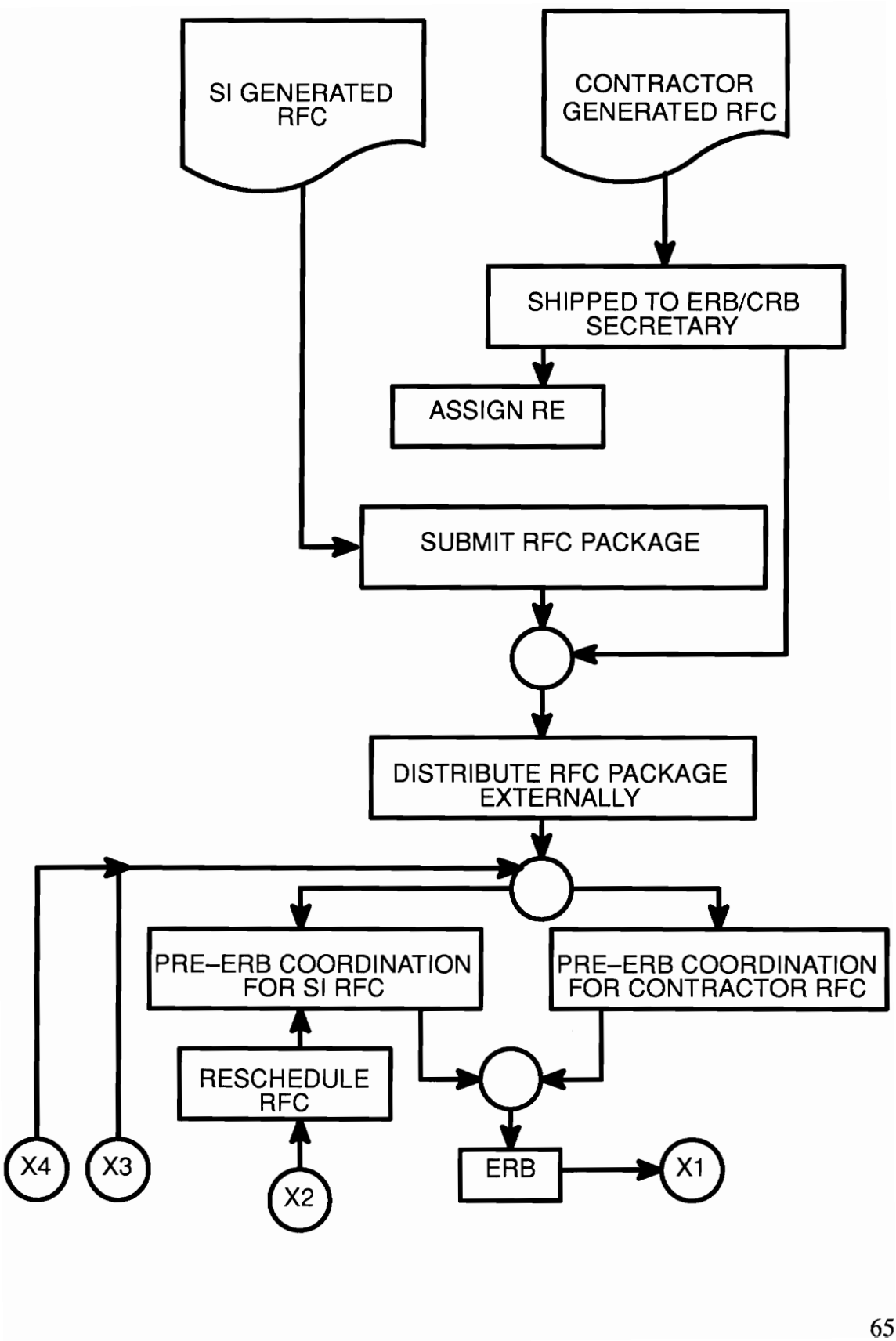
