IMPROVING
THE GENERAL MEASUREMENT METHODOLOGY

by

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(ABSTRACT)

This thesis proposed to improve an existing performance measurement methodology called the "General Measurement Methodology (GMM)." The GMM as well as its variations have been used in organizations to design a measurement effort to support performance improvement. It has evolved over a number of years and is currently being researched at the International Productivity Center (IPC). In order to attain its objective, this research adopted a case study approach supported by data from the literature as well as an expert panel. Three cases were considered to collect data on performance measurement system design and implementation. Two of these organizations (IPC and Acme Manufacturing Company) have used the GMM to set up performance measurement systems. The third case study (Golden State Power and Light (GSP&L)) was selected to lend another perspective to measurement system design since it used another approach or methodology. Site visits were made to each case study and data was collected primarily using the unstructured interview. The literature contributed more perspectives on how organizations measure performance. Responses from an expert panel of fourteen people enhanced the data base even farther. Data from each of the above sources have been collected and processed. As explained in Chapter 6, the research design adopted had to be altered toward the end since the development and validation of the improved GMM was difficult. The strength and advantages of the improved version could not be completely verified. However, the conclusions of this thesis include a comprehensive description of the knowledge, wisdom and insight gained about measurement. A roadmap (based on the information acquired) toward effective measurement system design, development and implementation has also been presented.
ACKNOWLEDGEMENTS

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## CONTENTS

Abstract .......................................................... ii
Acknowledgements .................................................. iii
Contents .......................................................... iv
List of Figures ...................................................... v
List of Tables ...................................................... vii
List of Appendices ................................................ viii
1. Introduction ..................................................... 1
3. Research Methodology .......................................... 55
4. Data Analysis ................................................... 119
5. Results .......................................................... 135
6. Conclusions ..................................................... 157
7. References ...................................................... 172
Appendices ........................................................ 186
Vita .......................................................................... 324
LIST OF FIGURES

1.1 A Model of Organizational Performance (Ivancevich, et al., 1977) 4
1.2 The Modified Management Systems Model 7
1.3 The General Measurement Methodology 10
1.4 Current Measurement Hierarchy 19
2.1 Performance Measurement Hierarchy for General Electric 28
2.2 Generic Key Result Areas 32
2.3 Attributes of Excellent American Companies 33
2.4 Performance Measures in a Manufacturing Environment 34
2.5 Price and Mueller's Performance Measures 35
2.6 Sink's Organizational Systems Performance Criteria 36
2.7 Relation between Drucker's, Peters & Waterman's and Sink's Observations on Organizational Systems' Performance 38
2.8 Relation between Kaplan's and Sink's Observations on Organizational Systems' Performance 39
2.9 Relation between Price and Mueller's and Sink's Observations on Organizational Systems' Performance 40
2.10 Design, Development and Implementation of a Productivity Measurement system using NPMM 44
2.11 Methodology for Generating Efficiency and Effectiveness Measures 48
2.12 An Example of an "Organization Diagram" 50
2.13 Comparing and Contrasting NPMM and MGEEM 53
3.1 Procedure Adopted for this Research Effort 58
3.1a Closer Examination of the Procedure 59
3.1 Procedure Adopted for this Research Effort 68
3.1a Closer Examination of the Procedure 69
3.1 Procedure Adopted for this Research Effort 84
3.2 IPC's Organizational Chart 88
3.2a Positions in IPC's Business Units and Operations Management 89
3.3 Organizational Chart of the ME Department (Old) 95
3.4 Organizational Chart of the ME Department (Current) 96
3.5 Management Systems Analysis 100
3.6 Organization of GSP&L 103
3.7 Organization of the Management Services Department 106
3.8 Organization of Divisions Planning and Administration 107
3.9 1988 Policy Deployment Process for the Nuclear Energy Department 109
6.1 Pictorial Representation of a Roadmap for a Measurement Effort 161
LIST OF TABLES

1.1 Four Views Depicting the Management Process 3
3.1 Characteristics of Good Research; A Comparison 56
3.2 Nine Basic Methods of Research 61
3.3 Sample Questions used during Interviews 79
3.4 Hand-out Distributed during IPC Panel Meeting 91
3.5 Package to Expert Panel 113
4.1 Consolidated Responses from Expert-Panel Members 134
5.1 Results from Case Studies 151
5.2 Results from Literature Review 153
5.3 Results from Expert Panel Members 154
5.4 Summary and Synthesis of Results 155
6.1 Steps Toward Measurement System Design, Development and Implementation 158
6.2 Example of an Agenda for a Measurement Effort 163
LIST OF APPENDICES

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Plan of Study</td>
<td>187</td>
</tr>
<tr>
<td>B</td>
<td>Reflections on Thesis Effort</td>
<td>188</td>
</tr>
<tr>
<td>C</td>
<td>An Example of an Interview Transcript and Trip Report</td>
<td>189</td>
</tr>
<tr>
<td>D</td>
<td>Literature Review Reports and Consolidated Report</td>
<td>200</td>
</tr>
<tr>
<td>E</td>
<td>The 7-Step Performance Improvement Planning Process</td>
<td>234</td>
</tr>
<tr>
<td>F</td>
<td>Manufacturing Engineering Department’s Measures</td>
<td>241</td>
</tr>
<tr>
<td>G</td>
<td>Management Practices in IPC &amp; Consolidated Report</td>
<td>252</td>
</tr>
<tr>
<td>I</td>
<td>Management Practices in GSP&amp;L &amp; Consolidated Report</td>
<td>303</td>
</tr>
<tr>
<td>J</td>
<td>List of Expert Panel Members</td>
<td>324</td>
</tr>
</tbody>
</table>
1. INTRODUCTION

1.1: What this Study is About.

1.1.1: Overview

The aim of this study is to determine how to improve the way in which organizations measure performance. In this study, measurement is seen as an integral part of managing the organization. To achieve the aim of this study, an existing measurement method referred to as the General Measurement Methodology (GMM) will be used, with the objective of improving it. The GMM is a portrayal of what a group of researchers in a Productivity and Quality Center view as being the approach organizations can take to design, develop and implement measurement systems. Adapted versions of this general methodology have been used in a few organizations. Two of these sites (IPC and Acme)\(^1\) have been designated as data sources to support this study. Reasons for the selection are presented in Chapter 3. Additional data sources are a third site (GSP&L), the literature and expert opinions from individuals who are familiar with measurement. Data has been extrapolated from the above sources back to the GMM and through inductive reasoning (will be defined in Section 3.3.3), an attempt has been made to improve the general methodology.

1.1.2: The Management Process

For the purpose of this thesis I will define the way an organization is managed as a "management process." Measurement is one component of the management process. To operationally define measurement in the context of the management process, I will use an example. Suppose an organization decides that it has two major functions. The first function is to do what it is supposed to do (deliver products and services at the right time,

\(^1\) The actual names of the data collection sites and the people contacted at each site have been changed to ensure confidentiality.
in the right quantity and within specifications). *The second function* is to constantly get better at doing it; to do this organizations need to possess high quality and pervasive measurement systems. I argue for an effective management process to carry out both the functions outlined above. I also argue for an effective measurement component if the management process is to be successful.

There are different views of the management process and each view refers to a different unit of analysis. Some authors have developed this process to depict individual performance (Porter, Lawler and Hackman, 1975; Campbell, Dunnette, Lawler and Weick, 1970), some have depicted performance at the work-group level (Hackman and Morris, 1975; Likert, 1967) and some others have depicted organizational performance (Lawrence and Lorsch, 1967; Pugh and Pheysey, 1976). There are also "integrative" views accounting for all these levels. In this thesis the integrative view will be used since the measurement approach (GMM) to be investigated is of an integrative nature. Most of the views of the management process includes the measurement component as an integral part of it. Table 1.1 shows four different integrative views, each with the critical measurement component.

1.1.3: Measurement in the Management Process

Each of the views of the management process in Table 1.1 is described below.

*Ivancevich-Szilagyi-Wallace:* This model is shown in Figure 1.1. It is designed to show the individual, group, and organizational variables; their relationships to each other, and their influence on the performance of the organization. In this model, performance is viewed as the outcome of systems that are determined by situational factors and operate through various processes. According to the model, any organization exists within a societal environment that has political, regulatory, resource, technological, and economic characteristics. These environmental characteristics are moderated by two sets of
<table>
<thead>
<tr>
<th>Model</th>
<th>Level of Analysis</th>
<th>Purpose</th>
<th>Key Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ivancevich-Szlabyi-Wallace</td>
<td>Integrative</td>
<td>To synthesize domain of organizational behavior</td>
<td>Integration of levels over situation-system performance</td>
</tr>
<tr>
<td>Thompson</td>
<td>Integrative</td>
<td>To show the task of managing as defining goal, finding path &amp; assessing performance</td>
<td>Co-alignment of people, action, technology, environment and organization structure</td>
</tr>
<tr>
<td>Barnard</td>
<td>Integrative</td>
<td>To describe functions of the management team</td>
<td>Emphasizes communication, cooperation and integrity of organization purpose</td>
</tr>
<tr>
<td>Sink-Kurstedt</td>
<td>Integrative</td>
<td>To study organizational interface; to show information flow</td>
<td>Emphasizes &quot;balance&quot; between manager, his organization, and the tools he uses to manage with</td>
</tr>
</tbody>
</table>
Figure 1.1: A Model of Organizational Performance (Ivancevich, et al., 1977)
dimensions: group and intergroup dimensions and individual dimensions. These dimensions are linked to the environment by leadership.

Further, according to the model, organizations can be analyzed by their macrosystem and microsystem properties. Examples of macrosystem properties are structure, culture or climate and organizational (transformation) processes. Examples of microsystem properties are individual tasks. Three additional elements, motivation, reward systems, and organizational change and development, are suggested as intervening between these systems and performance. Performance, as depicted in this model, depends on a complex interrelationship between the elements presented above and is determined by evaluating it against performance (or effectiveness) criteria through the application of performance measurement (or performance appraisal).

Thompson: Thompson (1967) refers to the management process as the "administrative process," and makes three critical points about it: (a) "administration" in an organization is not something something done by a single individual but is a process flowing through the actions of its employees, (b) the process not only occurs at one level in the organization but it spans and links various levels and (c) the process not only occurs at different levels but also supports the interaction and communication between levels. This last point of forms the basis of Thompson's definition of the function of the "administrative process," or as I have called it, the management process. He says the basic function of the process is the "co-alignment," of the organization's people, technology, environment and structure. As a result of this "co-alignment," Thompson says that the organization will be able to better define its business (goals, objectives and strategies); find better ways to achieve these goals; and develop effective measurement systems (assessment criteria) to track progress.
Barnard. Barnard (1939) in his classic, "Functions of the Executive," suggests three ways to improve the management process: (1) provide a system for communication within the organization; (2) maintain the willingness of members of the organization to cooperate; (3) ensure the continuing integrity of organization purpose. Though not very explicit, Barnard’s theory does have measurement implications. For example, consider the third suggestion above. Stated in simple terms it means you want to be sure that your organization is doing what it said it would do. How would you, as a manager or a part of a management team, ensure this? Answer, you need measurement and evaluation systems.

Sink-Kurstedt: This model (Figure 1.2) has its roots in Kurstedt’s Management Systems Model shown on the top right hand corner of Figure 1.2. The three components of Kurstedt’s model are (1) who is managing, (2) what is being managed, and (3) what is used to manage with. Three interfaces are described: (1) the measure to data interface between what is being managed and what is used to managed with (tools), (2) the portrayal to perception interface between tools and who is managing, and (3) the decision to action interface between who is managing and what is being managed. This model assumes an information flow perspective.

Figure 1-2 is a modified form of the Management Systems Model designed to focus on the measurement system perspective. If your goal, as a manager or part of a management team is to continuously improve the performance of your organizational system (see box #1 in Figure 1-2), you’ll have to take actions that will achieve the goal. Let’s call these actions “improvement actions.” These actions could involve the use of improvement methods or techniques such as gainsharing, inventory management, performance improvement planning, statistical process control etc. (see box #2). But how would you know that you need to do better inventory management, for example? How
Figure 1.2: The Modified Management Systems Model (Sink, 1987)
would you make that decision without support information? As may be clear, the inference is that some kind of measurement would have to take place.

Information telling you that you need to do better inventory management should be portrayed by the tools in box #5 through portrayal mechanisms in box #3. How is this information created? By collecting, storing, retrieving and processing inventory-related data from your organizational system that will tell you whether or not it's performing and in control in the area of inventory management. Data-collection processes appear in box #4. Thus, boxes #3, #4 and #5 constitute the measurement component of the Sink-Kurstedt representation of the management process.

The description of the four views of the management process above may have increased the reader's awareness that measurement is an integral part of it. As Sink and Tuttle (1989) say;

"As the complexity of the system being managed increases and our knowledge of cause and effect relationships improves, the sophistication of and maturity of our measurement systems will or can or should increase/improve appropriately. Measurement is the foundation of the development of support systems for planning, problem-solving, decision-making, improvement, control, adaptation, motivation, and even leadership. Measurement plays a critical role in the development of improved management support systems."
1.1.3. General Measurement Methodology

The GMM (Figure 1-3), as it is currently used, is simply an exploded form of boxes #3, #4, and #5 of the modified Management Systems Model shown in Figure 1-2. In other words, it's a methodology to define, develop and implement the measurement component of the management process depicted by the Sink-Kurstedt model. Sink refers to this process as Management Systems Analysis (MSA). MSA is a three step process of:

1. improving the management teams or measurement development teams' understanding of the target system (corresponds to box #1 in Figure 1.2);
2. identifying specific performance improvement interventions that can be made (corresponds to box #2 in Figure 1.2); and
3. developing a measurement system to tell the management team if they are doing what they said they would do to improve performance.3 (corresponds to boxes #3, #4 and #5 in Figure 1.2)

It was mentioned earlier that the GMM is an exploded form of Step 3 of MSA. The methodology is described below. The objective is to support the reader in understanding this chapter's next section which talks about the significance of my research problem. The General Measurement Methodology has six phases: preparation, determining what to measure, developing the measurement process, collecting required data, process and output validation, and linking to performance improvement and continuously recycling and modifying the system as necessary.

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2 The General Measurement Methodology is owned by and being researched at IPC which is a data site for this thesis. Unless otherwise mentioned, the source of all information regarding the GMM has been members of Company A as well as documentation copyrighted by IPC.

3 This sequence may indicate that Steps 1 & 2 occur in the absence of Step 3. This is not true. Measurement is a continuous, on-going process. During the design and development of your management system, the management process will typically proceed from Step 1 to Step 2 and finally to measurement. However, once you have an established management system, measurement begins to be the “driver” of the management process.
PHASE 0: Preparation
1. Form Measurement Teams
2. Create Suitable Climate

PHASE 1: What to Measure?
1. Develop Measures
2. Audit Measures
3. Break Down Measures

PHASE 2: Develop Process
1. Select Technique
2. Form Design Team
3. Ensure Technique Availability
4. Adapt Technique for Application

PHASE 3: Data Collection
1. Data Sources
2. Eliminate Infeasible Measures
3. Devise Forms and Logs
4. Set Accountabilities
5. Begin Collection

PHASE 4: Output Validation
1. Is the Output Accurate?
2. Is the Format Correct?
3. Is the Information Useful?
4. Is the Information Timely?

PHASE 5: Link to Improvement
1. Interpret and Understand Output
2. Link to Goal Setting
3. Link to Rewards
4. Develop Visibility Rooms

DEFINITION
OPERATIONALIZATION
VALIDATION & EVALUATION

Figure 1.3: The General Measurement Methodology
Phase 0: Preparation. This phase focuses on removing some of the deficiencies and roadblocks associated with the decision to measure. These could be in the form of inadequate knowledge about measurement and consequent fear of it, a lack of a "master," absence of performance improvement planning, impatience, unwillingness etc. This phase essentially prepares the management team to measure.

Step 0-1: Form measurement development teams: An issue which must be addressed early is the nature and number of participants in the measurement effort. A measurement development team might be (Sink & Tuttle, 1989): (1) the entire management team for the target system identified; (2) a subset of the management team for the target system; (3) a team of measurement masters tasked with the assignment of developing measurement systems for multiple target systems; (4) a combination of measurement masters with members of the management team for a given target system; or (5) managers of the "parent system" and even key customers (internal and external).

Step 0-2: Create a suitable climate for measurement: Once measurement teams have been formed, a formidable task lies ahead of them; that of making sure the measurement intervention is going to be made in a culture or climate that will support, understand, and promote it. This is easy to put down on paper but is probably one of the most challenging activities of the measurement system development process.
Phase 1: What is to be measured?: During this phase the decision about what should be measured is made. This decision should be made by a measurement team (of appropriate composition) and should depend on the organization's vision, mission, guiding principles, strategic performance dimensions etc.

Step 1-1: Develop measures: Once you’ve decided what you need to measure, it’s time to develop the measures. There are different ways to do this. The Nominal Group Technique and Delphi Technique are examples.

Step 1-2: Audit measures: The purpose of this step is to improve the quality of the set of measures to be used by the management team.

Step 1-3: Breakdown measures: The purpose of this step is to operationalize the definitions of the measures identified. Several of the measures developed will not be "countable" the way they are written. If you say that a measure of performance of an inventory system is the uninterrupted production of widgets, what will you count to tell you that you're achieving the goal?

Phase 2: Develop the measurement process:
Phase 1 should/may have defined some of your information requirements. This phase is concerned with devising effective data collection and portrayal mechanisms to create the information needed.
Step 2-1: Select technique: Selection of an appropriate technique to do
the above requires the expertise of a measurement master.

Step 2-2: Form design team: Once you know which technique you need to use, you
may have to design it for your specific application. A decision about the composition
of the design team needs to be made.

Step 2-3: Ensure availability of technique requirements: During this step there is a
concentrated effort to determine if the technique chosen is appropriate and available.

Step 2-4: Adapt technique: This step ensures the fit between your information needs
and the technique(s) you've chosen.

Phase 3: Collect required data: During this
step you need to decide what data you should
collect so that the information requirements can
be satisfied.

Step 3-1: Identify data sources: Once you
know what data should be collected, sources
for it should be identified. Where can we get
the data? Is it currently collected? By whom? How is it stored and retrieved?
What are the costs associated with getting the data? (Sink & Tuttle, 1989).

Step 3-2: Eliminate infeasible measures: At this time you may recognize the
inappropriateness of some measures. You may also find you've ignored a few other
potentially useful measures. The measurement team in a consultative fashion should remove the infeasible measures, and if necessary, add new ones.

*Step 3-3:* Devise forms and logistics: In some cases the data may not be readily available. A procedure for collecting, storing, and retrieving it may be necessary.

*Step 3-4:* Check accountabilities: This step attempts to answer questions such as: who will continue to reliably, accurately, and in a timely fashion collect the required data? Who will continue to ensure that the measurement system is portrayed in a timely and effective fashion? Who will be accountable for keeping the visibility rooms and charts current?

*Step 3-5:* Begin data collection and processing: At this time the infrastructure of the measurement system is ready; the measurement development team needs to begin collecting, processing and portraying data.

**Phase 4: Process output validation:** The "trench work" of measurement has just started. Now is the time when the users of the measurement system stand back to look at the different charts, figures, tables etc., to determine if they are seeing what they actually want/need to see. They need to make sure the system developed is rich in useful information, and not simply useless data.
Phase 5: Link to improvement: This is the phase which determines the success/failure of the measurement system. Why do people need to see all the information generated during the previous phases? The intent is that their performance can improve. According to Sink & Tuttle (1989), several things are designed into the GMM to ensure this happens; (1) the use of measurement masters; (2) the involvement of the management team; (3) the focus on improvement first and measurement second.

Having presented the General Measurement Methodology, I'm now in a position to describe the significance of my research. I have done this in the next section (1.2). The objective is to gain perspective on the areas where the GMM has been used successfully and those areas where it has been not.

1.2: Significance of Research

Modified versions of the General Measurement Methodology (GMM) have been applied in several organizations. Two of these are IPC and Acme. A description of measurement system development experiences at these sites has been presented in Appendices G and H. To recap, the methodology has six phases:

0. Preparation
1. Determining what to measure/Auditing the measures/Operationalizing the measures.
2. Information portrayal format and technique selection.
3. Data collection, storage, retrieval and processing
4. Validation of output.
5. Linking output to performance improvement.
Generating, Auditing, and Operationalizing Measures: Experience suggests that significant knowledge has been acquired to do these steps, although attempts to operationalize measures have been a struggle. (While doing them the tendency has been to assume the completion of Phase 0, preparation). There has been continuous improvement to the logic and the process of these steps. The NGT has been traditionally used to generate performance measures. The audit of measures has also evolved consistently over time. The purpose of the audit is to provide the team with information needed to improve the measures and ensure that they are adaptable, flexible and dynamic. The measures are typically audited against factors such as: (a) output from the organization's planning effort (if there is one), (b) criteria of performance, and (c) organizational system components.