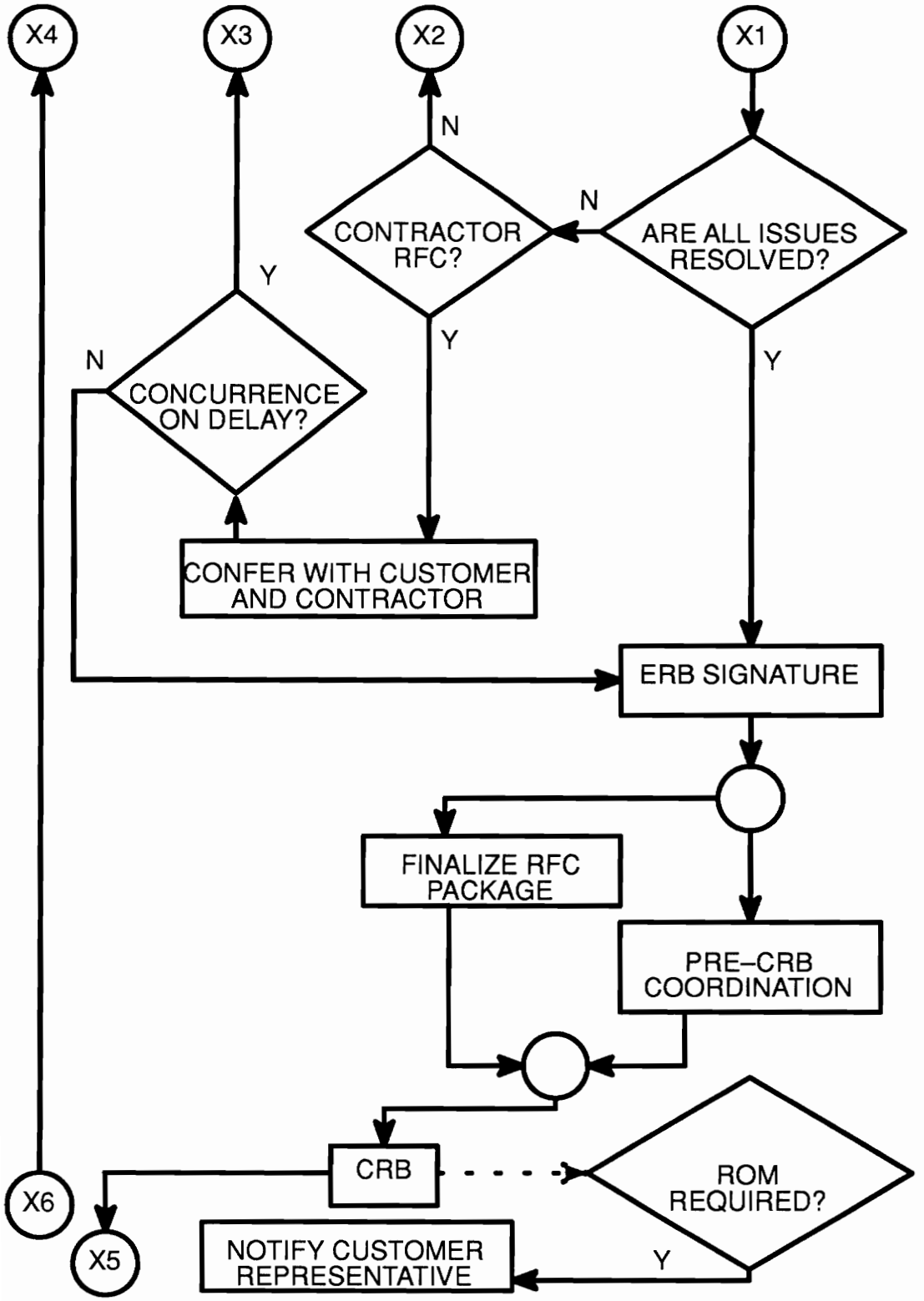
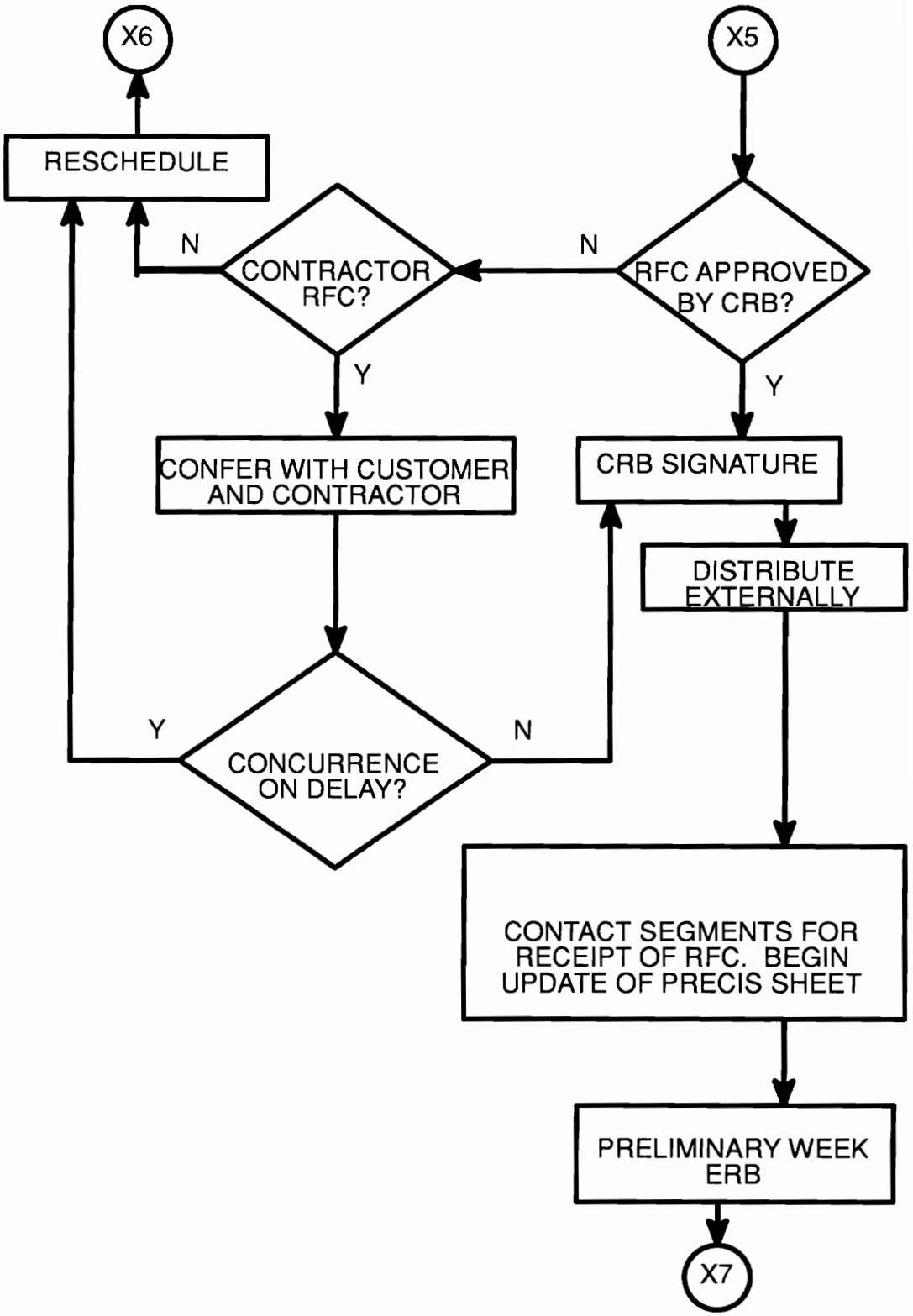
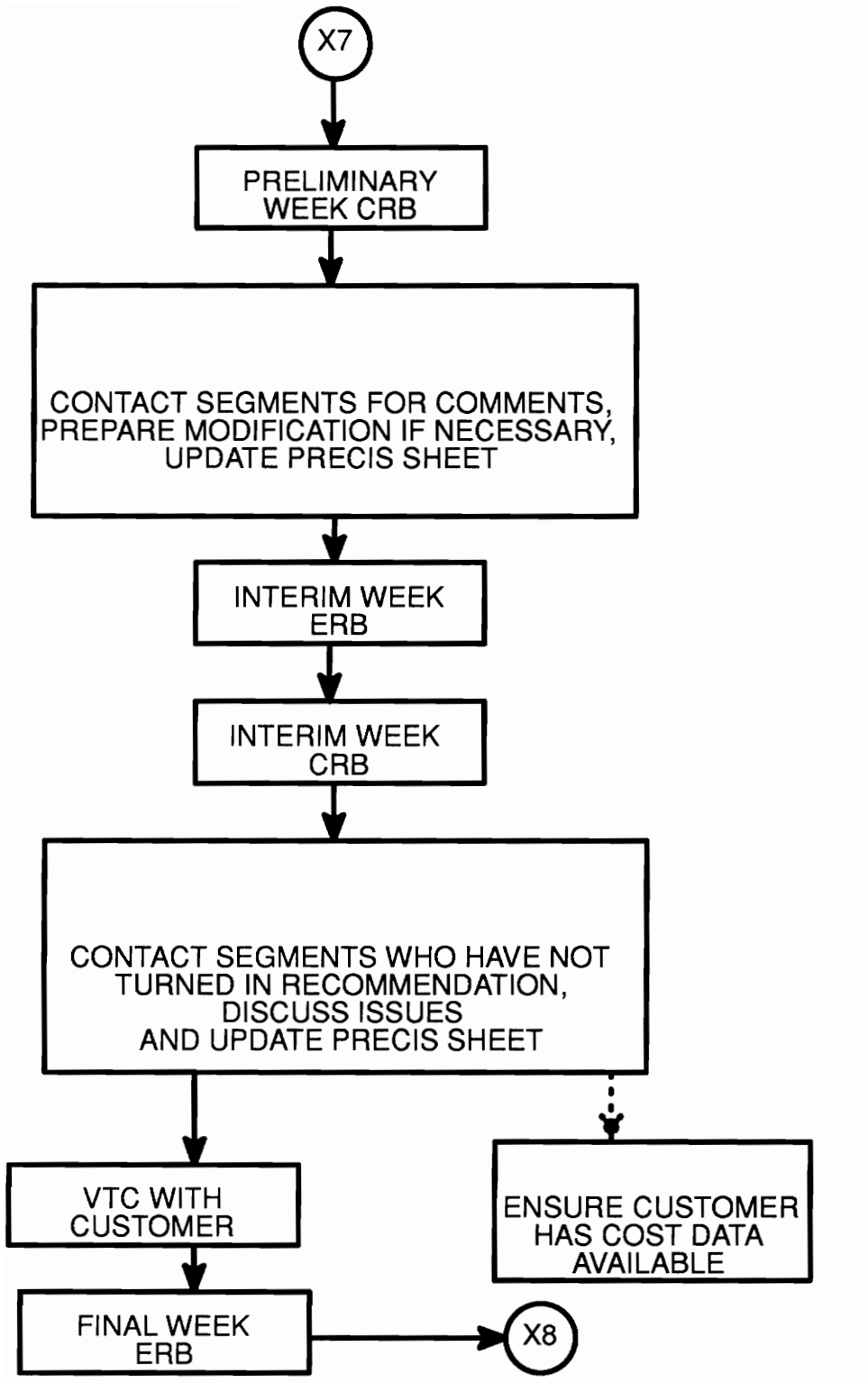
9.0 APPENDICES