The first audit factor shows if measurement supports critical aspects of the plan (vision, long-range goals, objectives etc.) This is necessary to ensure that the organization's desired outcomes are achieved. The next audit factor identifies specific performance criteria (effectiveness, innovation, quality etc.) which may have been overlooked or improperly addressed by the existing measures. The third audit check factor classifies each measure as a measure of input variables, transformation processes, output variables, or outcomes. It may be commonly observed that most measures that are generated fall within the transformation "box," focusing on processes and ignoring inputs, outputs and outcomes.

Advances in operationalizing measures have been more recent. Dr. Deming's (1986) concept of "operational definitions" has been a catalyst in the process. The basic issue involved here is that the measures generated using the NGT usually are not "countable." Unless the measures are stated in this form, collection of data to track that particular measure becomes almost impossible. Most people who participate in generating measures have been found to need specific guidance to arrive at that "level" of the measure for which data can be located, collected and tracked. The tool which the GMM has been attempting to
use to communicate the level is a "hierarchy of measures." Over time, this hierarchy has adopted various forms. The top of the hierarchy is that level where the measures are most difficult to "count." The design of the rest of the hierarchy attempts to coin words for the different levels in such a way that as one goes further down, the measure at the top is broken down step by step until a "countable" is reached.

A pattern in the evolution of the hierarchy has been difficult to trace because the several ideas and discussions on the topic haven't been sufficiently and completely documented; especially during the initial stages. However it has been possible to discern portions of the evolution and this will discussed next. An initial form of this hierarchy had three levels: measures, attributes and sub-attributes. The actual definition of each was not formalized. All those items generated during the NGT which required to be broken down were called "measures." "Attributes" referred to an identifiable characteristic of the "measure." A "sub-attribute" attempted to find a "countable." This hierarchy and possibly minor variations of it were used until recently, when focused attempts were made at crystallizing the levels. As a result the former hierarchy was more articulated by the definition of two more levels above the existing level "measure." Hence the new hierarchy reflected five levels; (1) Strategic Performance Dimension, (2) Criterion, (3) Measure (4) Attribute, and (5) Sub-attribute or indicator. Once again, definitions were not fully stated but the effort was better than the past. Examples of Strategic Performance Dimensions are Social Responsibility, Customer Satisfaction, Zero Defects etc. Elements at this level tended to be philosophies about particular ways in organizations should operate. "Criteria" included effectiveness, efficiency, productivity, quality, quality of work-life, innovation and profitability. These were directly borrowed from Sink' (1985) work which recommended that "performance" should reflect the seven criteria above.
The current from of the hierarchy distinguishes between "concept" and "practice." "Concept" is communicated in "theoretical language" and "practice" is communicated in "organization language." Three levels in theoretical language were redefined as, (1) Ultimate criterion/construct, (2) Intermediate criterion and (3) Immediate criterion. The same levels as defined by the language of the organization is shown in Figure 1.4.

Technique Selection: Here the client is asked how he or she wants information about the measure portrayed. There is an awareness that cognitive styles for people vary. It is also known that their personal preferences for how information needs to be portrayed vary. Mallak (1986) and Singhal (1986) have both studied the information portrayal/information perception interface of the Management Systems Model (Figure 1.2). Mallak's study of portrayal formats surveyed DOE managers on their conscious preferences for graphic versus tabular portrayal of information. Data from this survey suggested that bar chart graphics should be included as part of the decision support systems provided to DOE users.

Following finalization of information portrayal formats tools and techniques to transform data to information need to be selected. Spreadsheets, the Total Factor Productivity Measurement Model, the Objectives Matrix, the Multi Criteria Performance Measurement Technique, Statistical Process Control, Accounting packages, Productivity Map, the One Page Management System, Intuition, Judgment, Experience, Expert systems, Data base systems, and Report generators are all examples of "tools" and approaches that can be considered during this phase.
Figure 1.4: Current Measurement Hierarchy
Data Collection and Processing Procedures: This step is recognized as critical. One of the major problems in both Company A and Company B is ineffective and inefficient data collecting and accountability setting procedures. Typically this phase addresses the following questions:

1. What data do we need?
2. Where will we get the data?
3. How will we access the data effectively and efficiently?
4. How will we store and retrieve the data effectively and efficiently?
5. How will we obtain data that are not readily available?
6. Who will ensure that data needs are met on an ongoing process?

According to Sink and Tuttle (1989) this step is the "trench work" of measurement. There are examples where measurement efforts have fallen apart due to inadequate focus and management of the six questions presented above.

Once data is acquired, you need to use the tools selected in Phase 2 to create information. Processing data, report generation, audience and purpose analysis etc., are examples of activities during this phase. However, there is no firm rule that the selection of techniques cannot be reviewed at this stage. If necessary new techniques to process data can be selected, but the focus is on implementation of the chosen technique.

Diagnosis: The description above includes those aspects of the measurement process about which knowledge and insights have been gained through past and current efforts in measurement system design. Knowledge integrated from diverse fields such as sociology, psychology, work measurement, methods engineering etc. have lent a vision of how a measurement system should actually look like and perform. Based on this knowledge the
later stages of the General Measurement Methodology have been conceptualized and articulated well in words (Sink and Tuttle, 1989):

"The last step in the measurement development process focuses on real time implementation of the systems. A constant improvement orientation, a 'ready, fire, aim' attitude is a must. A 'bias for action' at this stage is critical. Visibility and ownership for the measures and the measurement system must be created. We recommend the development of a visibility room for the management team and other users. If you strive to make it perfect the first time you get the charts and graphs, etc. up in the room, you will likely never get the room completed. If you start with a satisfactory measurement system and recognize, expect that it will be modified and improved over time, then you will likely succeed. However, our experience suggests that this step is a "get over the hump" step. It takes a lot of patience, persistence, and prodding from the master in order to get the visibility room off the ground and running."

The contention of this thesis is that despite the fact that the GMM has evolved significantly in the way it supports measurement system design and implementation, there is room for improvement in several areas in the methodology. The GMM and the limited documentation related to it reflects a more visionary and philosophical orientation rather than a pragmatic one. This thesis recognizes the vision as an important element and is an attempt to describe more elaborately a strategy for how the GMM can be made more effective. To accomplish this objective this effort proposes to gather data from organizations that have attempted performance measurement, the literature, and knowledgeable individuals and process the data to gain insights, modify, and improve the GMM so that it can be ensured that the performance measurement system which comes out of the improved methodology is fully implemented.

1.4: Objectives

The purpose of this thesis is to identify the elements of an effective performance measurement system. Specific objectives are:
• To study: (a) selected sites where there is a history of specific measurement efforts, (b) selected work from the literature and (c) opinions from selected experts.
• To identify and recommend specific improvements to the General Measurement Methodology.
• A secondary objective is to verify the quality of the improvements to the General Measurement Methodology.

1.5: Limitations

This study will be limited to structured measurement methodologies or approaches that are designed to support the improvement of performance in organizations. It will not focus on or include the descriptions of specific measurement techniques such as Statistical Process Control, Total Factor Productivity Model, Accounting Packages, etc. The methodologies are "collarless;" in other words, it's effective for white-collar as well as blue-collar applications. Additionally, they are effective for any target system, from the company level to the work group level.

The measurement methodologies examined in this study are intended to be designed, developed, used and maintained by a management team. External support and assistance should be limited to a coordinating, facilitating and/or teaching role. The methodologies assume that organizations in which they are being applied have some sort of an on-going improvement planning effort.
2. MEASUREMENT: Issues and Trends

2.1. Introduction

One of the aims of this chapter is to convey to the reader the importance of measurement. In the previous chapter emphasis was more on showing measurement as part of the management process. Here the focus will be on understanding measurement as a basis for improving the operations of the organization. This has been done by reviewing how selected researchers have chosen to define performance and its measurement. The chapter begins by briefly capturing an overview of the history of measurement. Following this it proceeds to "prove" the need to avoid the trap of the single measure and the need to focus on multiple measures; if the desired outcome of measurement is the improvement of whatever that is being measured. Finally, an attempt is made to capture the history and evolution of the General Measurement Methodology. I believe this will be useful at a later stage in this thesis particularly during data analysis and while suggesting improvements to the methodology.

2.2. A Review of the History of Measurement

If there is a need to trace the history of measurement it's possible to go back several hundred years. Fabricant (1984) writes that clay tablets unearthed in archaeological digs and parchments salvaged from the ruins of medieval abbeys often contained records of crop yields, irrigation usage and other kinds of measurements. These usually tended to be what are now called "productivity" measurements. Evidence such as the above suggest that there was an awareness about the importance of recording and tracking quantifiable data from an operation, with the aim of improving the operation. As time passed, the interest in measurement and acquiring quantitative measurement data was not only found in crop yields but shifted to the factory floor where indices such as factory output per worker-hour
were developed. There appears to be a history of trust and belief in quantitative information. Measures such as profitability and market share continue to be widely in use.

Due to the fact that quantitative accounting information has been found useful, precise and represent indisputable facts (Riggs, 1981), organizations appear to be directing more and more resources into improving accounting systems (Kaplan, 1984). Accounting has been considered to be analogous to scorekeeping. In this sense, profits and market share would be examples of scores based on which managers and management teams would make decisions about the organizations they are managing. From the measurement standpoint, few people realize that accounting deals mostly with monetary measures and accounting reports are expressed mostly in monetary terms. According to several researchers much of the importance about an enterprise cannot be easily or usefully be expressed in monetary terms (Riggs, 1981; Hayes and Clark, 1986; Kaplan, 1984 & 1986; Miller, 1984; Davis, 1978).

Consider the following extracts from a few insightful works that focus on non-financial measures:

- "It is now time for concrete action on a practical level; action to change facilities, update processing technologies, adjust work-force practices, and perfect information and management systems. But when managers turn to these tasks, they quickly run up against a stumbling block. Namely they do not have adequate measures for judging factory-level performance or for comparing overall performance from one facility to the next. Of course, they can use the traditional cost-accounting figures, but these figures often do not tell them what they really need to know. (emphasis added). Worse even the best numbers do not sufficiently reflect the important contributions that managers can make by reducing confusion in the system and promoting organizational learning." (Hayes and Clark, 1986)
• "Many US companies are now exploiting new process technologies, new inventory and materials handling systems, new computer based abilities in design, engineering, and production, and new approaches to work force management. But these developments, promising as they are, rest on (an accounting) foundation that is obsolete and in need of repair." (Kaplan, 1984)

• '"Management needs to know the reasons for good and bad profit changes so that it can decide whether to concentrate its attention on productivity improvements or on pricing strategies, both of which directly affect profitability." (Miller, 1984)

• "...the net profit figure alone is an inadequate basis for judgment as to whether industrial operations are being carried out efficiently and labor and materials used effectively; it may merely tell us that a satisfactory balance has been struck between the value received and the value given." (Davis, 1978)

• "Short term profitability indicators will not signal the decrease in firms' value when they reduce discretionary expenditures for developing new products, for improving production processes, for maintaining the skill, loyalty, and morale of the work force...Effective managerial accounting systems must reflect the value creating activities of companies; in marketing and sales, and in product and process development." (Kaplan, 1986)

These observations indicate that in recent times, cost-accounting systems have been under attack. When decisions to change management and measurement systems in organizations are made, discussions have very often focused on the need to change "embedded cost accounting systems (Bruns & Kaplan, 1987)." Managers have been asked if their cost accounting is current, told that "yesterday's accounting undermines production," and promised that there is a cost-accounting revolution in the making. But Kaplan (1986) concludes that the revolution is hardly visible and changes in accounting, measurement and control systems are lagging far behind changes in the real production (operating) phenomena they are purported to represent.
Kaplan, in his article, was speaking about a manufacturing environment. Translating his thoughts and considering them in a broader perspective, it's reasonably clear that what he is trying to emphasize is the need for pervasive measurement systems throughout the organization. He and a host of others are reminding managers of the need to be aware of useful non-accounting information. Non-monetary measures or records will be of vital assistance to managements of both profit and non-profit organizations. Managers should seek out the non-accounting measures of performance that can provide insights into how to manage better, how to determine what to pay attention to, how to provide "scoreboards" for people so they know they did a good job, how to know when and why the system is out of control, how to help compete for sources and most of all, how to continuously improve performance.

If the role of measurement should reflect the improvement orientation depicted above, organizations should strive to move away from a "narrow" view of what measurement actually represents. Traditionally and as revealed by the use of accounting information, measurement systems have tended to be control oriented. What does control-orientation operationally mean? Maher (1987) presents a good example while describing a field study which investigated the use of relative performance evaluation in organizations. One of the companies in his research he calls "Conglomerate." "Conglomerate" actually is a conglomerate with multiple product lines in diverse industries. The diversity resulted in little correlation among divisional outputs. The corporate performance of Conglomerate has historically been measured by earnings growth. This performance indicator is conveyed clearly to the division managers through two financial performance targets; meeting divisional ROI and profit objectives.

Whether or not divisional managers meet these targets decides two things; their bonus and an opportunity to keep the job. Failure to meet the targets for two consecutive years
results in dismissal. Consequently, according to Maher, each year became a "new game" for divisional managers. Conglomerate became a classic example of a company "managed by numbers." The example continues to describe related issues and ramifications in detail. But the point to be made is that it's hard to miss the control-orientation of the measurement system in the divisions of Conglomerate. Of course, we don't know if other measurement systems with an improvement orientation existed in these divisions. But, it's important that they function simultaneously with the existing financial performance measurement system.

The discussion has come to an interesting point: the appropriateness of measurement systems that are control- and improvement-oriented. Sink and Tuttle (1989) say that a control orientation should not necessarily imply a negative connotation; just like an autocratic leadership style isn't necessarily dysfunctional. The immediate need is to expand, refine and redefine our thinking about measurement just as we have done it with leadership. In other words, there is an immediate need to get the roles of measurement in perspective. The shop-floor environments in the United States appear to be on the road to understanding this need. Utzig (1988) sites an example in General Electric Company where cost control, inventory control, labor measurement and manufacturing overhead allocation have all been simplified by designing and developing new measurement systems to replace traditional ones. Figure 2.1 shows a (manufacturing) performance hierarchy developed by General Electric. Notice that it considers the market, business, plant and shop-floor levels. In GE's definition a performance measurement system should measure business and plant performance in relation to the goals and objectives of the GE Strategic Plan and should also provide timely information for identifying manufacturing improvements on the shop-floor.

Notice the improvement focus on the shop-floor and the control-focus at the higher levels. Perhaps this combination is best for GE. The point being, there should be a
Figure 2.1: Performance Measurement Hierarchy for General Electric (Utzig, 1988)
proven, well-understood blend of measurement systems in organizations. A critical
examination of the mission, goals and needs of the organization will probably lead to the
determination of an appropriate combination.

Edward Deming (1986) in his book *Out of the Crisis* presents fourteen ways by
which American organizations can pave their way out of the industrial downturn they are
going through. One of the the ways is to "eliminate numerical quotas for the work force
and numerical goals for management." Another is "improve constantly and forever every
process for planning, production and service." Both these points made by Dr. Deming
have implications for effective and pervasive measurement and evaluation systems in
organizations. The first point directly questions the validity of the extensive research
available in the area of work measurement, time standards etc. Frederick Taylor's intention
was honorable. While employed at Midvale Steel Company (Barnes, 1980) in the late
1800s, Taylor decided to determine the best way to do a specific job. It was found that
motion and time study may be used to determine the standard number of minutes that a
qualified, properly trained, and experienced person should take to perform a specific job
when working at a normal pace. In later years this time standard has been used for
planning and scheduling work, for cost estimating, labor cost control and wage incentive
plans.

When Dr. Deming speaks and writes about throwing out standards the implication is
not a veto for measurement. Instead, he is distinguishing between measurement and
evaluation; he is throwing light on the need to distinguish between measurement for
improvement and measurement for control. He is trying to say that setting standards is a
natural part of the evaluation process and may be inappropriate for a group of people with
different talent and skill levels. Because a standard is set while observing average
performance, those people with low talent and skill will find it difficult to achieve it and
those people with a greater degree of talent and skill will find it easier to achieve. In the
General Electric example cited earlier, it was seen how divisional managers were measured and evaluated along the same lines despite significant diversity of the divisions. Performance was not operationally defined for each division. No effort was spent on clearly identifying the independent characteristics of each division from the point of view of designing, developing and implementing the performance measurement system. When one division performed well (i.e., met and exceeded financial targets) and the other did not, it was assumed to be either the competence or incompetence of the particular division's manager.

2.3. Understanding Performance and its Measurement

This brings us to the need to define and understand what performance means to the unit of analysis we're considering. Profitability is simply one measure of performance. It is certainly an important measure and is frequently used by top managers in organizations. As evident in the literature, experience and the results of this research, it is a measure which supports decision-making to a large extent at higher levels. It is also a measure which cannot be ignored even in the presence of the most effective measurement systems.

However, it is not clear that profitability is necessarily the most important measure of performance. For an organizational system which uses multiple resources in various operations, concentrated focus on any one performance measure can be inappropriate and invalid. The presence of a set of performance measures suited to the organizational system in context is critical. The search for the "ideal" combination of performance measures is similar to designing an instrument panel containing dials, indicators, knobs, controls, etc., which provide timely data and information about the performance of the system being managed. Measurement efforts should strive to incorporate the appropriate mix of measures in its panel(s). Clearly, these panel(s) will be distinctly different from one organization to another. What does one include in these panel(s)? The next section captures what several writers have recommended.
2.3.1. Operational Definitions of Performance

In 1939, Barnard implicitly referred to the panel and wrote "the essential to the survival of organization is the willingness to cooperate, the ability to communicate, and the existence and acceptance of purpose." In essence, Barnard was saying that if an organization were to be measured for high performance, the indicators showing that this was happening would be effective communication channels, cooperation between employees and accomplishment of purpose. Peter Drucker (1953) identified seven key result areas for this panel (Figure 2.2). Drucker indicated that in order to be successful, in the long run, an organization would have to manage these seven key result areas. Peters and Waterman (1983) identified eight criteria that "excellent" firms in America exhibit and manage carefully (Figure 2.3). Kaplan (1984) believes that the panel when in a manufacturing environment should have at least five measures (Figure 2.4). Price and Mueller (1986) have attempted to "standardize" organizational performance measures. Based on their review of literature and experience in organizations, they've identified a "frame of reference" containing 30 performance "concepts" or measures (Figure 2.5). Sink (1985) points out that the performance of an organizational system (i.e., a work group, cost or profit center, division, function, plant, firm, etc.) is comprised of at least seven criteria (Figure 2.6).

Note that in Figure 2.6, profitability is the relationship between total revenues and total costs. Effectiveness is the degree to which the system accomplishes what it set out to accomplish. It is the degree to which the "right" things were accomplished. Efficiency is the degree to which the system utilizes the "right" things. Quality is the degree to which the system conforms to requirements, specifications or expectations. Productivity is a relationship between quantities of outputs from a system and quantities of inputs into that same system. QWL is the way participants in a system respond to socio-technical aspects of that system. Innovation is applied creativity.
- Customer Satisfaction
- Innovation
- Internal Productivity
- Operating Budget
- Employee Attitude and Development
- Management Development & Performance
- Social Responsibility

Figure 2.2: Generic Key Result Areas (Drucker, 1953)
Based on their study of how the best-run large corporations in America manage themselves, Peters and Waterman offer these eight lessons:

1. *Begin with a bias toward action.* The best companies encourage action over procrastination or extensive analysis.

2. *Stay close to the customer.* The best companies cultivate their customers, are fanatics about quality control, and use customer suggestions for product improvement and innovation.

3. *Encourage autonomy and entrepreneurship.* At the most successful companies, all employees are encouraged to practice creativity and practical risk-taking during the execution of their jobs.

4. *Understand that people are responsible for productivity.* Rank and file are seen as root source of quality and productivity gain. They are treated as mature, adult people.

5. *Encourage "hands on," innovative values.* Winning companies have strong cultures. Values are maintained by personal enthusiastic attention from top management. Management stays close to the operations.

6. *Stick to the knitting.* The best companies know the ins-and-outs of their particular businesses and don't diversify into unfamiliar fields. Say reasonably close to the businesses you know.

7. *Keep the form simple and the staffs lean.* Top staffs are kept small. The structures of the companies organizations are kept simple and flexible.

8. *Employ "simultaneous loose-tight properties."* The best companies are tight about the things that are truly important and extremely loose about the rest.

---

**Figure 2.3: Attributes of Excellent American Companies**  
(Peters and Waterman, 1983)
Quality
Inventory
Productivity
Innovation
Workforce

Figure 2.4: Performance Measures in a Manufacturing Environment (Kaplan, 1984)
30. Work load.

Figure 2.5: Price and Mueller's Performance Measures (1986)
Effectiveness
Efficiency
Quality
Productivity
Quality of Work Life
Innovation
Profitability/Budgetability.

Figure 2.6: Organizational Systems Performance Criteria (Sink, 1985)
2.3.2. Comparing and Contrasting Operational Definitions of Performance

Irrespective of the size, type, or kind of the specific organizational system, the seven performance criteria presented above could represent the basic areas that managers, supervisors, presidents, vice presidents, directors and so forth should be focusing their management efforts on. I have attempted to show that most of these criteria are at the heart of Drucker's, Peters and Waterman's, Kaplan's and Price and Mueller's observations. That is to say, if it can be assumed that the seven criteria is a reasonably accurate representation of organizational systems' performance, then these writers have captured the essence of the criteria in their respective lists of performance measures; thus, in a way demonstrating the need for multiple measures. Figures 2.7, 2.8 and 2.9 attempt to do this by comparing and contrasting the five conceptualizations of organizational system performance presented in Figures 2.2 through 2.6. The comparison provided interesting results. Measures reflecting "effectiveness" and "efficiency" dominated all the four lists. However, consider "profitability." Drucker had only one key result area reflecting it. Peters and Waterman had no attributes related to profitability. Kaplan, too, did not have a measure corresponding to it. Price and Mueller had only four (out of thirty) performance concepts related to profitability.¹ This exercise was an attempt to show that current thinking in measurement is communicating a message which urges and encourages today's organizations to go beyond the single measure. This particular comparison showed this single measure to be "profitability." I believe the more important lesson to be learnt is to understand that panels with multiple indicators are going to be important components in the organizations of the future.

¹ This comparison was made solely by close examination of each list. The meaning of each item in the different lists was made clear; in most cases the writer's original definition was available. Consequently this meaning was compared with the meaning of each of the seven criteria to determine whether or not the measure reflected any or all the criteria. In Kaplan's case, three of his "measures" were the same as three of the criteria in Sink's list. All the other lists showed measures that were more "tangible;" they were defined at a level where they could actually reflect effectiveness, innovation, QWL etc.
Figure 2.7: Relation between Drucker’s, Peters & Waterman’s and Sink’s Observations on Organizational System’s Performance
Figure 2.8: Relation between Kaplan's and Sink's Observations on Organizational System's Performance
<table>
<thead>
<tr>
<th>Effectiveness</th>
<th>Absenteeism, Centralization, Complexity, Departmentalization, Distributive Justice, Effectiveness, Formalization, General training, Need strength, Turnover, Workload.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>Administrative intensity, Autonomy, Commitment, Communication, Violence of Conflict, Coordination, Distributive justice, General training, Mechanization, Motivation, Pay stratification, Bases of power, Routinization, Size, Standardization, Work group cohesion.</td>
</tr>
<tr>
<td>Quality</td>
<td>Communication, Departmentalization, Distributive justice, General training, Ideology, Need strength, Turnover, Work group cohesion, Workload.</td>
</tr>
<tr>
<td>Profitability</td>
<td>Distributive justice, Effectiveness, General training, Turnover.</td>
</tr>
<tr>
<td>QWL</td>
<td>Communication, Violence of conflicts, Coordination, Distributive justice, Ideology, Motivation, Need strength, Pay stratification, Satisfaction, Work group cohesion.</td>
</tr>
<tr>
<td>Innovation</td>
<td>Distributive justice, Formalization, General training, Innovation, Workload.</td>
</tr>
</tbody>
</table>

**Figure 2.9: Relation between Price and Mueller's and Sink's Observations on Organizational Systems' Performance**
2.4. Evolution of the General Measurement Methodology

2.4.1. The Ohio State University-Productivity Research Group Study

In 1975-1976, Drs. William T. Morris and Dr. George Smith (both of the Ohio State University) directed a two-year study on productivity measurement, sponsored by the National Science Foundation (NSF). The objective of the study was to develop a measurement methodology for Administrative Computing and Information (ACI) Services. At the time of this study there was no crystallization of terminology (Sink, 1989). Productivity was used in place of performance. There was inadequate focus on operational definitions (Sink, 1989). ACI services had evolved at a fast pace, having undergone an evolutionary phase driven by high innovation rates in technology. Three basic problems followed:

(1) Beyond some obvious and limited measures there was no crystallized methodology for assessing productivity.
(2) The "users," the clientele and the managers whose decision-making the management information systems tried to enhance, were rarely clear about their information needs.
(3) Thirdly, most ACI service systems operated under three philosophies: (i) Mechanize the existing manual system. (ii) Utilize the best data processing equipment one can afford. (iii) Ask managers what information they want and provide as much of it as the budget will permit.

In order to combat these problems the Ohio State University-Productivity Research Group (OSU-PRG) study set out with the following considerations or design principles for developing productivity measurement systems:
2.4.1.1. Design Principles

*Tailored Measurement Systems:* What is needed is not a standard set of measurements imposed on ACI but an approach by which ACI groups could create measurement systems suited to their own circumstances.

*Participation:* The greater the participation in the process of creating a productivity management system, the greater the resulting productivity change and the ease of implementing future changes that result from productivity management.

*Trap of the Single Measure:* Any productivity measurement system should result in a vector of productivity measures and/or ratios, not an attempt to achieve a single-measure and/or ratio.

*Simplicity and Cost Effectiveness:* A successful productivity management system (one that is actually used in the management process and leads to behavioral change) must be simple and cost effective.

*Congruence with other management systems:* A productivity management system must clearly fit into the ongoing management process/systems.

*Operation on the basis of Pareto’s Principle:* A successful productivity management system should provide the organization members with the ability to identify critical problems and opportunities. Further, it should incorporate a system by which only the critical or priority problems and opportunities are allocated resources.

*Early success stories:* Successful productivity improvement systems depend largely on the ability to establish a track record of successes early in a program in order to create appropriate expectations and incentives.

*Guiding Principles for productivity measurement:* Successful productivity measurement systems are as concerned with how they measure, whom they measure, and who decides what to measure as with what is measured.

*Guiding Principles for productivity management:* Successful productivity management systems incorporate involvement, as mentioned in the second design principle. Beyond
that, successful systems incorporate effective and efficient involvement as perceived by the participants.

*Productivity management is not a substitute for sound administration:* Successful productivity management systems are not considered a substitute for sound, disciplined management. In fact, in the absence of a disciplined management environment, such systems or programs have little chance of success.

*Productivity measurement and improvement can be applied in several areas:* Successful productivity management systems recognize that productivity measurement and improvement can occur relative to a number of key input variables (human, technology, materials, work processes, manufacturing processes, and so forth).

*Characteristics of successful productivity management systems:* Finally, successful productivity management systems are perceived by the organization as being systematic, explicit, consistent with management style, and action oriented.

These guiding principles formulated during 1975-77 continue to be used and followed while discussing the General Measurement Methodology today. However, the terminology appears different at the present time. Perhaps the most significant discovery with regard to an improved terminology is the crystallization of what performance means for the organizational system. Notice that the twelve design principles cited above does not distinguish between productivity and performance. Now we know that productivity is one and not necessarily the only component of performance.

**2.4.1.2. The Normative Productivity Measurement Model**

The OSU research group devoted considerable effort to designing a measurement system which would incorporate the design principles listed above. The result was the Normative Productivity Measurement Model (NPMM) depicted in Figure 2.10.
Figure 2.10: Design, Development, and Implementation of a Productivity Measurement System Utilizing the Normative Productivity Measurement Methodology. (Sink, 1985).
Stage 0 includes gaining management support and legitimization for the measurement effort. This is also the stage where the measurement system master plan is developed and approved. The decision as to what specific type of measurement technique(s) to employ is also made during this stage. The OSU-PRG study found Stage 0 as a necessary step before the design, development and implementation of a measurement system. The next stages in the methodology would depend upon the measurement technique chosen in Stage 0. Figure 2-10 is a depiction of the measurement system development process using the Normative Productivity Measurement approach.

During Stage 1, the Nominal Group Technique (NGT) or Delphi Technique was used as a mechanism to generate a prioritized list of measures for each specified unit of analysis. In the case of the NPMM, the focus was on the work-group level, divisions, functions and so forth that had been formed into small groups of 6 to 12 people. The NGT was and continues to be used to elicit participation and commitment from the group. It has been used as a "mechanism for forming closure on the process of generating measures (priorities, preferences, and/or relative importance between measures, ratios and/or indexes are set) and the potential for group process synergy is in fact achieved (Sink, 1985)."

Stage 2 deals with the "operationalization" of measures generated during Stage 1. Operationalization involves issues concerning the collection of data and the interpretation of results. Questions concerning the location of data and strategies for interpretation are discussed at this time. Although this stage requires a certain degree of expert involvement, it still needs the approval of the participants and the users of the measurement system. The findings of the OSU-PRG study include the important observation that strong leadership interventions become increasingly important as one goes from Stage 0 to Stage 5. A measurement effort in which leadership stays until the conclusion of Stage 1 and disappears thereafter, is doomed to fail. In the same vein, the findings report that "in the great
majority of cases, we have found that the skills, ability, and motivation for progressing from Stage 1 to Stage 4, integration and implementation, will simply be missing and must be 'driven.'" (Sink, 1985).

**Stage 3** involves a briefing, review, discussion, potential revision, and eventual approval of the draft operating system for the measurement program. This step was seen as necessary before the final implementation of the program. The main objective of Stage 3 is to maintain commitment to and acceptance of the final measurement system.

**Stage 4** calls for the integration of the newly developed measurement system with other measurement systems in the organization; MBO, Quality Circles, Performance Appraisal etc. This is to ensure that overlap or redundancy are taken into account and also ensure that the initial steps are being taken toward integrating the system to the way the organization goes about doing business. The other part of Stage 4 calls for the actual implementation of the measurement system. A clear picture of what "implementation" looks like has not been documented in the OSU-PRG study; however it is reported that this step would involve the actual collection and interpretation of data.

**Stage 5** represents the continuous monitoring and feedback process. The study reports that in this stage many organizations create "control rooms," in which the outputs from the measurement system are posted and are made highly visible. Following this stage, as shown in Figure 2-10, the organization has a few choices in terms of continuing the effort. Recycling and refinement is a first option. A second option is to maintain and develop the existing measurement system in order to move from a control-focus to an improvement-focus. Integrating the current measurement system with other existing organizational measurement is another alternative. A fourth option is to do nothing and maintain Stage 5 in the status quo.
The Normative Productivity Measurement Model explained above was the first attempt to depict the steps to building a measurement system from a methodology standpoint. The OSU-PRG study was initially heavily dependent on the Nominal Group Technique to generate measures and some of the most fundamental and rudimentary questions were left unanswered. One of the hypotheses of the study was that if the "expert" facilitated an NGT session for the group and came up with a prioritized list of measures, then the group would be able to finish the rest of the job (Sink, 1989). Therefore, success stories related to the actual implementation of measurement systems were few; however a review of the measures generated would indicate that they were of high quality. Continued and persistent effort to think through what happens after the generation of measures resulted in the conceptualization of the normative approach.

2.4.2. MGEEM: Methodology for Generating Efficiency and Effectiveness Measures

Soon, it was recognized that despite the conceptual elegance of the NPMM, the model was a complex one. The need to achieve a better balance between rigor and relevance was increasingly becoming obvious. At the about the time this was being recognized, Dr. Thomas Tuttle of the Maryland Center for Productivity and Quality of Working Life was carrying out research to develop and test a methodology for generating efficiency and effectiveness measures. It was called "Methodology for Generating Efficiency and Effectiveness Measures (MGEEM; Figure 2.11). The General Measurement Methodology (GMM) was the result of a need to develop a measurement methodology which incorporated selected characteristics of both Sink's Normative Productivity Measurement model (NPMM) and MGEEM. The following couple of pages will present the MGEEM as described by Tuttle and Sink (1984-85). Following this I will compare and contrast NPMM and MGEEM and show how they were "collapsed" to form the GMM.
Figure 2.11: MGEEM-Methodology for Generating Efficiency and Effectiveness Measures (Tuttle, 1982)
The approach adopted by MGEEM tended to be highly participative and made extensive use of the NGT. One of its critical design criterion was to reduce fears and promote user acceptance. MGEEM and the Normative approach were based on similar ideology but the terminology and actual steps involved in each differed to an extent. MGEEM was based on three basic assumptions (Tuttle & Sink, 1984): (1) Participation in the development of measures enhances understanding and acceptance; (2) People who do the work are able and willing to assist in defining appropriate productivity indicators; (3) An appropriate role of management is to define and prioritize key mission facets called Key Result Areas (KRAs).

Based on these assumptions MGEEM consisted of six phases:

1. Preplanning
2. Development of Key Result Areas
3. Development of indicators
4. Review of indicators
5. Establish baseline weights and desired performance levels

**Phase 1: Preplanning.** During this phase, the facilitator gathers background data on the organization and constructs an organization diagram as shown on Figure 2.12. The diagram is used by the facilitator to bring participants into phases 2 and 3 and to support them in viewing the organization abstractly in terms of inputs, outputs, impacts, etc. The intent was to create the mental set necessary for the development of Key Result Areas (KRAs) and indicators.
Figure 2.12: An Example of an "Organization Diagram" of an Airforce Weather Detachment (Tuttle, 1984)
Phase 2: Development of Key Result Areas (KRAs). Following the preplanning phase, the facilitator convenes a group of managers from the organization and presents an orientation briefing. Following the briefing, the managers are asked the question, "What are the results this organization is expected to accomplish?" The NGT is used to come up with a list prioritized KRAs.

Phase 3: Development of indicators. Once the KRAs have been defined, the managers are asked to respond to the question, "What indicators should the organization track on a periodic basis to show if the KRA is being accomplished efficiently and effectively? The NGT is used again to generate and prioritize indicators for each KRA.

Phase 4: Review of indicators. During this phase, the indicators are reviewed by either the manager of the organization or a group of managers to modify or delete indicators that are judged not important or not feasible. This helps refine "crude" indicators and reduce their number.

Phase 5: Establish baseline weights and desired performance levels. A reporting format is necessary to use the indicators as an ongoing performance tracking and improvement tool. Ideally the reporting format would allow for comparing performance to a baseline and would be future goal oriented-not present standards oriented.

Phase 6: Data Collection, analysis and interpretation. Data should be collected on a regular periodic basis (weekly, monthly, etc.). Timely feedback of measurement results is essential for the information to have motivational value.
2.4.3. Comparing and Contrasting NPMM and MGEEM

Figure 2.13 shows the Normative Model and MGEEM together for the purpose of comparing and contrasting. A quick review will show a similar framework for each methodology.

- MGEEM does not emphasize the initial "setting the stage" part as well as the NPMM. However the MGEEM does explain the importance of what we now know as Input/Output Analysis.

- The consensus generating technique used during the second step of each methodology is the NGT. The NPMM uses it to generate "measures," and the MGEEM uses it to generate "Key Result Areas."

- The development of "indicators" for each measure or KRA is not stressed as much in the NPMM as it is in the MGEEM. The NPMM probably does a better job with terminology in this step while the MGEEM does a better job in clearly defining what is to be done during "operationalization." The NPMM includes an attempt to map a strategy for data location, collection and interpretation during this step while the MGEEM does not yet deal with data.

- The next step which involves a review of the operating system is handled more or less with same amount of attention by each model. However, the NPMM documents this step in a better fashion in the organizational context. In other words, NPMM documentation explains the importance of this review and emphasizes the need for the approval of the system by the people using it.

- The next step (Stage 4 in NPMM and Phase 5 in MGEEM) advocates different actions for each methodology. The NPMM suggests integration of the new measurement systems with other organizational measurement systems (MBO, Performance Appraisal, Merit Evaluation, Reward systems etc.). However, other than depicting this idea conceptually, the author(s) agree that it is impossible to prescribe or even describe what will take place at this time. Also during this step the NPMM suggests
Figure 2.13: Comparing and Contrasting NPMM and MGEEM.
the actual collection and interpretation of data. In the case of MGEEM, the author(s) suggest the establishment of "baseline weights and desired performance levels," so that the current performance levels would be future goal oriented and not present standards oriented.

• The MGEEM concludes by suggesting data collection, analysis, interpretation and feedback. NPMM also concludes by recommending a continuous monitoring and feedback process. As shown in Figure 2.10, the Normative methodology has conceptualized options for "program continuation."

The General Measurement Methodology (GMM) is the result of "collapsing" the NPMM and MGEEM. The GMM has been described in detail in Chapter 1. As this chapter would have shown, the evolution of the GMM has been through mostly coordinated efforts, interspersed with periods of development that may not have had a focused approach. This thesis attempts to improve it further and take it to the next stage of evolution. As mentioned in Chapter 1, this effort is supported by data from three case studies, the literature and an expert panel.

Chapter 3, which is next, describes how I have used each of the three data sources to acquire data that would eventually be used in the improvement of the GMM. The data sources have been treated separately and the research procedure adopted for each source has been presented. Chapter 4 presents an analysis of the data collected. Chapter 5 presents the results of this research. On the basis of information gained, Chapter 6 (Conclusions) includes a roadmap toward effective measurement system design, development and implementation.
3. RESEARCH METHODOLOGY

3.1. Research and its Relevance to this Thesis

This thesis adopts a certain form of research. Sekaran (1984) describes research as a systematic and organized effort to investigate a specific problem that needs a solution. Leedy (1985) defines research as the manner in which we attempt to "solve problems in a systematic effort to push back the frontiers of human ignorance or to confirm the validity of the solutions to problems others have presumably resolved." While Sekaran points to the problem, Leedy focuses on the need to make sure that one has the correct answers to the problem.

The literature is abundant with varying forms of the definition of research. The definitions selected and presented above interest the author since they complement the nature of the research being carried out in this thesis. There is no arguing that performance measurement system design and implementation (the problem) is hard to do. In response to this difficulty an approach (the solution) called the General Measurement Methodology (GMM) was developed and has evolved over a number of years. The goal of this research is to simultaneously investigate performance measurement (consistent with Sekaran's view of investigating the problem) to gain a better understanding and identify improvement areas for the GMM (consistent with Leedy's view of validating solutions.) In addition to identifying improvement areas, this research will also develop and present an improved methodology.

3.2. Characteristics of Good Research

Table 3.1 (p.56) shows a comparison between the works of two people who have attempted to identify characteristics of good research (Leedy, 1985; Issac and Michael, 1981).
<table>
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<tbody>
<tr>
<td>Research begins with a problem in the form of a question in the mind of the researcher.</td>
<td>Definition of basic difficulty.</td>
</tr>
<tr>
<td>Research demands the identification of a problem, stated in clear, unambiguous terms.</td>
<td>Rationale and theoretical base.</td>
</tr>
<tr>
<td>Research requires a plan.</td>
<td>Statement of purpose and problem.</td>
</tr>
<tr>
<td>Research deals with the main problem through appropriate subproblems.</td>
<td>Questions to be answered.</td>
</tr>
<tr>
<td>Research seeks direction through appropriate hypotheses and is based on obvious assumptions.</td>
<td>Statement of hypothesis or objectives.</td>
</tr>
<tr>
<td>Research deals with facts and their meaning.</td>
<td>Design and procedure.</td>
</tr>
<tr>
<td>Research is circular; research always gives rise to unexplored questions.</td>
<td>Assumptions.</td>
</tr>
<tr>
<td></td>
<td>Limitations.</td>
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<td></td>
<td>Delimitations.</td>
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<td></td>
<td>Definition of terms.</td>
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Combining the lists of Leedy and Issac & Michael there are seven basic characteristics that good research should possess:

1. Good research should have a clearly identified and defined problem.
2. Good research should have a sound theoretical base.
3. Good research should pose relevant questions.
4. Good research should have a design, plan and method.
5. Good research should identify sub-problems.
6. Good research should be based on certain assumptions.
7. Good research should address the issue of terminology adequately.

3.2.1. Incorporation of good research in this Thesis

I will proceed to show how each of the above characteristics is incorporated into the body of this thesis.

Identification and Definition of the Problem: For this thesis the problem has been identified and defined in Chapter 1; (see section 1.3). It has been further elaborated in Chapter 2 through the establishment of a theoretical base.

Research Questions: Two major research questions were stated at the proposal stage: (1). What are the components of a complete design for a measurement system development and implementation plan? (2). How can the process of measurement system implementation using the General Measurement Methodology be improved? Both these questions have been answered while describing the improved methodology in Chapter 5.

Procedure: Figure 3.1 (p.58) shows an overview of the procedure adopted by this thesis. Notice that there are three distinct phases in the procedure; design, single-source collection and analysis, and cross-source analysis. Figure 3.1a takes a closer look at the second and the third phases and depicts exactly what was done during these phases. The research
Figure 3.1: Procedure Adopted for this Research Effort (Adapted from Yin, 1988).
Figure 3.1a: A Closer Examination of the Procedure.
method used is predominantly the "case study" strategy supported by data from the literature and an "expert panel." This method is discussed in detail in Section 3.3.3 of this chapter.

_Identification of sub-problems:_ This is considered in Chapter 4 while discussing results. _Assumptions and Limitations:_ These were identified and presented in section 1.5. _Terminology_ was addressed in Chapter 2.

### 3.3. Research Methods

Before detailing the research method used in this thesis, I will present some of the common research methodologies in the literature. Table 3.2 (p.61) shows a list of nine basic research methods with a description of each method's most obvious characteristics. Research methods are typically chosen based on the nature of the problem.