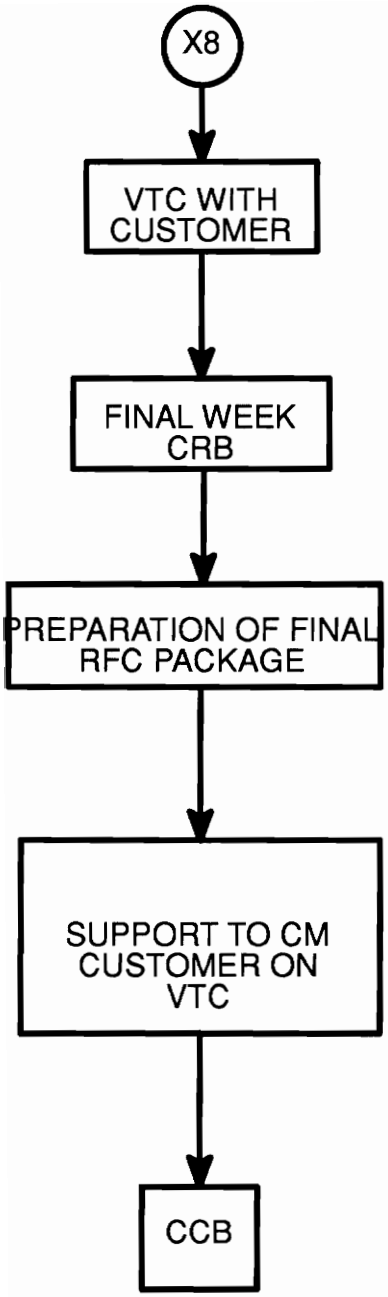
APPENDIX A: FLOW DIAGRAM OF RFC PROCESS


SI GENERATED RFC
CONTRACTOR GENERATED RFC
SHIPPED TO ERB/CRB SECRETARY
ASSIGN RE
SUBMIT RFC PACKAGE
DISTRIBUTE RFC PACKAGE EXTERNALLY
PRE–ERB COORDINATION FOR SI RFC
PRE–ERB COORDINATION FOR CONTRACTOR RFC
RESCHEDULE RFC
ERB
X1
X2
X3
X4


X4
X3
X2
X1
N
CONTRACTOR RFC?
N
ARE ALL ISSUES RESOLVED?
Y
Y
N
CONCURRENCE ON DELAY?
Y
CONFER WITH CUSTOMER AND CONTRACTOR
ERB SIGNATURE
FINALIZE RFC PACKAGE
PRE–CRB COORDINATION
CRB
ROM REQUIRED?
X6
X5
NOTIFY CUSTOMER REPRESENTATIVE
Y


X6
X5
RESCHEDULE
N
CONTRACTOR RFC?
N
RFC APPROVED BY CRB?
Y
Y
CONFER WITH CUSTOMER AND CONTRACTOR
CRB SIGNATURE
DISTRIBUTE EXTERNALLY
Y
CONCURRENCE ON DELAY?
N
CONTACT SEGMENTS FOR RECEIPT OF RFC. BEGIN UPDATE OF PRECIS SHEET
PRELIMINARY WEEK ERB
X7


X7
PRELIMINARY WEEK CRB
CONTACT SEGMENTS FOR COMMENTS, PREPARE MODIFICATION IF NECESSARY, UPDATE PRECIS SHEET
INTERIM WEEK ERB
INTERIM WEEK CRB
CONTACT SEGMENTS WHO HAVE NOT TURNED IN RECOMMENDATION, DISCUSS ISSUES AND UPDATE PRECIS SHEET
VTC WITH CUSTOMER
ENSURE CUSTOMER HAS COST DATA AVAILABLE
FINAL WEEK ERB
X8


X8
VTC WITH CUSTOMER
FINAL WEEK CRB
PREPARATION OF FINAL RFC PACKAGE
SUPPORT TO CM CUSTOMER ON VTC
CCB

APPENDIX B: SURVEY QUESTIONS USED IN ASSESSMENT

Leadership

1. How do managers/supervisors demonstrate leadership, personal involvement, and visibility in the following quality related activities?
    a. Goal Setting
    b. Planning (Strategic)
    c. Reviewing Company Quality Performance

2. What approach is used to encourage leadership in all level of management and supervision of quality?

3. Is there clear documentation and communication fo performance requirements throughout the organization? This should include a clear understanding of service need, and customer requirements.

Quality Policy

1. Is there a Quality Policy in place within the SI? If so, is there any documentation?

2. How does the Organization define service quality? This has a direct impact on what is expected for the RFC process.

Deployment of Quality Tasks, Reporting and Communications

1. Is there clear documentation and communication of performance requirements throughout the organization? This should include a clear understanding of service need and customer requirements.

Quality Planning (Strategic and Operational)

1. What should be used to develop quality goals and objectives for the organization?

2. What resources would have to be committed to establish quality goals and objectives into the organization?

3. What kinds of planning would have to be done in the long–term vs. the short–term?

Customer Relations/Commitment to Customer

1. What types of commitments does the organization make to promote trust and confidence in its products, services, and relationships?

2. How does the organization ensure that these commitments address the principal concerns of the customer?

3. How does the organization ensure that these commitments are understandable?

4. How is the information about customer requirements and expectations shared with the relevant employees?
    a. How do employees use this information?

5. How do contract reviews assure product quality with respect to:
    a. Processes
    b. Personnel skills

6. What processes are used to determine customer needs, expectations and their measure of satisfaction?
    a. What means beyond contract descriptions and specifications are used to establish performance requirements, measurements and feedbacks?

Determining Customer Requirements, Expectations, Satisfactions

1. How does the organization determine current requirements and expectations of customers?
    a. What is the process for collecting information and data?
        i. What information is sought?
        ii. How frequent are surveys made?
        iii. Who is interview or contacted?
        iv. How is objectivity measured?