#### 3.3.1. The Research Method used in this Thesis

This study uses a _case study approach_ supported by data from an expert panel and the literature. The problem to be addressed in this thesis is to determine ways to improve implementation strategies of measurement systems. While the problem was being formulated, I (the author) belonged to the International Productivity Center (IPC) which conducts research in measurement system design and implementation. The General Measurement Methodology had evolved at IPC and versions of it had been used with the company's clients (according to their needs) to help them design, develop and implement performance measurement systems. However difficulties that occurred while working with some of them showed IPC that its measurement methodology required improvement. As a result, meetings were held where the problem areas were discussed and attempts were made to resolve them. This awareness and recognition of potential improvement areas for the GMM in IPC was one of the factors which helped me locate and formulate the thesis problem. After consultation with the advisor of this research effort, it was decided that
<table>
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<tr>
<th>METHOD</th>
<th>PURPOSE</th>
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<tr>
<td>HISTORICAL</td>
<td>To reconstruct the past objectively and accurately, often in relation to the tenability of an hypothesis.</td>
</tr>
<tr>
<td>DESCRIPTIVE</td>
<td>To describe systematically a situation or area of interest factually and accurately.</td>
</tr>
<tr>
<td>DEVELOPMENTAL</td>
<td>To investigate patterns and sequences of growth and/or change as a function of time.</td>
</tr>
<tr>
<td>CASE STUDY</td>
<td>To study intensively the background, current status, and environmental interactions of a given social unit: an individual, group, institution, or community.</td>
</tr>
<tr>
<td>CORRELATIONAL</td>
<td>To investigate the extent to which variations in one factor correspond with variations in one or more other factors based on correlational coefficients.</td>
</tr>
<tr>
<td>CAUSAL-COMPARATIVE</td>
<td>To investigate possible cause-and-effect relationships by observing some existing consequence and searching back through the data for plausible causal factors.</td>
</tr>
<tr>
<td>TRUE-EXPERIMENTAL</td>
<td>To investigate possible cause-and-effect relationships by exposing one or more experimental groups to one or more treatment conditions and comparing the results to one or more control groups not receiving the treatment (random assignment being essential).</td>
</tr>
<tr>
<td>QUASI-EXPERIMENTAL</td>
<td>To approximate the conditions of the true experiment in a setting which does not allow the control and/or manipulation of all relevant variables.</td>
</tr>
<tr>
<td>ACTION</td>
<td>To develop new skills or new approaches and to solve problems with direct application to the classroom or other applied setting.</td>
</tr>
</tbody>
</table>
studying actual cases where the methodology (including its variations) had operating difficulties would be another way to gain more insights into the use of the GMM in designing and implementing measurement systems.

Based on the decision, two case studies were selected. One of them was IPC itself; since its inception, the company had directed several efforts at measuring its own performance. Although measurement systems at IPC are more evolved at the present time than ever before, improvements had been slow and sporadic and implementation difficulties continued to remain. The second site selected was Acme Manufacturing Company (Acme). A team had recently completed setting up a measurement system in one of departments of this company. They had done so using the principles of the GMM. Consequent to the selection of these two sites, a third site (Golden State Power and Light or GSP&L) was included in the list of case studies. Discussions with people at this site informed me that the utility had been using a "management indicators process" (GSP&L's terminology for measurement systems) which had evolved over several years and was now tailored to meet their specific requirements. Including GSP&L helped get another perspective on how organizations measure performance. Chapter 4 has captured the evolution of measurement at IPC, Acme and GSP&L.

The case study strategy adopted for this thesis is also dependent on two secondary sources of data. This can be seen in Figure 3.1(p.58). One of them is the literature and the other is an expert panel. In the literature review, a survey was conducted to identify existing measurement methodologies for the purpose comparing and contrasting with the General Measurement Methodology. The "expert panel" consisted of people who I believe have knowledge and understanding of performance measurement. Future sections in this chapter will elaborate on how each data source was used. It may be important to mention that the addition of supplementary data sources to the research design does not weaken the
case study strategy. The literature on research methods makes it clear that a given study rarely follows a single research method (Yin, 1988; Issac & Michael, 1981; Sekaran, 1984; Leedy, 1985). I would like this study to be seen as one which adopts a predominantly case study strategy while relying on other data sources for a more robust investigation/research design.

3.3.2. The Case Study Research Method

The case study is one of the most popular social science methods of doing research. It has been used both in traditional disciplines (psychology, sociology, political science, anthropology, history, and economics) as well as in practice-oriented fields such as urban planning, public administration, public policy, management sciences and education (Yin, 1988). The method also is a frequent mode of thesis and dissertation research in all of these disciplines and fields. Yin proposes a "technical" definition for the case study. According to him it is an empirical enquiry that "investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used."

3.3.2.1. The Appropriateness of the Case Study

When does one use the case study strategy? As noted in Section 3.3.1 there are several research strategies available to the researcher. It was also mentioned that it is incorrect to assume that the various research strategies are "arrayed hierarchically." That is to say, there can be significant overlap between research strategies. Hence, choosing any one should be done after ensuring that another appropriate strategy or a combination of such strategies are not eliminated from the choice. If one reviews examples of studies where specific research methods have been used, it is possible to discern that in most cases the nature of the problem is investigated before deciding on the research method. However
in this thesis, the problems were initially defined conceptually and later crystallized by choosing the three case studies (IPC, Acme & GSP&L).

Yin (1988) writes that three conditions need to be considered while deciding on a research strategy: (a) the type of research question posed, (b) the extent of control an investigator has over behavioral events, and (c) the degree of focus on contemporary as opposed to historical events. The type of question posed depends on whether the researcher would like to be either predictive about outcomes of the research effort or explain the effort. According to Yin the "how" and "why" questions are more explanatory and likely to lead to the use of the case study strategy. This thesis adopts the explanatory stance. It explains how the process of measurement system design and implementation can be improved.

"...'how' and 'why' questions are more explanatory and likely to lead to the use of case studies, histories, and experiments as the preferred research strategies. This is because such questions deal with operational links needing to be traced over time, rather than mere frequencies or incidence." (Yin, 1988).

The degree to which the researcher has control over actual behavioral events is a second factor which influences the decision to use the case study strategy. The case study strategy is preferred when the investigator cannot manipulate relevant behaviors. This is in contrast to an "experiment" strategy when these behaviors can be manipulated, for example, within a laboratory setting. But although the case study strategy has no control over behavioral events, it is unlike the "history" strategy where one deals with a "dead past," and does not focus on contemporary events. The case study focuses on contemporary events and hence its unique strength is its ability to deal with a full variety of evidence -documents, artifacts, interviews and observations (Yin, 1988; Issac & Michael, 1984).
3.3.2.2. Strengths and Weaknesses of the Case Study

Despite its popularity, the case study method has been subject to quite a few prejudices in the past. In Yin's (1988) words, the case study has been "stereotyped as a weak sibling among social science methods. In spite of this stereotype, case studies continue to be used extensively in social science research." This seems to be a paradox: if the case study method has serious weaknesses, why do investigators continue to use it?

One of the main reasons quoted in the literature is the fact that very often these investigators lack the knowledge and are not trained in other methods. Secondly, and equally important is the argument that the case study may not be a stereotype at all. Leedy (1985) and Douglas (1976) say that the strength of the case study strategy has not been established because it has rarely been seen as a "research tool." Frequently, the strategy has been confused with teaching tools, ethnographies, participant observations and other "qualitative" methods. This thesis adopts the case study strategy as a research tool. It is the tool used to collect data from the research sites, process the data and finally portray information in the form of conclusions.

Let's now review how this study meets and overcomes some of the common concerns that people have for this research tool. These concerns have been identified in one form or the other by Yin (1988), Leedy (1985), Douglas (1976) and Sekaran (1984). The greatest concern appears to be about the lack of rigor in case study research. The writers report that very often researchers have not been disciplined enough to keep biased views and uncertain evidence from influencing conclusions. This has been largely due to an under-developed strategy for the analysis of data. As a later section will show, this thesis has a plan for analysis of data, an objective of which is to eliminate the author's bias as far as possible.
Another common cause for concern about case studies is that they do not represent robust and generalizable research. Issac and Michael (1984) write about the narrow focus of case studies on a "few units" and their consequent "limitations in their representations." Where the case study focuses on a single unit, the question of robustness is raised frequently. Yin (1988) quotes Guba and Lincoln (1981) who say that several people have attempted to address this concern without much success. There is no definitive answer on what constitutes robust research in case studies. Is case study research generalizable? Once again, there is no consensus on the response. However, most researchers agree that case studies, like experiments, are generalizable to theoretical propositions and not to entire populations.

Case studies are usually differentiated by single and multiple case designs. This thesis follows a multiple case design. Single cases are a common design for doing case studies and are most appropriate when the case represents a critical test of existing theory, or where the case is a rare or unique event, or where the case serves as a revelatory purpose (Yin, 1988). Clear specification of the unit of analysis is critical while adopting the single case design. The literature does not definitively say that the single case design is better than the multiple case design or vice-versa.†

However, it does indicate that the evidence from multiple cases is often considered more compelling, and the overall study is regarded as being more "robust." The multiple case design however, does not always satisfy the rationale of the single case design; that is to say, the critical case, the rare case and the revelatory case are all likely to involve only single cases (Yin, 1988). The objective of the multiple case design should be to achieve "replication logic." Replication in multiple case designs means similarity in observed

† In a later section, a sample analysis has been done. The nature of the sample in each population has been presented. In addition, a commentary on how the sample affects the results has also been included.
phenomena across cases. This is different from a "sampling logic" typically adopted while during a survey where a sample from a population (or a case) is chosen to demonstrate the replication phenomenon. The issue is one of distinguishing between "cross-case analysis" (for the multiple case design) and "within-case analysis" (for the single case design). The plan for analysis in this thesis (which has a multiple case design) will reveal that a desired outcome is to get similar observations (or replication) from each of the cases as well as the data sources. A review of Figures 3.1 and 3.1a (referred earlier but presented again on p.68-69 for the reader's convenience) shows that the "final analysis" stage follows a "cross-source" logic than a "within-source" logic. This is consistent with the design requirements for a multiple case study.

A third often quoted complaint about case studies is that they take huge amounts of time to do and result in an overload of unreadable documents. The issue about time stems from a previously mentioned point that case studies are and have been confused with ethnographic studies which usually consume long periods of time. The issue about the massive documentation can be resolved by adopting alternative ways of writing the case study.

3.3.3. The Modified Case Study Research Method

Figures 3.1 and 3.1a, shown on the following pages for the reader's convenience, depict the research method adopted by this thesis. The rest of this section will describe the method in detail. The method essentially consists of three phases as shown in Figure 3.1; (1) design, (2) single source collection and analysis, and (3) cross-source analysis. As noted earlier, Figure 3.1a takes a closer look at the second and third phases.
Figure 3.1: Procedure Adopted for this Research Effort (Adapted from Yin, 1988).
Figure 3.1a: A Closer Examination of the Procedure.
3.3.3.1. **DESIGN**

This stage comprises of the "development of theory," which includes identification, understanding and crystallization of the problem to be investigated. From the viewpoint of this thesis, the design stage also consists of selecting data sources and determining mechanisms to collect the data from each of these sources. The development of theory has been addressed partially in Chapters 1 and 2. In Chapter 1 a basic theoretical foundation was established. An overview of the problem was presented and it was seen how measurement fits into the management process. Chapter 2 captured the history and evolution of performance measurement. The background of the General Measurement methodology was also discussed in detail. In this Section, I will focus on (a) how the problem was identified, understood and crystallized and (b) how the data sources were selected.

(a) **How the problem was identified, understood and crystallized**

This thesis was triggered off by the author's interest in white-collar performance measurement. The exact problem to be resolved was not clear for quite a while. A review of current literature in white collar performance and discussions with people knowledgeable in the area conveyed to me that measurement is a topic in performance management which had not developed as much as some other areas such as planning or compensation management systems. True, measurement is a critical component of both planning, and compensation; but when one looks at the advances that organizations have made in the area of assessing overall performance, good examples are hard to come by. This awareness evolved over a period of time and soon enough I was a looking for a way to translate this awareness into a specific problem I could research for my thesis.

The information contained in the previous paragraph should be seen in the context of the research method. The exact thought processes which occurred during the
development of the problem statement were not recorded and that may be attributed to a weakness in the design of the research. Those unrecorded thoughts may have been useful input to this chapter on the research methodology because according to Yin (1988), "doing" a case study actually begins with the conceptualization and definition of the problems or issues to be studied." In this thesis, while I was attempting to define the problem, it was not known if the approach which would be adopted to seek a solution would be the case study method. I mention this because, most descriptions of case study examples appear to have prior knowledge that the route to the solution is via the case study strategy. This thesis did not have that prior knowledge. While attempting to define the problem, unrefined forms of the research questions gradually began forming in the author's mind. A major catalyst and supporter of this development was the author's association with IPC which was finally chosen as one of the research sites.

(b) How the data sources were selected

One of IPC's areas of expertise is performance measurement; a methodology (General Measurement Methodology) to develop measurement systems was/is available. This methodology has been explained in detail in Chapter 2. In consultation with other associates of IPC, it was determined that the existing methodology (which had evolved over a period of eight to ten years) needed to be reviewed and improved. It was pointed out in Chapter 2 and also earlier in this chapter that the evolution of the methodology had been without a specific plan. Changes and modifications to the methodology had been incorporated more from conceptual and philosophical thinking rather than a thought-process which was based on lessons learned from systematically investigating actual cases of measurement system design, development and implementation. The problem was not a lack of sites where the methodology was used; IPC had clients who were at the initial stages of developing measurement systems and there was really no way of learning much from these examples.
The goal was to locate examples of measurement systems (developed by using IPC's methodology) that had been through the steps of the methodology. IPC was selected as one of the examples. Acme was another. Descriptions of both are available in Appendices G and H. (Acme had used the General Measurement Methodology to develop a measurement system in one of its departments.) Once these had been decided upon, the author in association with the advisor of this research effort decided that a third site should be included in the sample. The characteristic which would distinguish this site from the other two is its different approach to performance measurement. GSP&L was chosen as a third site. A description is available in Appendix I.

In addition to the research sites, a second source of data for this thesis is an "expert panel" comprising of fourteen people in the United States. Each member of the expert panel was sent a questionnaire with a cover letter; this package was designed to elicit responses from the panel which would throw light on how the implementation strategies of performance measurement systems could be improved. Both the cover letter and the questionnaire are included in Chapter 3 while discussing the research methodology. A third source of data is the literature; a survey was made to locate models that depicted the process of performance measurement.

3.3.3.2. SINGLE SOURCE DATA COLLECTION AND ANALYSIS

Strategy for Data Collection

In this section I will outline how data from each of the three sources was collected, stored and retrieved and processed. A critical portion of my data for this research effort came from the three case studies. At each site three modes of data collection methods were used; reviewing written documents, interviews, and observations. Leedy (1985) writes
that the most important measure of the quality of data, irrespective of the source, is their reliability and internal validity.

In the context of this thesis, internal validity is the extent to which the author can establish what the data really represents. Low internal validity results from the misinterpretation of the message communicated by the document, interview or observation; consequently making the data of little practical use. Conversely, if the message is understood accurately, the data is internally valid and describes what the document, interview or observation is attempting to communicate. Reliability, from the perspective of written documents questions the accuracy of those documents. From the perspective of the interview, reliability is governed by how accurately I ask questions and how accurately the respondent answers. Low reliability of observations at the three sites arises from failure to observe the "relevant phenomena" at each site.

The Interviews as a Data Source

Interviews or "verbal reports" form the most important and frequently used data collection method in this thesis. It should be understood that the three data collection methods are not "arrayed hierarchically." In other words, reviewing written documents and observing are an integral part of the interviewing process. Ericsson and Simon (1980) have suggested three ways to collect verbal data. These are: (1) thinking aloud, (2) concurrent performance of a task and verbalization, and (3) retrospective verbalization.

According to the researchers, one of the most direct and widely used methods to gain information about the subjects' internal states is to instruct them to "think or talk aloud." This is similar to interviews of an open-ended nature (Yin, 1988) where an investigator asks key respondents for the facts of the matter as well for the respondent's opinions about events. Under these circumstances, the investigator may even ask the
respondent to propose his or her own insights into certain occurrences and may use such propositions as the basis for further inquiry.

"Concurrent performance of a task and verbalization" and "retrospective verbalization" fall under the realm of the focused interview (Yin, 1988). In the former, subjects are probed concurrently with their performance of a task. This method helps gain specific information "usually of a kind that they (the subjects) presumably need to guide their succeeding behavior." Retrospective verbalization probes the subject for information after the completion of the task.

A third type of interview is along the lines of a survey. Here the interviewer uses a list of questions to guide the conversation. In this thesis, interviews of all the three types mentioned above were done. The choice was rarely made prior to the interview; it depended quite a bit on the personality of the respondent. There were several kinds of respondents. Some were involved with the task of setting up the measurement system and willing to speak about it. This personality type did well with the open-ended interview. Some others who were involved were more reserved and required the focused approach. Some other respondents who belonged to a specific unit of analysis (IPC, Acme or GSP&L) were less informed or uninformed about measurement practices in their companies. Even within this group there were some who understood the problem quickly and responded by offering continuous commentary; and there were others who once again needed guidance and the focused interview.

The interview as used in this research is"...a two-person\(^1\) conversation, initiated by the interviewer for the specific purpose of obtaining research-relevant information, and

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\(^1\) The interview was not always diadic during the course of this research. On several occasions, the interview was conducted with more than one person excluding myself. The reason this was done on some of the occasions was in the interest of time; in other cases it was because one respondent required the presence of a colleague to recall facts and share accurate information.
focused by him or her on content specified by research objectives of systematic
description." (Lindzey and Aronson, 1969). The literature on field research presents
varying forms of the steps required to conduct an interview. A typical interviewing
procedure has four phases (Leedy, 1985; Spradley, 1979; Lindzey & Aronson, 1969):

1. **Preparation/Design**
   - Select a sample of interviewees in the organization.
   - Set up the interview well in advance.

2. **Pre-interview activity**
   - Send the agenda of questions to the interviewee.
   - Ask for permission to tape the interview.
   - Confirm the date immediately in writing.
   - Send a reminder together with another agenda of questions several days before
     expecting to arrive.

3. **Conducting the interview**
   - Be prompt; follow the agenda; have a copy of questions in case the interviewee has
     mislaid his or her copy.

4. **Post-interview activity.**
   - Following the interview, submit a transcript of the interview and get either a written
     acknowledgment of its accuracy or a corrected copy from the interviewee.
   - Write a trip report and conduct preliminary analysis of the interview.
   - After incorporating the material into the research report, send the report to interviewee
     for final approval and written permission to use the data in your report.

An evaluation of the actual steps in the interviews conducted so far against the generic
steps presented above is in order. A formal sampling strategy was not adopted for any of
the research sites. The literature shows that there are different sampling techniques that are
appropriate for different population types; simple random sampling, simple stratified
sampling, proportional stratified sampling, cluster sampling, etc. Each of these techniques is applicable to a particular population type. It is not clear if a formal and scientific way of choosing the interviewees would have produced any better on any of the three sites. For example, I'm a member of IPC. Respondents from this site were chosen based on the following criteria: knowledge about measurement systems, familiarity with the measurement system in IPC, experience with the Organization, and the author's perception of who would be able to make useful contributions. The implication was not that each selected person satisfied all the above criteria; rather he or she satisfied at least three out of the four criteria. In Acme or GSP&L, the strategy of population selection involved establishing a contact person prior to the first interview. This person, in both cases was involved in the development of the measurement system. In the author's judgment, this person had the ability and willingness to "participate" in this research despite other commitments. The author explained the research problem in detail to this person and relied on his judgment to select the sample. This strategy proved to be effective.