2. What is the process for determining product and service characteristics?
    a. What is the relative importance of these features to customers?

3. Do quality standards exist within the division? Do they exist at the organization level?

Measurement

1. Do customer quality service standards exist within the organization?

a. If so, what do they state?
b. If so, are the service standards well defined and set to meet customer requirements?

2. Is there customer satisfaction with respect to scheduling requirements?
   a. How is performance compared against contractual milestones?

3. How would you divide 100 points among the following service quality criteria in order of importance?
   a. Tangibles
   b. Reliability
   c. Responsiveness
   d. Assurance
   e. Empathy

Employee Involvement

1. What actions does the organization take to increase employee authority to act (empowerment)?
   a. What are the principle goals for all categories of employees?

2. What actions does the organization take to increase employee responsibility?

3. What actions does the organization take to increase employee innovation?

4. Do you feel that the management of the organization has given you the right to voice and that they demand responsibility from you?

Quality Education and Training

1. How does the organization assess the amount of quality education and training needed for all categories of employees?

Employee Well Being and Morale

1. How are employee well–being and morale factors listed below included in quality improvement activities?
   a. Health
   b. Satisfaction

Behavioral Reinforcement/Recognition/Individual Performance Management

1. What types of recognition are used for groups and individual acknowledgement within the organization?

2. What actions does the organization take to increase employee authority to act (Empowerment)?

3. What actions does the organization take to increase employee responsibility?

4. What actions does the organization take to increase employee innovation?

5. Do you feel that the management of the organization has given you the right to voice and that they demand responsibility from you [7]?

Control

1. Is continuous improvement and adequate control present in all activities affecting service quality?

2. Are there currently understandable procedures for the RFC process?
    a. If so, do customer requirements exist within these procedures?

Management of Data and Information

1. What data is currently being collected on the RFC process and how is it being used?

2. What is the criteria for selecting the data to be gathered?

3. What processes and techniques does the organization use to review the data that is collected?

4. What processes and techniques does the organization use to ensure the data is reliable and consistent?

5. There is an effort underway to improve the RFC process, is the data being used for quality analysis such as measurement, evaluation and control?

Documentation/Work Instructions/Quality Control Records

1. How are documents used to support the following activities?
    a. Training
    b. Quality–related tracking of products and services

2. What are the principle quality–related purposes of documents, such as those used for recording procedures and practices and for retaining records?

3. Does the organization develop, issue, and maintain unambiguous and understandable operational procedures?
    a. Do these operational procedures outline anything in the way of quality management?
    b. Do they contain performance criteria to be satisfied?
    c. Do they contain methods for continuous improvement?

4. What quality program documentation exists with respect to each of the following?
    a. Testing
    b. Facilities
    c. Quality Performance
    d. Implementation and maintenance of a quality management system
    e. Testing documentation and response to failure
    f. Records retention
    g. Problem Solving

TQM System Assessment/Quality

1. What types of reviews are conducted to assess organizational quality performance?
    a. How frequent are the reviews?
    b. What is the content of these reviews?

2. Is there a periodic review for quality issues or to develop a quality program?

3. What principle types of data and information does the organization use to determine needs and opportunities for improvements in processes. Address each of the following:
    a. Customer data
    b. Service performance data
    c. Evaluation of all process steps

4. What approaches does the organization use (such as reviews or audits) to assess

the quality of the following?

a. Systems
b. Services
c. Products (Documents, etc.)

APPENDIX C: GLOSSARY OF ACRONYMS

CCB	CONFIGURATION CONTROL BOARD (CUSTOMER)
CEO	CHIEF EXECUTIVE OFFICER
CRB	CONFIGURATION REVIEW BOARD
ECP	ENGINEERING CHANGE PROPOSAL
ERB	ENGINEERING REVIEW BOARD
GE	GENERAL ELECTRIC
M&DSO	MANAGEMENT AND DATA SYSTEM OPERATIONS
RE	RESPONSIBLE ENGINEER
RFC	REQUEST FOR CHANGE
ROM	ROUGH ORDER OF MAGNITUDE
SI	SYSTEMS INTEGRATOR
SIPD	SYSTEMS INTEGRATION PROGRAMS DEPARTMENT
TQM	TOTAL QUALITY MANAGEMENT
VTC	VIDEO TELE–CONFERENCING