Pre-interview activities assumed slightly varying forms on each site. In IPC, the participants were geographically close to me and also reasonably knowledgeable about my thesis research and performance measurement in general. The original plan for data collection at IPC was to interview selected individuals and adopt a strategy similar to the one adopted in Acme and GSP&L. However, the design was altered slightly after learning at (Acme and GSP&L) that having a group together in a room was more effective than the individual interview especially if the subject matter of the discussion was of a common interest to all people concerned. The number of ideas generated, circumstances recalled and amount of useful information exchanged increased tremendously with this tactic. Hence in IPC the data collection strategy was to interview a panel of selected members from the organization. As explained above, this panel was chosen based on the following criteria: knowledge about measurement systems, familiarity with the measurement system in IPC,
experience with the organization, and the author's perception of who would be able to make useful contributions. Each of the five members of the panel received a handout prior to the meeting. This helped facilitate the discussion. In Acme, the strategy adopted for pre-interview activity took another form. Since each person to be interviewed was a full time employee of Acme, there were restrictions concerning when the interviews could be conducted. As much as I would have liked a "grand strategy" for all interviews, where each one was scheduled for a certain date and time, this was not possible and understandably so. The contact person in Acme handled all the scheduling, taking into account the author's schedule, the respondent's schedule and his own. Typically, the contact person would brief the respondent on the reason for my visit. In most cases, the respondents in Acme were in one way or another, involved with the development of the performance measurement system. Written confirmations were not found to be necessary. Only on one occasion did the author have to travel to Acme to find out that the person he was scheduled to meet had to cancel the appointment for another meeting. Permission to tape the interview was not handled during this phase. In all the cases, the request was made moments before the actual interview began. The pre-interview strategy for GSP&L was almost identical to that adopted in Acme. However, with GSP&L which was geographically very dispersed from the author, the strategy possessed more structure. The first contact was made close to three months prior to the interview sessions. Since GSP&L was very large and had pervasive measurement systems it was important to arrange interview schedules which would be both effective and efficient. The author had two working days to meet with the selected people and perhaps no opportunity to make another visit. Here again, I established a contact person who coordinated the entire visit. A sample list of questions with a cover letter was sent to this person, who made copies for those people I would be interviewing.
Conducting the interviews in IPC involved facilitating the panel of five people. A hand-out with an agenda and a request to focus on specific issues helped to a great extent in the effective and efficient facilitation of the meeting which lasted about ninety minutes. Conducting interviews in both Acme and GSP&L followed a similar pattern. These interviews typically lasted for about an hour and a half. I began by providing a brief introduction on my purpose. As is usually the case, each personality type required a different "mode of professional functioning." Hence, although the basic objective and questions of the interview remain unchanged, the respondents were encouraged to approach them in a way they felt comfortable. Respondents were encouraged not to be constrained in any way while sharing information. Most questions asked were variations of, or exactly those depicted in Table 3.3 (p.79). I did not find it either useful or comfortable to go from one question to another in a mechanical fashion. The open-ended interview dominated on several occasions. Many times, one question led to another issue that needed to be addressed. Many "how," "what," "why," and "when," questions had to be supplemented to the list of basic questions. The intent was to initiate and maintain a dialogue or a conversation rather than a question and answer session. The analytic strategy designed and adopted for this study was partly based on the expectation that the interviews would generate a lot of data and would not necessarily follow a pre-designed list of questions. After doing several interviews and being close to inundated with data, I'm convinced that for this thesis-problem, the "conversational" approach to interviewing was probably most appropriate.

Post-interview activity involved transcribing each interview and sending the transcript to the respondent for validation. My observation is that almost none of the respondents felt threatened during the interview and really did not care about this part. In some cases, they

\[2\] While discussing the results in Chapter 4, we will take a look at the modified and additional questions that were asked as well as the output from the interviews.
Table 3.3: Sample Questions used during Interviews

**DESIGN**

Who constitutes a measurement team in an organization? What are the skills required by a measurement team? What is the role of the "measurement master"?

How does top management see its role in measurement system development?

How can an organization elicit the commitment and cooperation of its people to successfully perform measurement?

Is the concept of performance measurement communicable? If not, why? If so, how?

How does an organization know if it is measuring performance and doing it right?

**IMPLEMENTATION**

Why don't organizations measure performance? Why don't they do it right?

What are some of the "critical incidents" that occur during the implementation of a measurement system?

Why is there a tendency toward a fear of measurement?

How do some organizational factors that support performance measurement?

How do some organizational factors fail to support performance measurement?

How can an organization elicit the commitment and cooperation of its people to successfully perform measurement?

Is the concept of performance measurement communicable? If not, why? If so, how?

**OUTCOMES AND OBSERVATIONS**

Why do organizations measure performance? What principles guide the setting up of measurement systems in organizations?

How do current measurement philosophies differ from traditional/classical measurement beliefs?

How can one distinguish between effective and ineffective performance measurement systems?

How pervasive are performance measurement systems in organizations that you've been in?

For an organization, what are some of the short-term and long-term consequences of not measuring performance?

How do reward systems tie to measurement systems?

How can we develop a consistent terminology with respect to measurement?
even advised that returning the transcript would not be necessary. The proposal of this thesis had indicated that "preliminary" analysis would be done on each interview. A trip report constituted this part of the analysis. I would like to report that more discipline could have been maintained at this stage and most preliminary analyses could have done in a more timely fashion.

The Expert Panel as a Data Source

The Expert Panel used for this thesis consisted of fourteen people in the United States; in the judgment of the author these people are knowledgeable about performance measurement. The formation of this panel was gradual. It was created with the guidance from the advisor of this research effort as well as recommendations from associates of IPC. Since IPC was actively involved in improving its knowledge about measurement systems, the identification of "colleagues" in the field was not particularly difficult. A list of seventeen questions was mailed to each with a cover letter requesting a response and providing a summary of this thesis problem. The letter emphasized that there was no need to answer all seventeen questions individually. The two main research questions (see Section 3.2.1) were presented and the potential respondents were given the choice of generating a commentary of their thoughts on those questions. The responses to this method of data collection have been varied. Some answered each question individually; others provided a 1-2 page commentary along with copies of helpful journal articles. Others returned my letter and questionnaire with thoughts scribbled on the sheet. Still others called in, apologized for a lack of time, and agreed to spend 10-15 minutes on the phone to discuss my questions.

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3 Please see Appendix C for examples of interview transcripts and trip reports.

4 The letter as well as the questions are included in Chapter 3 while discussing the research methodology.
The Literature as a Data Source

As indicated in the proposal of this thesis, the literature has been included in the list of potential data sources, in addition to the interviews and the expert panel. Choosing articles/sources which depicts the appropriate measurement methodologies was difficult. The literature does show advances in the area of measurement; however, the dilemma is that the word "measurement" appears to take so many connotations. As Lawler, Nadler and Cammann (1980) point out that the "development and use" of measures and measurement methodologies is largely fragmented. Psychologists have their own methods of measuring organizations (as depicted in Robinson and Shaver, 1973). Sociologists have theirs, anthropologists have theirs, and engineers too, design still other methods of measurement. Even within these disciplines, the literature reports a lack of agreement as to how specific variables should be measured. Under these circumstances, the following question was raised: "What are the factors that should influence my decision to choose measurement methodologies from the literature?" Before responding to the above question it will be useful to distinguish between measurement methodologies and measurement tools/techniques.

The objective of this part of my research was to locate measurement methodologies and not tools and/or techniques. In my opinion, the General Measurement Methodology, Cost Definition Methodology (CDEF) and The One Page Management System (TOPS) are examples of a measurement methodologies; Work Measurement, Variance Analysis and Financial Ratios are examples of measurement techniques. The measurement methodology should lead the user to a particular tool or technique; tools and techniques should be selected based on the preferences/needs of the user of the measurement system.
Returning to the question posed earlier, what is the most effective way of choosing a sample of measurement methodologies from the literature, so that the sample is a representative data source for this research? An adequate and sensible response to this question seemed to be to audit each selected measurement methodology against the principles that guided the design and development of the General Measurement Methodology. These are documented by Sink and Tuttle (1989) and are listed below. Obviously, it was not expected that each selected methodology would satisfy all the guiding principles. The objective of the audit was simply to narrow the list down to research-relevant measurement methodologies.

For the purpose of the audit, the guiding principles have been rephrased as questions. An affirmative answer is the expected response for each question. The greater the number of "yes" responses, the closer the selected measurement methodology matches the General Measurement Methodology. The rephrased guiding principles are listed below:

1. Does the measurement methodology either explicitly or implicitly state that it cannot be used to drive performance improvement? Is there knowledge/awareness that performance improvement results from the business strategy and the performance improvement plan?

2. Does the measurement methodology reflect the need for the acceptance of the measurement process?

3. Does the measurement methodology guide the user to measure what's important and not what's easy to measure?

4. Does the measurement methodology encourage an experimental approach toward developing measurement systems?

5. Does the measurement methodology attempt to elicit the participation of those involved/concerned?
6. Does the measurement methodology attempt to achieve multiple measures rather than a single measure?

7. Is the measurement methodology considered part of the "management process" and is the measurement system which results viewed as a decision-making and problem-solving support?

8. Does the design of the measurement methodology reflect anticipation for the unintended and potentially dysfunctional consequences of performance measurement?

9. Does the measurement methodology differentiate between measurement and evaluation?

   Five methodologies were finally selected from the literature. An individual report of each was written. Following this a consolidated report or a "cross-source" analysis of all the methodologies was generated. This is included in Appendix D.

3.3.3.3. CROSS SOURCE ANALYSIS

   Preliminary Analysis: Figure 3.1 (shown again on p. 84 for the reader's convenience) depicts this step in the research procedure. During data collection and recording (irrespective of whether it is a case study, expert panel or literature), simultaneous development of a set of ideas from the data acquired is critical (Geer, 1964; Burgess, 1984). The aim is to generate "themes" from the data as and when they are collected and recorded. Glaser and Strauss (1967) and Schatzman and Strauss (1973) say that when themes emerge "analytic memos" become important. They encourage researchers to write continually a series of analytic memos which can form the core of the preliminary analysis. An activity which goes hand-in-hand with data collection, recording and analysis is the establishment of a rudimentary indexing system. Research of this nature typically collects a significant mass of material which would make it impractical to have to

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5 Selected reports are included in Appendix D.
Figure 3.1: Procedure Adopted for this Research Effort (Adapted from Yin, 1988).
go through each page every time something needs to be looked up. Douglas (1985) suggests that this potential problem may be resolved by having a page in three columns containing, for each interview, expert panel response and literature review, the date, the person interviewed, the expert panel respondent or document reviewed, and a brief summary of the interview, expert's response or literature review. By doing this, when it comes to reviewing notes or writing from them, a brief perusal of the index would be enough to give a reasonably full picture of what is available and where any given item could be located.  

*Intermediate Analysis:* The form of intermediate analysis is that of a chronological narrative of the research effort till this time. This narrative is facilitated by the outputs from preliminary analyses, namely, memos, notes etc. The objective is to generate an integrated, in-depth description of these outputs in a journalistic (almost novelistic) fashion. Lofland and Lofland (1984) capture the essence of what I call intermediate analysis: "(Intermediate analysis) is simply to review the totality of your analytic files for existing patterns among the small pieces. Arrange and rearrange them for some kind of expository or sociological coherence."

*Final Analysis (Analytic Induction):* Preliminary and intermediate analyses were used to support the final analysis of data. The approach used for the final analysis was modified "analytic induction." Burgess (1985) outlines the steps involved in classical analytic induction. I will first present these steps and then go on to describe the modified form. The main steps in analytic induction have been identified as:

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6 A variation of this technique worked very well during preliminary and intermediate analysis. Please see Chapter 4 for a description.
1. Defining the phenomenon to be explained.
2. A hypothetical explanation of the phenomenon is formulated.
3. One case is studied to see whether the hypothesis relates to the particular case.
4. If the hypothesis does not fit the case, it is either reformulated or the phenomenon is redefined in order to exclude the particular case.
5. Practical certainty is achieved with a small number of cases, but negative cases disprove the explanation and require a reformulation.
6. The examination of cases, redefinition of the phenomenon and reformulation of hypotheses is continued until a universal relationship is established.

*Modified Analytic Induction:* In this research, the hypothesis developed in Step 2 is equivalent to the General Measurement Methodology. In Chapter 6 (Conclusions) I will attempt to determine if the methodology actually accounts for the information portrayed by the data I have collected. The logic of the General Measurement Methodology and each of its steps will be reviewed to determine if it fits the reports from cases, literature review and the opinions of the expert panel. In the event I see a misfit I will "reformulate" the methodology accordingly. The aim is to use the acquired data and change, modify and flesh out the methodology for sharper clarification until all data were satisfied. Chapter 6 will present the results of this procedure and the modified and improved measurement methodology will be depicted and described.† The following sections present a description of the background of each data source. For each case study, the organization charts have been depicted along with brief descriptions of the roles and responsibilities of individuals contacted for the interviews. The application of the data collection procedure at each site has been described. For the literature review, a list of the sources from which the methodologies were chosen is presented along with a description of the method used to elicit information from each methodology. Finally the expert panel has been briefly introduced. A description of the data collection procedure used for the panel is also presented.

† This aspect of the research design has been changed in Chapter 6 (Conclusions).
3.3.4: Description of Background at IPC

The management practices of IPC have been described in Appendix G. Figure 3.2 shows its organization chart. Figure 3.2a shows those individuals responsible and accountable for "business units" and "operations management." Notice that one person can occupy more than one role at IPC. The measurement effort at IPC has been coordinated by the Director, Administrative officer (AO) and the Graduate Research Associates (GRAs). As stated earlier, conducting the interview here involved facilitating a panel of five selected people in the organization. The selection was done in consultation with the advisor of this research effort and was based on the following criteria: knowledge about measurement systems, familiarity with the measurement system in IPC, experience with the organization, and my perception of who should be able to make useful contributions.

Three of the five people in the panel were GRAs; one was a Research Associate (RA) and the fifth was the AO. Two of the GRAs have been with IPC for more than three years and are regarded as the measurement specialists. Both have been involved with measurement efforts within IPC as well as its clients. The third GRA has been with IPC for two years. The AO has also been employed by IPC for about four years and is primarily responsible for the financial measurement system in the organization. The Research Associate has been in this position for a little less than a year, prior to which he was a GRA for about two years. This person has been taking a lead in project and program management and also works directly with clients in the area of measurement system design and development.
Figure 3.2: IPC's Organizational Chart
Figure 3.2a: Positions in Business Units and Operations Management
The panel meeting lasted about 90 minutes and adopted a structured-interview orientation. Each of the five members of the panel received a handout which is shown in Table 3.4. A transcript of the entire meeting is available in the Detached Appendix. As shown in Table 3.4, four major topic areas were covered; (a) A picture of the evolution of measurement at IPC, (b) A critique of the General Measurement Methodology, (c) A focused look at current measurement practices at IPC and (d) An evaluation of IPC's measurement experience with clients. Data collected under each of these topic areas are documented in the IPC consolidated report presented in Appendix G. The next chapter presents an analysis of the data contained in the consolidated report. Chapter 5 presents the results obtained from this site.
Table 3.4: Hand-out Distributed to IPC Members during Panel Meeting

To: Mary, Paul, Eva, Garry and Tony  
From: Hasi  
Subject: Measurement Panel Meeting  
Date: 11 September 1989

The following are my desired outcomes/outputs from the meeting:

1. A picture of the evolution of measurement at IPC.
3. A focused look at current measurement practices at IPC.
4. An evaluation of IPC's measurement experience with clients.

1. A picture of the evolution of measurement at IPC.

- Everyone is welcome to participate but I would like Paul, Tony and Marty to take a lead on this one.

- I'm looking for every element of IPC's effort so far. It doesn't matter if there hasn't been continuity of effort; that in itself is good data.

- I would like to look at the strong and the weak points in IPC's measurement effort.

- In the interest of time, I would prefer not to have a debate on the topic. As far as possible let's recall and dig out facts.

- Let's aim to keep this particular discussion within 25 minutes.


- Everyone is welcome to participate but I would like Paul, Tony and Garry to take a lead on this one.

- Please review attached methodology before the meeting.

- I would like the panel's opinion on the strengths and weaknesses of the methodology. Where does it work and where does it fall apart?

- If we were to use this with a client today what are the phases/steps you would choose to change/delete/modify/expand?

- In the interest of time, I would prefer not to have a debate on the topic. Nobody is going to be “right” or “wrong” in presenting an opinion. If a member of the panel feels strongly about an opinion of another please don't challenge the opinion. We'll wait until the end of the meeting.

- Let's aim to keep this particular discussion within 25 minutes.
Table 3.4 (Cont’d): Hand-out Distributed to IPC Members during Panel Meeting

3. A focused look at current measurement practices at IPC.
   • I would like everyone to contribute during this discussion.
   • This is different from (1) in that I would like to closely examine measurement at IPC since its last planning retreat.
   • I would like to to identify current roadblocks, problems, constraints, strengths and weaknesses.
   • In the interest of time, I would prefer not to have a debate on the topic. As far as possible let's recall and dig out facts.
   • Let's aim to keep this particular discussion within 20 minutes.

4. An evaluation of IPC's measurement experience with clients.
   • Everyone is welcome to participate but I would like Paul, Tony, Garry and Eva to take a lead on this one.
   • I would like to capture the following: (a) How did we do four years ago? (b) How did we do 1.5-2 years ago? (c) How are we doing now and (d) How do we expect to do in the future?
   • If there has been change in performance with clients over time, what are some specific reasons that contributed to either a positive or negative trend?
   • In the interest of time, I would prefer not to have a debate on the topic.
   • Let's aim to keep this particular discussion within 20 minutes.
3.3.5: Description of Background at Acme

A description of Acme and its management practices is available in Appendix H. One of the differences between Acme and IPC in terms of unit of analysis and sampling strategy is that in Acme I've studied measurement in a department and in IPC, I've considered the organization. The potential effect of this difference on the results of this research will be discussed in section 3.3.9. In all, seven interviews were conducted at this site. One of these interviews had two people excluding myself. The procedures related to the interviews were discussed earlier. Selected interview transcripts and trip reports are included in Appendix C. Copies of all interview transcripts and trip reports are included in the Detached Appendix. A consolidated report of the data collected during the field interviews at Acme is presented in Appendix H. The next chapter presents an analysis of the data contained in the consolidated report. Chapter 5 presents the results from this site. A background of the ME department in Acme and the measurement effort initiated there has been documented on the following pages.

3.3.5.1: Department Description-Manufacturing Engineering

The Manufacturing Engineering department (referred to as the ME department throughout the thesis) was the "case study" for a State University Senior Design Group project. It has four sections: Advanced Manufacturing and Engineering Design, Tooling, New Products, and Processing/NC Programming. The Advanced Manufacturing and Engineering Design section is responsible for analyzing present problems, and finding new solutions. They are also involved in capital equipment investigations. The Tooling section determines the tools, fixtures and amount of tool room supervision for the shop floor. Other responsibilities include keeping inventory of the tool room, deciding when and how tools should be reprocessed, and giving input to the purchase of new tools. New Products consults with the Advanced Manufacturing and Engineering Design section to make estimates, process plans, and routing for new products. Writing NC programs, developing process plans, routings and performing cost analyses for existing products are
responsibilities of the Processing/NC Programming section. At the time of the study the Manufacturing Engineering department consisted of 15 people.

Since the conclusion of the project in April 1988, there have been a few changes in the organizational chart of the Manufacturing Engineering department. Figure 3.3 shows the organizational chart at the time of the study and Figure 3.4 depicts the chart at the present time. D.S. and E.D. have been assigned to Computer Integrated Manufacturing (CIM) Operations. J.S., who was Supervisor-Processing and NC has been made Manager of Manufacturing Engineering. D.C. has been assigned a special project and C.M. retains his job as Supervisor, Tooling. All the five people shown in Figure 3.3 participated in the development of the measurement system and all five were interviewed. To get the perspective of a person in a non-managerial position, I was advised (by the contact person at Acme) to interview an industrial engineer in the ME department. This was also done. In addition, I interviewed the VP of Human Resources (who was instrumental in approving the project) as well as the General Manager of Acme.

3.3.5.2: The Decision to Select the ME Department

The Senior Design Group's Final Report and my own investigation reveals that prior to the group's project, the departments in Acme had no specific ways to assess their performance against their goals. Consequent to meetings, it was mutually decided that the ME department would be used as a case study because they were "relatively most responsive to performance measurement." According to the report, department accessibility and manageability were other key decision factors. The department was accessible in that E.D. was a department supervisor and the group's company contact, and manageable because of the department's small size.
Figure 3.3: Organizational Chart of the ME Department during the Senior Design Project
Figure 3.4: Current Organizational Chart of the ME Department

Manager of Manufacturing Engineering (MS)

Supervisor Processing & NC (has not been filled)

Supervisor New Projects (FV)

Supervisor Testing (CM)
3.3.5.3: Problem Areas

During the first three plant visits of the Senior Design Group, they had discussions relating to the need to measure white-collar performance in the ME department. With support from the supervisors of the department, four basic problems were identified:

1. A white collar performance measuring system did not exist.
2. Information sharing about performance was limited between and within the various groups and departments.
3. Knowledge about performance measurement and evaluation was needed.
4. Improved understanding of the relationship between goals and measures of performance was needed.

The diagnosis was that the department needed a measurement system to monitor its progress. Although the four sections of the department were housed in the same room and despite their relative dependence on each other, they had not been able to participatively set goals and achieve the consensus required to meet those goals. It appears as though all supervisors did not share the same goals thus making it difficult for the department to function as a unified organizational unit. The "scoreboard" which was created was intended to help make departmental measures visible and to let members know how they were doing as a group. Some of the desired outcomes were higher motivation and increased satisfaction rather than competition.

A problem encountered during initial deliberations was the department's apprehensions toward the "scoreboard." These concerns are summarized in the following list:

1. Potential misunderstanding and misuse of measurement information by higher management.
2. Possible embarrassment.
3. "Scoreboard" will not measure true performance.
4. Extra time will be needed to update and maintain the "scoreboard."
5. "What's in it for me?"
6. "Will individual performance be obvious on the "scoreboard?"

The Senior Design Group's final report indicates that these concerns were definitely taken into account if not fully addressed. They emphasized to the department supervisors that the unit of analysis for the "scoreboard" was the department and not the individual. Thus, they explained, individual performance would not be displayed on the board. In addition, they gave a brief introduction with the objective of taking the threat out of the project.

3.3.5.4: Project Objectives

After having set the stage for the project, the following objectives were defined:
1. Build a visible performance measurement system for the Manufacturing Engineering Department.
2. Make the process transferrable to other departments.
3. Make the department more aware of "constant improvement."

By accomplishing the first objective, the Senior Design Group believed that the department would have a formal, visible performance measurement system. They wrote a guide to help the users of the system. The guide contained steps to adjust and maintain the system. It was hoped that other departments would be able to use this guide, thus accomplishing the second objective listed above. The project group believed that the third objective could be accomplished by the department working through the process of building the performance measurement system. By defining departmental goals, performance measures and maintaining the "scoreboard," it was visualized that the department would be made aware of the constant improvement orientation.
3.3.5.5: Methodology Used

The approach adopted by the project group to develop the measurement system was Management Systems Analysis (MSA). MSA was discussed in detail in Chapter 1 (Please see pages 6-10 in Chapter 1). There, MSA was defined as a three step process of:

1. improving the management teams' or measurement teams' understanding of the target system;
2. identifying specific performance improvement interventions that can be made, and
3. developing a measurement system to tell the management team if they are doing what they said they would do to improve performance.

The Senior Design Group "exploded" the general form of MSA a little further and defined it as having five steps:

1. Input/Output Analysis
2. Performance Improvement Interventions.
3. Information needed to support decisions.
4. Data needed to support decisions.
5. Tools/techniques employed to convert data into information.

On close examination, the list immediately above is not different from the 3-step MSA process depicted earlier. Input/Output analysis is one way of understanding the ME department. The next step is the same on both lists. The last three steps in the second list spell out how one should go about developing and building measurement systems. MSA was shown pictorially in Figure 1.2 but is reproduced once again for your convenience in Figure 3.5. Notice that the sequence of MSA steps adopted by the Senior Design Group follows that depicted in the figure.
Figure 3.5: Management Systems Analysis
Relationship between the methodology and the GMM

How does this tie into the General Measurement Methodology? As mentioned in Chapter 1, the GMM is an exploded form of boxes #3, #4, and #5 in Figure 3.5. Boxes #1 and #2 which involve understanding the organizational system and identifying performance improvement interventions would be activities which would take place in Phase 0 of the GMM. The GMM implicitly assumes that these two steps of Management Systems Analysis are done. One way of performing Steps 1 and 2 of MSA is the 7 Step Performance Improvement Planning Process (Please see the Appendix E for a description of this process).
3.3.6: Description of Background at GSP&L

A description of GSP&L's management practices is available in Appendix I.\textsuperscript{7} One of the main differences between GSP&L, Acme and IPC is in the consideration of the unit of analysis and sampling strategy. In Acme, a department was studied. Although the unit of analysis in GSP&L and IPC is the organization, due to difference in size and population the sampling strategy adopted is different at each site. The potential effects of these differences will be discussed in section 3.3.9. In all, three interviews were conducted at this site. Two of these interviews had two people excluding myself. The third interview had five people excluding myself. The procedures related to the interviews were discussed earlier in this chapter. Copies of interview transcripts are included in the Detached Appendix. A consolidated report of the data collected during the field interviews at GSP&L is presented in Appendix I. The next chapter presents an analysis of the data contained in the consolidated report. Chapter 5 presents the results obtained from this site. The following pages document background information on GSP&L and the data collection procedure adopted at this site.

3.3.6.1: Organization of GSP&L

Reviewing GSP&L's organization structure before understanding how the respondents were selected would be helpful. The organizational structure of GSP&L is depicted in Figure 3.6. There are three basic areas of operations; The General Office (GO), Plants and Divisions/Districts.

\textsuperscript{7} The reader will find it helpful to familiarize with the terminology in GSP&L's Quality Improvement Program (QIP), described in Appendix I, before reading the results from this site.
Figure 3.6: Organization of GSP&L
- The General Office develops corporate management policy, performs long-term capacity planning, develops corporate-wide plans and programs for electric operations and analytic support, coordinates programs for division/district offices and power plants and operates transmission and power supply system.

- The Plants operate and maintain the power generating equipment, and

- The Divisions/Districts prepare plans and programs tailored to local and regional characteristics, supply electricity, provide customer services and construct, operate and maintain the distribution and transmission facilities.

The pre-interview strategy for GSP&L was almost identical to that adopted in Acme. The first contact was made close to three months prior to the interview sessions. Since time was a limiting factor, it was important to arrange interview schedules which would be both effective and efficient. I had two working days to meet with the selected people and perhaps no opportunity to make another visit. Here again, I established a contact person (Tom) who coordinated the entire visit.

3.3.6.2: Identification of Groups to Interview

During the two days I was there, I had opportunities to speak with three groups of people. One group (consisting of two people) belonged to "Management Services," a corporate staff service organization (see Figure 3.6). Here I spoke to a Manager and a Senior Analyst. A second group (consisting of four people) was selected from Nuclear Energy Staff. This selection was made because the Quality Improvement program at GSP&L is perhaps best implemented here and was in fact, triggered off by outstanding quality performances in one of the nuclear energy departments. Here I spoke to the Manager of Planning and Control and four staff members of Nuclear Information Management. A third group (consisting of two people) was selected from Divisions Planning and Administration (DPA). In DPA, I spoke with the Manager (Tom, who
coordinated my visit) of a group called Division Information Services and his associate. The location of these three groups (Management Services, Nuclear Energy Staff and Divisions Planning and Administration) have been highlighted in the organization chart of GSP&L.

On what basis was this selection of groups made? Several weeks prior to my visit to GSP&L, Tom and I had telephonic conversations during which we attempted to make this selection. I specified to Tom that my purpose was to determine how GSP&L developed performance measurement systems. Tom responded that performance measurement (or "management indicators process" as GSP&L calls it) is an integral part of the Quality Improvement Process. However, the development of measurements or indicators for the entire GSP&L operation had been centralized and is now coordinated between DPA and Management Services. Hence, Tom recommended that I would necessarily have to meet with selected people at these two places. In addition, Tom also recommended that I visit with the Nuclear Energy staff to take a look at how QIP was being deployed at GSP&L.

Before presenting the process of "indicator development" in GSP&L, I will briefly describe each of the three groups I interviewed; Management Services, Nuclear Energy Staff and Divisions Planning and Administration (particularly the Divisions Information Services group within DPA). Figure 3.7 shows the organization structure and major accountabilities of Management Services. Figure 3.8 captures the structure, responsibilities and accountabilities of Divisions Planning and Administration (DPA). Tom is manager of Divisions Information Services (DIS), which is a part of DPA. As Figure 3.8 shows, his team is accountable for: (i) maintaining and disseminating Divisions' performance information (ii) researching and developing new performance measurements of Divisions' activities and (iii) assisting Divisions in the analysis of performance information. DIS is where a significant and critical portion of Company's measurement practice and indicator development goes on.
Figure 3.8: Organization of Divisions Planning and Administration
Figure 3.6 shows the location of the Nuclear Energy department in GSP&L's organizational structure. As mentioned earlier, Nuclear Energy was chosen since it has been a pioneer in adopting the quality improvement process within GSP&L. My interview with the group from Nuclear Energy helped me see how the process is actually deployed in a critical area of the organization. Figure 3.9 shows the 1988 Policy Deployment Process (PDP) for Nuclear Energy Department. Notice the "projects" under each Short-Term Plan. Indicators are developed for each of these projects.

To effectively understand the process of how the company develops indicators, Tom recommended that the process be seen in the light of the Quality Improvement Program. In fact, as we shall see shortly, GSP&L has just recently tied measurement to improvement. However, the "management indicators process" has been around in GSP&L since 1978. The evolution of this process has been captured in Appendix I. During my two-day visit to GSP&L, my first day was spent with the Nuclear Energy department and Management Services. Both these departments were geographically dispersed from Divisions Planning and Administration by about 70 miles. On the first day, my first meeting was with the five-person group from Nuclear Energy. As mentioned earlier they briefed me on the PDP in the department and later critiqued the General Measurement Methodology. During the afternoon of the first day I met with the two-person team from Management Services. The entire second day was spent with DPA. In retrospect I believe the meetings could or should have been rearranged. They occurred the way it did due to some scheduling problems. A better sequence of meetings would have been to spend the first day at DPA and begin the second day with Management Services and conclude the visit with Nuclear Energy. This way I would have understood the process first and then experienced an example or an application.
Company C Corporate Vision: "During the next decade, we want to become the best managed electric utility and an excellent company over all and be recognized as such."

Midterm Plan I: Achieve customer satisfaction. II: Shape the environment

(No nuclear energy projects)

Short Term Plan I

Midterm Plan II: Shape the environment

Short Term Plan III

Midterm Plan III: Strengthen organizational effectiveness

Effective deployment of resources (Mr. B - Coordinating Executive)

Midterm Plan IV: Effective utilization of resources

Short Term Plan IV

Continue emphasizing safe, reliable and efficient nuclear plants (Mr. C - Coordinating Executive)

Short Term Plan II

Continue to improve employee safety (Mr. A - Coordinating Exec.)

Figure 3.9: 1988 Policy Deployment in Nuclear Energy Department (Descriptions of projects are not included to ensure confidentiality.)
I informed the interviewees at GSP&L that I had two main objectives to accomplish. First, I wanted to understand the approach they adopted to design and implement performance measurement systems. Second, I wanted them to critique the General Measurement Methodology. To accomplish the first objective, I had anticipated using the unstructured interview strategy (used in Acme) once again. However, I changed the strategy slightly when Tom suggested that we could facilitate the discussion with the support of flowcharts depicting measurement or the "management indicators process" at GSP&L. To accomplish the second objective I invited them to critique the methodology based on their knowledge and experience gained at GSP&L and elsewhere. The data collected is presented in the consolidated report in Appendix I. Notice once again that my data collection strategy at this site is different from the strategies adopted in IPC and Acme. Each site provided different opportunities for collecting data as well as different types of data. In section 3.3.9, these differences are explained in the context of the results obtained.
3.3.7: Background on Literature Review

Section 3.3.3.2 explained the role of the literature in this thesis and how the methodologies were chosen (p.81-83). Five methodologies were chosen as a result of the selection procedure. These are:

1. "American Productivity and Quality Center's (APQC) Improvement Methodology."

2. "EG&G's Performance Measurement Methodology."


5. "A Methodology for Measuring Administrative Productivity."

Chapter 5 attempts to generate specific improvements to the GMM by comparing it with each of the above methodologies. Two questions were asked during each comparison: (1) How are the steps in Methodology X similar to the phases in the GMM? (2) How are the steps in Methodology X different from the phases in the GMM? The "report of comparison" in Appendix D is a commentary of observations, insights, and ideas gained by consolidating the responses to these questions.

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8 On reviewing the descriptions of the methodologies in the Appendix, the reader will notice that they have been called "white-collar" performance measurement methodologies; I believe they can be used for blue collar applications as well. In earlier chapters the GMM was referred to as a "collarless" methodology; i.e., the GMM can be used for white-collar and blue-collar applications as well. Hence, I believe the comparison between the GMM and the methodologies in the literature is valid.

9 The coding technique was one again used for the purpose of analysis.
3.3.8: Background on the Expert Panel

The objective of choosing an expert-panel as an additional data source was to expand and enhance the data-base for final analysis. Also, it was expected that the panel would take a "fresh" look at measurement and not necessarily from the point of view of the General Measurement Methodology. The GMM was not revealed to the panel. They were primed with a list of questions only.

The Expert Panel consisted of fourteen people in the United States. The procedure for the selection of the panel was described earlier in this chapter. A list of questions was mailed to each with a cover letter requesting a response and providing a summary of this thesis problem (see Table 3.5). As the Table shows, each question pertained to at least one of four categories: (a) design and development of measurement systems, (b) implementation, (c) outcomes of measurement and (d) general observations. The letter emphasized that there was no need to answer all seventeen questions individually. The two main research questions (see Section 3.2.1) were presented and the potential respondents were given the choice of generating a commentary of their thoughts on those questions. After the letters were mailed out for the first time, only five responses were received. Two of these people chose to address each question separately. Two others preferred to write a commentary based on the two main research questions. One person called in, apologized for a lack of time and agreed to spend ten minutes on the phone sharing some of his thoughts with me. Notes of the conversation were made. A couple of weeks after the initial contact, reminders were sent out to the members of the panel who had not responded. Another copy of the original letter and the list of questions were also enclosed. At the time of writing this thesis, five more members had responded to the second call. The strategy adopted to write this consolidated report is similar to the one
Table 3.5: Package to Expert Panel Member; Letter

Mr. XYZ
Park Road
Anytown, USA

1 May 1989

Dear Mr. XYZ:

I'm a graduate student in Industrial Engineering at Virginia Tech. My master's level thesis focuses on ways to improve implementation strategies of performance measurement systems. I'm writing with the hope that you will share with me, some of your knowledge, thoughts and insights in the area of performance measurement. In my research I'm attempting to answer two basic questions. These are:

1. What are the components of a complete design for a measurement system development and implementation plan?

2. How can the process of measurement system implementation be improved in organizations?

I would prefer not to constrain your thinking by being very specific. At most, I would request you to avoid focusing on the individual in the organization. My focus is on group and organizational level measurement systems in the white-collar environment.

You can either directly address the questions listed above or simply provide me with a commentary of your thoughts related to my research questions. On the following page I've listed a series of additional questions that may help your thought process.

At the conclusion of my research I hope to have established a reasonably accurate and generalizable response to these questions. The procedure I've proposed to adopt to arrive at my conclusions essentially consists of collecting and analyzing data from different sources; case-studies, experts and the literature. You, as an expert, are an extremely valuable source of data for me. I would appreciate it very much if you can help me in my endeavor and mail your response to me by June 1, 1989.

Please call me at 703-961-6397 (Work) or 703-552-1529 (Home) if you have any questions. Thank you for your time and cooperation.

Sincerely,

Hari Menon
Table 3.5 (Cont'd): Package to Expert Panel Member; Questionnaire

**DESIGN**

Who constitutes a measurement team in an organization? What are the skills required by a measurement team? What is the role of the "measurement master?"

How does top management see its role in measurement system development?

How can an organization elicit the commitment and cooperation of its people to successfully perform measurement?

Is the concept of performance measurement communicable? If not, why? If so, how?

How does an organization know if it is measuring performance and doing it right?

**IMPLEMENTATION**

Why don't organizations measure performance? Why don't they do it right?

What are some of the "critical incidents" that occur during the implementation of a measurement system?

Why is there a tendency toward a fear of measurement?

What are some organizational factors that support performance measurement?

What are some organizational factors that fail to support performance measurement?

How can an organization elicit the commitment and cooperation of its people to successfully perform measurement?

Is the concept of performance measurement communicable? If not, why? If so, how?

**OUTCOMES AND OBSERVATIONS**

Why do organizations measure performance? What principles guide the setting up of measurement systems in organizations?

How do current measurement philosophies differ from traditional/classical measurement beliefs?

How can one distinguish between effective and ineffective performance measurement systems?

How pervasive are performance measurement systems in organizations that you've been in?

For an organization, what are some of the short-term and long-term consequences of not measuring performance?

How do reward systems tie to measurement systems?

How can we develop a consistent terminology with respect to measurement?
adopted for the case studies. Each panel member's input was read a couple of times and an attempt was made to classify or code the responses under "information generating topics." Due to the categorization of the questions (design and development, implementation, outcomes and general observations) this was not as difficult to do as it was for the case studies' consolidated reports. Following this each response was reviewed for pieces of information which would fit under one or more categories mentioned above. These have been compiled in Chapter 5 (Results).

3.3.9: Effects of Sampling and Data Collection Methods on Results

As mentioned earlier in this chapter, this thesis has not used a formal sampling strategy. According to the research in literature, sampling of any nature typically implies random selection. This thesis did not adopt a random search for its data sources. The selection of the case studies was based on the availability of opportunity to conduct this thesis research as well as the convenience do it. The literature and the expert panel were included as additional sources of data. Random selection was not applied to the measurement methodologies chosen from the literature; this is evident from the fact that each was audited against the guiding principles of the GMM before including it in the study. The expert panel was also not chosen randomly. As described earlier, the formation of this panel was gradual. It was created with the guidance from the advisor of this research effort as well as recommendations from associates of IPC.

Essentially then, I have five data sources; a productivity center (IPC), a manufacturing company (Acme), a utility (GSP&L), the literature (5 methodologies) and a group of selected people (expert panel). If I had adopted a sampling strategy, then IPC, Acme and GSP&L should be respectively representative of all productivity centers, all manufacturing companies and all utilities. I don't claim this to be true. What does "representation" mean in this case? It means that the selection of another productivity
center, another manufacturing company, another utility, another set of articles from the
literature and another group of fourteen people should give me similar data based on which
the GMM can be modified and improved. Since I cannot verify representativeness, I also
cannot confirm receiving similar data. This increases the probability that if I had chosen
another population, the improved GMM would have taken a different form than the one in
Chapter 5. I also have to take into account "within-population" differences. That is to say,
IPC, Acme and GSP&L are three different organizations (units of analysis) from the point
of view of size and the nature of business. However, in the context of this thesis the more
important difference is in the amount of resources available and allocated for the
measurement effort. For example in GSP&L, an entire department works full time on the
measurement effort. In IPC and the ME department in Acme, resource availability has been
a major constraint. Hence the results of this thesis come from analyzing data from sites that
have had varying capacities to commit resources to one of the most important steps in a
measurement effort; data management. How do these differences affect the final product
(the improved General Measurement Methodology)? How can I account for these
differences? I believe the most effective way of addressing the issues raised by these
questions is to treat the differences appropriately while drawing conclusions from the
results.

These observations reinforce a point I had made in section 3.3.2 (The Case Study
Research Method). There I mentioned that a common cause for concern about case studies
(or studies of this nature that use multiple data sources) is that they do not represent robust
and generalizable research. Robustness and generalizability in this context are defined from
the viewpoint of entire populations. The chances are remote that I would be able to
generate the same improved GMM using another set of data sources. Despite this
drawback, I believe the improved GMM is a fairly accurate representation of how
organizations need to approach measurement system design and implementation. In other
words, the results of this study are generalizable to what Yin (1988) calls "theoretical propositions" as opposed to "entire populations." The theoretical proposition here is that the improved methodology can be used (with modifications) in organizations to design and implement measurement systems.

Another factor which should be considered is that the data collection strategy in this research was different for the different data sources. In some field situations for example, the unstructured interview was used. In still some others the structured interview was adopted. There were also occasions where I used a combination of both. Although the research questions and the main objective of the study (improvement of the GMM) remained unchanged, there were dissimilarities in questions posed to respondents at each site and the expert panel. There were several reasons why a common list of questions could not be used: (a) The nature and role of the different data sources; the expert panel and the literature were predominantly supporting data sources. Further, I could not treat the panel and the literature in the same fashion as I treated the interviews. There was no opportunity for a dialogue or scope to investigate a specific situation in the case of the expert panel and the literature. Data from these data sources were more general in nature. The case studies provided situation specific data. (b) Although measurement was the common phenomenon being investigated, I was not investigating exactly the same measurement approach in each data source (c) The size and the nature of business of each case study was different. (d) Availability of time at each site was another factor and (e) Knowledge levels with respect to performance measurement varied considerably across the data sources.

Since data collection has varied from one data source to another, the form in which it was stored and processed also varied. For example, in the case studies, field interviews led to transcripts of each interview. Trip reports were written based on the transcripts.
Consolidated analytic reports were written based on trip reports and transcripts. For the methodologies in the literature, a "report of comparison" was written after reading each and comparing it with the GMM. Responses from the Expert Panel were summarized in a table and synthesized in a report. The differences in data storage and processing are evident. A description of how these differences have been addressed follows.

Firstly, with the support of the reports from the field, the literature and the expert panel, I've attempted to determine how each data source does measurement. For example, using the "consolidated reports" from the field, I've captured the principles based on which IPC, Acme and GSP&L design and implement measurement systems. This was done by analyzing the reports from the sites (Appendices G, H and I) to identify "lessons learned" from each site. Where the literature is concerned, once again I was supported by the "report of comparison" in Appendix D. A synthesis of the views on measurement system development expressed by the authors of the articles has been done. The responses from the expert panel has also been treated similarly.

Secondly, I identified "replication" across the information portrayed by the case studies, the literature and the expert panel. In other words, on comparing the information from each data source with the GMM, I identified those pieces of information that were missing from the General Measurement Methodology. Identifying these missing pieces led to the formulation of specific improvements for the GMM.†

† Chapter 6 (Conclusions) will show that in its final stages, the focus of this research switched from improving the GMM to communicating information gained about measurement. Please see Chapter 6 for details.
4. DATA ANALYSIS

4.1: Objective

The objective of this chapter is to analyze and discuss the raw data collected from each of
the three data sources. Its content provides the link between the data collected and the results
of this research derived and presented in the following chapter. During the analysis and
discussion, the reader can identify several themes emerging that are common to all the data
sources. However, each data source provides an opportunity to interpret and discuss a
particular theme in a different context. (The raw data from the case studies are in Appendices
G, H and I, in addition to interview transcripts in the Detached Appendix. The raw data from
the literature are in Appendix D. The responses from the expert panel are also in the Detached
Appendix.)

4.2: Analysis and Discussion of data from IPC

Analysis of the data collected from this site generated information along several themes.
Each theme is individually described in the following paragraphs.

4.2.1. Performance Measurement systems should consider the multi-
dimensionality of performance.

It was established in Chapter 2 that performance has several dimensions including (but not
restricted to) effectiveness, efficiency, quality, productivity, quality of worklife, innovation and
profitability. It was also explained that depending on the needs of the organization,
measurement systems should be able to track all or a particular combination of the various
performance dimensions.

Data from IPC reiterated the importance of treating performance as multi-dimensional
and setting up measurement systems to complement this characteristic of performance.
Although IPC’s measurement system continues to be primarily financial in nature, efforts such
as the administration of the Delphi Technique show that measures which reflect both, the
financial and non-financial dimensions of performance are considered important at IPC. In measuring non-financial dimensions, a significant part of the effort has attempted to measure productivity at the center level, quality of products and services and the quality of life of IPC associates.

4.2.2. The financial component of the measurement system tends to attract and retain a sizable portion of allocated resources.

The financial measurement system at IPC is evolving at a faster pace when compared to the non-financial measurement system. The main reason is that there has been a concentrated effort to allocate resources to developing the financial component of the system. Resources have taken the form of people's time, technology (computer, accounting packages etc.) and staff hired primarily for the measurement effort.

This type of resource allocation in an organization which is as small as IPC is natural and probably the right thing to do. For young organizations like IPC, financial measurement systems need to be in place before the organization can track other dimensions of performance. This is to say that most organizations need to have a few mandatory measurement systems in place to track "key areas" of performance.

At the current stage in IPC's life, a key area is financial performance and hence most of the energy and resources have been directed to develop the financial performance measurement system. Only when this system is under control and generating useful information for decision making, can IPC effectively begin developing measurement systems for other dimensions or key areas of performance (productivity, quality, innovation, QWL etc.).

4.2.3. Formal and informal measurement systems tend to develop simultaneously. The importance of each must be recognized.

The data from IPC revealed that measurement efforts are not always formal; that is to say, a focused approach, complete with the support of measurement methods and/or techniques is not always necessary to track performance in any given area. Since resource allocation can
often be problem for formal measurement efforts, informal measurement is a widespread occurrence in organizations. These efforts usually lack the visibility of formal ones but do play an important role in tracking and improving performance. In fact, most of these informal efforts do have the potential to become formalized once the organization is capable and ready.

Measuring performance in this area was never formalized. Measurement was primarily carried out by creating and sustaining an awareness that the Center needed to produce error-free products and services. When a quality deviation was noticed, it was brought to the attention of the person or the group of people concerned. Data concerning quality problems were collected but these were random efforts. The data was sometimes shared during IPC meetings. The informal measurement effort has paid off. Over a period of time, IPC has noticed a reduction in the number of quality errors. The point is that we need to distinguish between formal and informal measurement systems and understand that both play important roles in organizations.

In the context of the IPC measurement effort, although the financial component may appear formalized, effective and useful informal components do exist.

4.2.4. Identifying "levels" of measurement supports the definition of critical initial parameters of a measurement effort.

IPC has identified "levels" of performance measurement; Center level, project and program level and individual level (see Appendix G for details). The definition of these levels of measurement helps in the identification of a few critical initial design parameters such as the purpose of the measurement effort, the unit of analysis which is being measured, the measurement team within the unit of analysis and the intended audience for the information generated from the resulting measurement system.

Identifying these critical initial parameters is essential during the design of the measurement system. If one considers IPC's financial measurement system as an independent measurement effort, one finds that most of these parameters have been thought through.

An explanation of the relationship between the levels of measurement existing at IPC and the critical initial parameters follows. The definition of levels is a step toward defining the unit
of analysis which has to be measured. Level 1 represents company performance. The financial measurement system and the Delphi efforts are both attempts to establish Level 1 measurement systems. At Level 2 (project and program), personal or disaggregated measurement systems have been created by project and program managers. At Level 3, Performance Development Reports (PDRs) are used to improve individual performance.

Notice that for each level there is a specific audience and purpose. Level 1 measurements are used for decision-making by a key people including the Director, Associate Directors and Research Associates. For the others at IPC, Level 1 measurements are perhaps only "nice to see;" these people do not make decisions based on tracking or observing information from the Level 1 measurement system. At most it helps them understand why some decisions are made and why some others are not. Information from the Level 2 measurement system is more project and program specific. Once again, there is a different audience for information from this level of measurement. There are people who make decisions based on this information, there are others who need to be kept informed about project and program performance and there are still others who will not find the information from this level useful.

The discussion on the levels of measurement during the IPC panel meeting also suggested that care needs to be taken while choosing the group or the "measurement team," within a defined unit of analysis. Who is the measurement team and what is its composition? If the purpose of the measurement effort (irrespective of the level at which it occurs; whether organizational, departmental/project or individual level) is identified, the problem of defining the measurement team and its composition finds its own solution. For example in the development of the IPC financial performance measurement system, the measurement team is comprised of the Director, the administrative assistant and the fiscal assistant. Similarly, when a Performance Development Report is initiated for an IPC employee, the measurement team is comprised of the person who initiated the report along with other employees invited to serve as referees (see Appendix G for details). In each case a clearly defined purpose initiated the measurement effort. Once this was known, decisions to select and include the right people were not as difficult to make.
4.2.5. Identifying "levels" of measurement supports the definition of critical initial parameters of a measurement effort.

The General Measurement Methodology (GMM) lists the "creation of a suitable climate" as one of the steps in Phase 0. This seems to imply that the climate can be "manufactured" before embarking on the measurement effort. The measurement specialists at IPC believe that this is not possible. The climate in this context is a culture issue and is formed over a period of time by constant and consistent changes and improvement in an organization's internal management processes and practices.

Among the three sites this thesis has studied, IPC was found to have an environment or a climate most conducive to initiating and sustaining a measurement effort. One of the factors which supports these formal and informal efforts in this case study is that knowledge and awareness levels pertaining to performance measurement are high. This has helped and continues to help in gaining the acceptance of the measurement effort by the employees of IPC. The data shows this well; typically measurement is considered threatening in organizations but owing to the nature of IPC's business and its management practices (see Appendix G), "threat" was not an issue encountered during the development of IPC's measurement system.

Another factor supporting the climate for measurement and which is reflected in the data from IPC is that of top management commitment and involvement. In IPC's case key members were involved during the "system start-up" stage, but the data reports that "ownership" for the measurement effort was passed on during the implementation stage. This needs to be examined further and brings up the need to differentiate between top management commitment and involvement; organizations often confuse between the two, hoping for involvement from top management when only commitment and empowerment were necessary for a group to proceed and implement an idea or in this case, design and implement a performance measurement system.
4.2.6. Closure

Section 4.2 has presented an analysis and discussion of the data collected from IPC. Each of the sub-sections above provides a description of the different themes that were generated from the data. In a similar fashion, section 4.3 which follows analyzes and discusses the data collected from Acme.

4.3. Analysis and Discussion of Data from Acme

Analysis of the data collected from this site generated information along several themes. Each theme is individually described in the following subsections.

4.3.1. Education plays an important role in the design, development and implementation of measurement systems.

Subsection 4.2.5 described knowledge and awareness levels with respect to measurement as one of the reasons why the climate in IPC was found to be conducive to measurement. The data from the ME department in Acme as well as the author’s assessment of the climate suggests that at this site, there was a need for an effective strategy to educate the measurement team in current philosophies and practices in white-collar performance measurement.

There were two basic reasons why imparting the right kind of education to the members of the ME department was not possible. Firstly, the measurement effort was predominantly facilitated by a team of relatively inexperienced students. It's perhaps unfair to assume that they would have been sufficiently equipped to transfer the requisite amount of knowledge and skills. Secondly, the students were working against a deadline and had to conclude setting up the measurement system within a specified time frame.

4.3.2. An early definition of critical initial parameters for the measurement effort is important.

Echoing the findings from IPC, data from the ME department also suggest the need to have clear definitions of purpose of the measurement effort, the unit of analysis, the measurement team and the intended audience. It was not fully clear that the purpose of the
measurement effort was understood by the ME department. As the consolidated report in Appendix H shows, a variety of responses were recorded while asking the respondents to define the purpose of the measurement system based on what they knew and believed.

There was also confusion arising due to inadequate focus on the specific unit of analysis within the ME department. This problem was more predominant in Acme than in IPC since the ME department was composed of four separate groups and the measures developed were meant to be common to the entire department. However, the data reveals that the "measurement board" was attaching a progress report to each of the separate groups and not necessarily to the department.

Further, the composition of the measurement team was not clear. This was made particularly clear by responses from interviews that suggested low involvement by participants during the design of the measurement system. Here the argument is not to determine whether or not everybody in the department should have been involved; the point is that the definition of the roles and responsibilities of members of a measurement team during the design stage would pave the way for easier and more accepted future steps in the measurement effort.

An absence of a clear definition of purpose, unit of analysis, the measurement team and the audience is probably the reason why the measures generated were not found useful.

4.3.3. Informal and personal measurement systems are integral components of measurement efforts.

The use of "disaggregated" or personal measurement systems figured prominently in both Acme as well as IPC. Data from Acme suggest that the procedure adopted to set up these systems was not a formalized one but similar to the procedure adopted to set up a group measurement system. The only difference in this case was that usually the audience for this system was one person or at most two people. Most of these systems were created by individuals who had a need for visibility systems to help them keep track of their jobs. In one case an individual maintained a personal measurement system to report information to his boss.
How do these personal systems relate to the measurement systems as defined and developed by a methodology such as the GMM? This relationship is not very clear; but it was clearly established that for those people who maintained personal measurement systems, they were very important from the point of view of helping them make decisions.

4.3.4. Resource availability and allocation are factors to consider while implementing measurement systems.

The data collected from the ME department showed that if the measurement system were to be useful, then it had to be periodically updated. This meant that data had to be collected at fixed intervals for each of the charts. This task was time-consuming and required the attention of several members of the ME department; particularly since each of the charts depended on data from individuals in the department.

Although the senior design group had made an attempt to set responsibilities for data collection and processing, the actual implementation of this critical part of measurement system design did not take place. The interviews show that the job of coordinating and maintaining a measurement system can be beyond the capability of any one person.

However in Acme, one person assumed the responsibility of maintaining the measurement system and found the task overwhelming. Hence, although the members of the ME department initially participated in data collection, their efforts dwindled when they noticed that the charts were not being updated periodically. The question which was frequently during field visits at Acme was that if a result (trend in performance levels as defined by the measurement board) could not be observed, how could people be expected to participate?

4.3.5. The role of management cycles should be considered during the development of measurement systems.

The data collected from this case study offers another insight to keep in mind while designing measurement systems. Top managers at Acme observed that organizations pass through "management cycles." During high management cycles companies typically made a lot
of money; the bottom-line. Under these circumstances, how could one expect a performance measurement system such as the one in the ME department (within Acme) to succeed/survive? The implication apparently is that people all over the organization is looking at the bottom line of the company which is profitability. They probably find it difficult to understand the need for improvement interventions such as measurement systems. According to the managers, in "low management cycles," organizations tend to be more receptive to such interventions.

4.3.6. Closure

Section 4.3 has presented an analysis and discussion of the data collected from the ME department at Acme. Each of the sub-sections above provides a description of the different themes that were generated from the data. In a similar fashion, section 4.4 which follows analyzes and discusses the data collected from GSP&L.

4.4. Analysis and Discussion of Data from GSP&L

Analysis of the data collected from this site generated information along several themes. Each theme is individually discussed in the following subsections.

4.4.1. Audience analysis is important during the design and development of measurement systems.

As the data from GSP&L (in Appendix I) will show, most indicators for the measurement system at this site were initially developed for a single audience; top management. These initial measurement efforts tracked financial or "cost" indicators. Typically top managers would request to see certain pieces of financial information. These requests would be satisfied by a group of employees (Divisions Planning and Administration (DPA)) specifically assigned to work on the development of the indicators.

However this changed as more and more people from the line organization began suggesting ideas to DPA for possible indicator development. Since DPA viewed top management as its only primary customer, many of these requests were rejected or unheeded. Typically, the reason stated was either that the requested indicators were not suitable for the particular line organization or that data collection procedures were long and tedious.
The points above indicate that once again, echoing the findings from IPC and Acme, Critical Initial Parameters of the measurement effort were not well defined. Recall that audience analysis is one of these parameters. Until recently (1987), the audience for GSP&L’s measurement effort was internal customers and improving the performance of internal operations. The addition in the current process is the reinforced and enhanced external customer orientation. Key performance areas have been identified that attempt to capture the most important requirements of external customers.

4.4.2. The “development” of indicators or measures should be given as much importance as their “production” and “delivery.”

The Management Indicators Process at GSP&L has three basic steps. “Development” of indicators includes those steps that lead to their definition. Despite these drawbacks, the actual "production" and "delivery" of the indicators at GSP&L followed a defined pattern. "Production" of indicators includes those steps that lead to their creation; this is equivalent to what this thesis has termed "data management" (the location, collection, storage, processing and portrayal of data). "Delivery" of indicators refers to how these indicators are compiled, distributed and shared by the intended audience. (Please see Appendix I for a more elaborate description of these terms.) The data from GSP&L reveals that despite the improvements in the production and delivery processes of indicators, their development continued to remain unchanged.

As explained in the previous subsection, initially the measurement system at GSP&L developed financial indicators for top management. The data reveals that in many cases the indicators were not screened thoroughly to determine if they would portray useful information. However this view is from people who were involved in developing the indicators and not from those who requested for them (top management). It could perhaps be assumed that these requests were based on the decisions that top management had to make. The point made is that an important function of information from a measurement system is that it needs to help users in making decisions, solve problems etc. The uncertainty about whether or not this was happening shows one of the weaknesses in GSP&L’s initial measurement effort, that the indicators were apparently not tied to a specific area designated for improvement.
The data suggests that this gradually began to change during 1986-87 when the management indicators process moved away from being totally dependent on individuals for ideas for indicators. Instead indicators began to be based on the plans developed as part of GSP&L's quality improvement program. These plans were developed by a committee comprising of coordinating executives from all parts of the company (please see Appendix I for details). Hence for the first time, indicators were being based or tied to key areas of performance as reflected by the plans which were simply objectives for company-wide performance improvement.

This new development at GSP&L is similar to the measurement component of IPC's 7-Step Planning Process where measures are generated to track the progress of the plan generated. In addition to tying measures to key areas GSP&L also made a distinction in levels of measurement similar to IPC's definition of the three levels of measurement. This was done by identifying those plans that needed to be implemented or "deployed" throughout the organization or only within a department or division. This helping in identifying those indicators that were relevant to a particular unit of analysis.

4.4.3. Resource availability and allocation are factors to consider while implementing measurement systems.

As the consolidated report from GSP&L will indicate, "data management" at this site has been aided by a tremendous amount of human and computer resources. During the late 70s and early 80s when data collection and processing were mainly manual, it's reported that each indicator used to consume approximately 6-7 hours of a person's time. In GSP&L's case this was not considered a problem since sufficient resources had been allocated.

The "production" and "delivery" processes were mostly manual during the early 80s and were automated during 1985. Also additional human resources were committed to the measurement effort. The decision to automate was primarily due to the fact that requests for indicators reached overwhelming proportions. While automation was in the form of computer technology, commitment of human resources was in form of "staff groups" in each division to
administer and coordinate this newly added technology. Computer systems were set up to tap
directly into data, compute the required indicator using an inputted formula and display the
information on-line. If necessary it was also possible to automatically print the graphs or
charts or whatever the information portrayal format may have been. Staff groups were created
in each division to collect data from the division and send to DPA who would process the data
so that information would be available on-line.

As the preceding paragraph shows, a significant amount of resources was invested in
GSP&L's measurement effort. In an organization which embarks on a measurement effort
with the plan of using existing resources, data management could be more difficult to perform.
Among the three sites considered, GSP&L helped by pointing out that the design of a
measurement system needed to viewed in the context of the size of the organizational unit and
its resource availability. The equivalent of the DPA department may in fact, be absent in most
organizations and hence the measurement effort will probably have to be designed taking into
account that its successful implementation would be dependent on people considering the
measurement effort as a part of their jobs and voluntarily choosing to participate in the effort.

4.4.4. The dissemination of information from the measurement system needs
to be designed appropriately.

"Delivery" of indicators as stated earlier, refers to how the indicators are compiled,
distributed and shared by the intended audience. In GSP&L, this is made possible by
publishing "indicator books." These books are the equivalent of Acme's measurement board.
Indicator books were typically separated by divisions and were published monthly. The data
from GSP&L suggests that publishing the indicator books by divisions had problems
associated with it. One of them was that the divisions did not share enough information about
each other's operation.

In Acme the case was almost the reverse. There the measurement board helped share
information between the four inter-dependent groups in the ME department by depicting
important areas of performance for each group. However as the interviews at Acme reveal this
was not considered useful. At GSP&L, it's a case where one division in the company required performance information about another division but did not get it due the design and distribution strategy of the indicator books. One of the more important reasons for this inconsistency between Acme and GSP&L is perhaps due to the fact that the measures/indicators developed at each site and the purpose of the information they generated was not thought through.

In time, the information in the indicator books were available on-line. Now, a person in any division or district could access information about his or her own division/district or on any other. This design of the computer systems and the decision to share information were based on the realization that the whole point in performance improvement was to expose one's problems, to bring them to the surface and not to be ashamed of them.

Despite this benefit, the introduction of technology in the measurement effort was not entirely without problems. One of the more important one was that of "duplication of information" which involved people accessing data from different points and using their own formulas to calculate the indicator. These people made decisions about what should be included in or excluded from the computations. This obviously caused the problem of "inconsistent standards" between divisions; it was eventually resolved by creating a standard set of programs to generate information for all divisions.

This situation which was created by the information dissemination issue also clarified the roles of the different groups involved in the measurement effort. For example, DPA who until now did not have an opportunity to work closely with the other divisions received a chance to do so to come up with a common list of information needs for all divisions. Once this was done, the standard set of programs was written which again called for interaction between DPA and its customer groups.
4.4.5. Closure

Section 4.4 has presented an analysis and discussion of the data collected from the ME department at GSP&L. Each of the sub-sections above provides a description of the different themes that were generated from the data.

4.5: Analysis and Discussion of data from the Literature and the Expert Panel

As explained in Chapter 3, the literature and the expert panel have been used in this thesis as secondary data sources with the case studies being the primary sources. An analysis of the data collected from the supporting data sources indicate that they confirm the results obtained from the case studies. The following sections summarize the results obtained from the literature and the expert panel.

4.5.1. Literature Review

All the major ideas offered by the literature were also offered by the data from the case studies. Seven major lessons were captured from the methodologies. These pertained to the following: (a) performance being viewed as multi-dimensional, (b) knowledge to develop measurement systems exists with the users of the system, (c) clear definition of the unit of analysis and measurement team is critical, (d) role of the facilitator(s) needs to be clarified, (e) an "agenda" for the measurement effort needs to be thought through, (f) measures need to be generated for an "area" or a "process" which is important to the unit of analysis and its participants, and (g) issues concerning data need to be managed well.

4.5.2. Expert Panel

Data from the expert panel were collected under three categories pertaining to measurement systems ("design and development", "implementation," and "outcomes and observations.") All the responses are compiled in Table 4.1. All the eleven points expressed by the expert panel in this category have been reflected by the case studies as well as the literature.
A majority of responses offered advice on design issues with respect to measurement systems. In terms of their value for the GMM, Phase 0 (preparation) has been most benefited. The panel members did not refer directly to Phase 1 and Phase 2, although most respondents stressed the need to define purpose and unit of analysis clearly. None of the respondents wrote about the important issue of data management in Phase 3 of the GMM. The need to carefully review the newly installed measurement system (Phase 4) was mentioned by two respondents.

4.6: Closure

As the previous sections show, the data sources have provided information on how they do measurement. In many cases, the lesson(s) taught by one data source have been reflected by other data sources as well. On the basis of the analysis in this chapter the next chapter will present and discuss the results obtained from each data source.
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<thead>
<tr>
<th>Design and Development</th>
<th>Implementation</th>
<th>Outcomes &amp; Observations</th>
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<tbody>
<tr>
<td>1. Clear definition of the group.</td>
<td>1. Make sure implementation is carried out by the group and its &quot;natural leader.&quot;</td>
<td>1. Understand that some measurement systems support evaluation of employee performance and modification of employee behavior in ways which will benefit the organization.</td>
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<tr>
<td>2. Definition of purpose, plan direction</td>
<td>2. Use results in ways that are useful or beneficial to all concerned.</td>
<td>2. Effective measurement systems support decisions which generate cost savings or cost-effective performance which greatly exceeds the cost of maintaining the system.</td>
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<tr>
<td>3. Focus on improvement orientation.</td>
<td>3. Be aware that the first management action based on the newly-installed measurement system is critical. Recognize that in the beginning, poor performance may be reflected. This should be weathered out.</td>
<td>3. Effective measurement systems give employees a sense of knowledge of their own performance, and that management also knows their performance.</td>
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<tr>
<td>4. Make sure measures are not designed to become a &quot;license for meddling.&quot;</td>
<td>4. Tie formal and informal rewards to what is being measured. Be aware in most organizations reward systems are well-entrenched and do not change with a new measurement system.</td>
<td>4. In the short-term, there may be no consequences for not measuring. In the long term, failure will result.</td>
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<td>5. Keep in mind that white-collar workers are hard to control; but they can be fairly easy to inspire with sensible propositions.</td>
<td>5. Incorporate measurement as part of management goal to achieve mission.</td>
<td>5. Organizations have few, if any measurement systems. Most of these are &quot;terrible&quot; and are usually put to counterproductive uses.</td>
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<tr>
<td>6. Distinguish between top management &quot;empowering&quot; the effort and being involved in the effort. Sometimes &quot;empowered&quot; staff groups need to proceed on their own.</td>
<td>6. A measurement system must be implemented with the support of levels.</td>
<td>6. Measurement systems should provide valuable information to strategic planners.</td>
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<td>7. Do a thorough analysis of the group: mission, products, services, customers etc.</td>
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<td>8. Be prepared to do a lot of initial adjustment as well as continuous monitoring.</td>
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<td>9. Ensure linkage between measures and behavior.</td>
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<td>10. Think through &quot;measurement team.&quot; Clarify meaning of measurement master.</td>
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<td>11. Understand measurement is a natural part of the business enterprise.</td>
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5. RESULTS

5.1: Introduction

The objective of this chapter is to communicate the results obtained from this research to the reader. "Results" in this context refer to those lessons learned or information gained about measurement while performing this research. While presenting these results, I attempt to look beyond the measurement methodology at the process of measurement in organizations to understand and describe how measurement can be done effectively. The information gained and lessons learned are presented in Section 5.3. These results are significant because they reflect an additional output from this research; the design of which has focused heavily on attempting to improve the GMM. At the conclusion of data collection and analysis, I find that the task of "improving" an existing methodology is more challenging than what it initially proposed to be. The following section explains and describes this challenge.

5.2: Building "good" theory

Any improvement in the GMM depends on whether or not I've been able to build "good theory" (Eisenhardt, 1989) about measurement and incorporate it appropriately in the GMM. Good theory in this context refers to the quality of the information gained as a result of my efforts. The literature on the social sciences is abundant with examples of theory-building research. Just like I have attempted to improve the GMM, other researchers have attempted to build concepts (Mintzberg and Waters, 1982), construct conceptual frameworks (Harris and Sutton's, 1986), and state propositions (Eisenhardt and Bourgeois, 1988) from case-study data.

In each case the researchers formed closure to their study when "theoretical saturation" was reached (Eisenhardt, 1989). Two things occurred at this saturation stage: (a) despite the addition of more cases to the data base, the incremental learning was found to be minimal because the researchers were observing phenomena seen before and (b) despite enhanced efforts to analyze data, the incremental improvement to the "theory" was minimal.
Once this stage was reached the researchers would reconcile to the "dead-end" and begin to evaluate whatever theory they had built. The literature suggests that there are no "generally accepted set of guidelines for the assessment of this type of research (Eisenhardt, 1989)." However, a few criteria are applicable. Good theory according to Pfeffer (1982) is "parsimonious (close to data), testable and logically coherent." According to Eisenhardt, it also depends on the analytic procedure used. Finally, according to this researcher, "strong theory-building research should result in new insights." The outcomes of this evaluation of theory-building typically fall into three main categories (Eisenhardt, 1989). First, the theory-building study could present "new, perhaps frame-breaking, insights." Second, it could make a modest contribution and replicate past theory. Third, it could result in a "disappointing final product," where there may be no clear patterns within the data.

The results of this research fall into the second category. Although "grand" theory (Eisenhardt, 1989) has not emerged in order to significantly improve the GMM, the important point to note here is that the value of the state-of-the-art information and knowledge acquired about measurement cannot be underestimated. The development and building of models and/or methodologies is a challenging and time-consuming effort and appears to require considerable talent, wisdom and experience on the part of the researcher.

Due to these facts, the strategy for the final chapter of this thesis (Conclusions) has been slightly altered. Instead of "building" the improved version of the GMM, a roadmap (based on information gained from this thesis effort) for effective measurement system design, development and implementation has been suggested and described. The following section describes the lessons learned and information (results) gained from this thesis effort.

5.3. Results

The lessons learned and information gained fall under several separate categories. Each has been described below in subsections 5.3.1 through 5.3.7. Results from the individual data sources (the case studies, literature and expert panel) have been summarized and presented in Tables 5.1 through 5.4 in the next section (5.4).
5.3.1: The Role of Measurement in the Improvement Process

At the conclusion of this thesis effort, if I were asked to define the purpose of measurement on the basis of the data I've collected, my response would be that the most important role of measurement is to support performance improvement. This is not to imply that measurement results in improvement. Rather, measurement points to the need for improvement. Improvement actually occurs when actions based on the need are taken by the organization or the management team. The action orientation is achieved by articulating an overall improvement process. Measurement is a part of this process.

For IPC, the process is in the form of the 7-step performance improvement planning process. The measurement component which is a part of this process currently treats/considers the reporting of financial performance information as top priority. GSP&L's overall improvement process is the "Quality Improvement Program (QIP)." The equivalent of the measurement component of this program is the Management Indicators Process. For GSP&L, the current priority of the measurement process is to track and improve external customer satisfaction. Acme's overall improvement process is called the "Productivity Plan," but does not appear to be as clearly defined as IPC's or GSP&L's. The plan has four "core values." These are (a) Employee Involvement, (b) True Partnerships, (c) Reciprocal Credibility and (d) Utilization of Technology and Advanced Manufacturing Methods. The link between these core values and the ME department's measurement system is not readily apparent. This is probably because the Productivity Plan has been conceived and developed at the organizational level, the measurement system has been developed at the departmental level. Nevertheless, the role of the measurement system in the plan is/should be important; although not clearly defined, the system appears to be a part of the first three values of the plan.

The three case studies show that the ways in which the improvement process is defined in organizations vary. In some cases it can be formalized, clearly defined and easily identified; in other cases the process may not be as formal but could exist within various segments of the organization as independent improvement efforts. In any case, the presence of an operational improvement process in the organizational unit will set the stage for what Phase 0 in the GMM
calls, the "creation of a suitable climate" before embarking on a measurement effort. Recall that the GMM is an "exploded" form of Step 6 (the measurement step) of IPC's performance improvement planning process (PIPP). Steps 1 through 5 attempts to "create" the suitable climate before the measurement step. Similarly in GSP&L's QIP (see Figure 1.7 in Appendix I), measurement occurs following the establishment of objectives and processes for performance improvement.

To this point, two important issues related to measurement have been discussed. First, I stated that measurement does not appear to be a driver of performance improvement. Second, I stated that measurement is part of an overall improvement process. If these two statements are true, then what is the sequence of measurement and improvement in an organization's overall improvement process. IPC and GSP&L as well as expert opinions clearly suggest that improvement actions are initiated first and measurement follows to support further improvement.

5.3.2: Education: Developing Measurement Master(s)

The discussion in the previous section was largely based on the assumption that organizations have company-wide measurement and improvement systems in place. Be reminded that this research focused on: (a) how the three case studies did measurement, (b) how the literature viewed measurement and finally (c) how the experts viewed measurement. The objective was not to determine whether or not measurement systems are pervasive in organizations. However with the support of the experience and insights gained during this research, one could infer that few organizations have designed measurement efforts like the one proposed in this thesis. The reason appears to be that the roles of measurement, as in the past, continues to be viewed in areas such as finance, accounting, work standards etc. Top managers referred to the bottom-line (financial) indicators several times during interviews giving an impression that nothing else mattered as much. The goal here is not to de-emphasize the importance of these indicators at this level of management; even in the most well designed and finely tuned measurement systems, financial performance information will be critical for top management. The point of concern is that there appears to be a lack of basic awareness of
the other dimensions of performance and their importance. Organizations perhaps cannot be criticized for poorly defined measurement systems, a lack of them or even an absence of the awareness of current developments in measurement system design. The contemporary view of measurement is complex and a new paradigm. It has been demonstrated that existing paradigms are difficult to eliminate. This is possible with an effective strategy to build awareness, transfer knowledge and develop skills. Three issues arise as a need for this strategy for education. First, who is qualified to teach?; second, what are the specific theories and skills that should be taught?; and third, how should the strategy for education be implemented? The following discussion will address the first and third issues; the next section (5.3.3) will focus on the second one (specific knowledge and skills).

Addressing the first issue, this study shows that the "teacher" in context of measurement system development process has been most often been referred to as the "facilitator." However the complexities of the process have shed light on the need to develop "measurement masters." Who is a measurement master? In my opinion (which is shaped by observations made during the study), this person could be internal or external to the organizational unit. He or she should possess good platform skills. More importantly, this person should be an inspired and inspiring teacher. The measurement master should be able to facilitate small groups smoothly. He or she, in this definition gets involved with the client group. Involvement in this context means that the association between the master and the group begins long before the first activity in the measurement system process takes place; he or she uses this association to get an in-depth understanding of the group. He or she should also be experienced, well read and genuinely interested in performance measurement and should be able to discuss associated concepts, philosophies and trends. In addition, this person should also possess a comprehensive "measurement skill-kit." Skills include not only the ability to facilitate small groups, but also the ability to construct, read and interpret statistical charts, the ability to offer advice on issues concerning data management, the ability to "stand back" and trouble-shoot the group's system and the wisdom to envision what a particular measurement system will look like at a later stage of evolution.
Although this study supported the conceptualization of a measurement master, it did not reveal one; which leads me to believe that they are rare in organizations. Their absence or rarity is not surprising, considering the fact that a relatively new paradigm of measurement is being considered. Hence it may be more appropriate to consider measurement masters as an evolving group of people rather than an existing one. Organizations appear to be identifying people with the necessary background, experience and aptitude to develop them into measurement masters. An example comes from GSP&L, where the position of an "application expert (AE)" has been created. People in these positions interface with the builders and users of the measurement system, helping them alleviate problems encountered during their interaction with the measurement system. AE's were typically Industrial Engineers, Statisticians and Human Resource specialists. Most of them also possessed a background in Computer Science.

So far the discussion has focused on who is qualified to implement a strategy for education. Now let's focus on how this needs to be done. Recall that most data sources strongly supported the need for a roadmap for the entire measurement effort. By a roadmap I mean an "agenda" or a "grand strategy" for the effort which depicts and describes what needs to be done at each stage, why it should be done, how it should be executed and who needs to be involved at each stage. This is a critical initial design parameter for the measurement effort and the strategy for education should be crystallized and incorporated in it. The following points would indicate if this taken place: (a) the roadmap should reflect the transfer of appropriate theory and the development of appropriate skills (as related to process of measurement system development); (b) the roadmap should reflect and encourage constant contact between the measurement master and the client-group and finally (c) the roadmap should be extend over a sufficient period of time so as to enable each phase of the process to implemented effectively.

5.3.3: Knowledge and Skills Required

This section presents the important areas of expertise required to build and maintain a measurement system. The people who have been designated as measurement masters should be one group who should acquire and/or possess the expertise. The question of who else
should acquire it is a design issue and would depend on the plan for the measurement effort. The data collected during this research supports several of the areas of expertise identified by Tuttle and Sink (1989). These authors have drawn attention to the need for:

(a) in-depth knowledge of conventional measurement systems in addition to in-depth knowledge of the state-of-the-art.
(b) broad and deep knowledge of measurement, ranging from personnel testing, psychometrics to macro-economic analysis and productivity measurement at the industry and national level.
(c) excellent problem-solving skills, interpersonal skills, exploratory data analysis skills and professional communication skills.
(d) good ongoing relations with all segments of the organization.

(a) and (b) essentially echo the points I had made earlier in Section 5.3.2 about the need to communicate the new, emerging paradigm about measurement; its basis, the theory which it proposes, its importance in the overall business operation and its potential advantages for the organization. Much of this awareness building needs to be done before actually embarking on the measurement effort and being involved in its methodological aspects.

Knowledge of and skills in using data collection and analysis tools have also been found to be important. The measurement methodology or process should provide sufficient opportunity for the participants in the effort to acquire this knowledge and skill. The implementation strategy reflected by the GMM appears to assume that the measurement masters and/or the users are familiar with data gathering tools such as checksheets and statistical data analysis tools such as graphs, histograms, pareto charts, cause and effect diagrams, scatter diagrams and control charts. According to GSP&L, "...Eighty percent of all problems can be solved by using the check sheet, pareto-diagram and the cause and effect diagram." Keep in mind that these are GSP&L's "problems" and are related to ensuring customer satisfaction. Different measurement systems probably have different combinations of tools to convey the required
information. It’s important to understand what these tools are, why they are useful, what they look like, how they are used and when they are used.

5.3.4: Importance of Critical Initial Parameters

The definition of "critical initial parameters" is the most important step toward ensuring that the measurement system which is developed serves its basic function; provide required information to its audience. The first "result" in Table 5.1 reports that an important measure of success for the installed measurement system is how well a few critical initial design parameters are thought through. These parameters include the identification of: (a) the purpose of the measurement effort, (b) the unit of analysis which is being measured, (c) the measurement team within the unit of analysis and (d) the intended audience for the information generated from the resulting measurement system.

The definition of the purpose of measurement and ensuring a common understanding of it is important. The major decision in this regard would be whether measurement was being considered to gain control or to seek performance improvement. Deliberation on the "purpose" should not end with this basic definition. As mentioned in Chapter 2, although the phrases "measurement for control" and "measurement for improvement," are conceptually appealing they have to be clarified and elaborated upon while defining purpose. First, it should be pointed out that gaining control is an important and perhaps dominant purpose of measurement. Improvement which is the emphasis of this research is another important purpose. Just as in a way one practices situational leadership, organizations should also practice situational measurement. Second, what does "gaining control" and "seeking improvement" operationally mean for the organizational unit being measured? These are important issues to be thought through while defining purpose. They appear deceptively simple to do but in reality, that may not be the case. Another critical initial parameter which goes hand-in-hand with the definition of purpose is the definition of the unit of analysis. This calls for a strategy to identify the system to be measured, as well as its boundaries. Input-Output Analysis (detailed in the modified GMM in the next chapter) is an effective tool to do this.
The definition of purpose and unit of analysis, if done well, should reflect two other important initial critical parameters; the specific audience and the answer to the question, "what is to be measured?" Identifying the specific audience is usually a difficult task and typically shows who should get involved in the measurement effort. An issue to be considered while choosing a specific audience or group is whether it is "homogeneous" or "heterogeneous." This research has shown that measurement systems are designed for both groups. However, there appears to be a difference in each case. A measurement system designed for a group of people who have similar decisions to make (a homogeneous group) tends to have measures that support decision-making. A measurement system designed for a group of people who have dissimilar decisions to make (a heterogeneous group) tends to have measures that are "nice to see."

Does this mean that a heterogeneous group (as defined above) does not have common decisions to make? Probably not. Heterogeneous groups can develop measurement systems that support decision making. They can if and only if a clear definition of "what is to be measured" is made. In homogeneous groups this definition is easier to make than in heterogeneous groups. Examples of both types of groups were found during this research. IPC, for example facilitated measurement sessions with several heterogeneous groups (that consisted of people who had dissimilar decisions to make) and initially found it difficult to identify what needed to be measured. In an attempt to resolve the problem, measures were developed for the "desired outcomes" of the organizational system being measured. This seemed to work better since the members of the group could relate to the desired outcome; and were comfortable with the fact that the measures were being tied to something that was important to them.

In Acme, a heterogeneous group in the ME department was attempting to track a common list of measures, hoping they could all make decisions based on the information these measures portrayed. As explained, this did not work very well for the following reasons. First, the heterogeneity of the group wasn't recognized; second, the procedure to arrive at a common list of measures was perhaps not the right one and hence, the measures themselves
weren't the right ones. My conclusion is that they did not ask the question, "What needs to be measured for our (heterogeneous) group so that we make decisions with the support of the measurement system?"

5.3.5: Developing Measures

All data sources reflected the use of structured group processes at some point in the respective measurement efforts, to develop measures. IPC, while facilitating measurement sessions used the Nominal Group Technique to generate measures. In GSP&L, indicators were developed for the quality elements through brain-storming. Where facilitating the group processes was concerned, the need for a trained person was clear. However, there were subtle differences in views as to how the facilitator needs to approach the task.

A more important issue related to the development of measures is captured in the fourth point in Table 5.1 which states:

"The 'Key area-Information need-Measure' relationship should be understood and applied to the measurement system development process. Measures need to reflect the information needs of the users of the measurement system regarding key areas of performance. Information from the system should aid decision-making."

The information this result is trying to communicate is the following. During the development of measures, the management team needs to make sure that they (the measures) are not generated using a what GSP&L calls a "light-bulb" approach to generating measures. Recall that during the initial stages of the "management indicators process" in the utility, indicators that were developed were not tied to anything specific. Ideas or requests for indicators came in from several parts of the organization. In several cases the time and effort spent to develop these indicators were wasted since they reportedly, did not communicate useful information to the users (those people who had the idea or made the request in the first place). Similarly in Acme measures were generated on the basis of the following task statement; "Generate performance measures for the Manufacturing Engineering Group." Once again this was a "light-bulb" approach to the development of measures. In other words, there was no evidence that the measures generated were based on what was perceived as important to the members of the ME department.
An attempt to resolve this problem resulted in the finding stated above. It was stated earlier that the most important function of the measurement system is to provide information to the user. Two things should be noted about this "information." First, the information need should be stated clearly by the user(s) of the measurement system during its design. Second, the information need should belong to an area of importance to the user(s) of the system. The identification of "key areas" is critical. It can also be challenging for a couple of reasons. First, identifying these areas will not be as easy as it sounds. Being able to articulate them clearly would depend on the talent of the measurement master as well as how well the user(s) are able to analyze the existing situation and focus in on their specific problem areas. Second, for the measurement system to be accepted and therefore useful, the list of information needs will have to be as representative as possible of the group's actual requirements. This second challenging factor calls for a high degree of consensus between group-members regarding the final list; it is not clear whether the NGT can engineer the consensus to the extent required. However, it appears to be a useful first step. Further analysis of the output from the NGT (prioritized list of information needs) will be required to ensure a fit between the audience and the final list of information needs.

5.3.6: Data Management

"Data Management" in the context of the measurement system design, development and implementation includes five distinct steps: identifying data requirements, locating data sources, assigning accountabilities, devising data-collection methods and finally the actual process of collecting data. The third step "accountability assignment" which is difficult to implement focuses on the following issues: Who will continue to reliably, accurately, and in a timely fashion collect the required data? Who will continue to ensure that information is portrayed in a timely and effective fashion? Who will be accountable for keeping the charts current? The actual assignment of a person or a team to address the questions above in not the central issue. This could be done during a measurement session. As demonstrated by two of the case studies, the problem lies in doing what this step proposes. In a target system where everybody has work to do, deadlines to meet and crises to cater to, asking people to collect and
contribute data to feed the measurement system is indeed a difficult and sensitive issue.

The insights provided by the data sources indicate that three factors determine whether or not "data management" is implemented effectively: (a) discipline, (b) belief in the measurement system and the effort and (c) amount of resources allocated for data management. The third factor is particularly important. IPC and Acme faced difficulties during data management while GSP&L did not because of the resources committed by GSP&L to this stage of measurement system development. Resources were in the form of a whole department involved in the implementation of the five steps of data management listed earlier. However, in IPC and Acme the allocation of comparable resources was infeasible due to size of the organizational unit and its resource availability. It appears more likely that most organizations during the initial stages of a measurement effort, when the results are not yet visible, would be skeptical about allocating abundant resources to the effort. In other words, the measurement system and the effort would have to earn its resources. The more it becomes a part of the management process of the organization and the more result-oriented the system becomes, the natural tendency perhaps would be to divert more and more resources (as appropriate) for the continual improvement of the system.

In the absence of further information on "data management" from the study so far, I turned to the literature for more insights. This search was also instigated by a belief that "data management" could not be as straightforward as it had appeared so far. I was sure that a person evolving into a measurement master would need to know more about issues concerning data, besides identifying data requirements and locating data sources. As a result of this quest, I found that Organization Development (OD) literature discusses data as a tool for organizational change but acknowledges that the knowledge available is limited. Quite a bit of emphasis has been placed on planning to use data for what Nadler (1977) calls "feedback activities." Critical issues include: (i) Relationship building/contracting for the change effort, (ii) Planning what data to collect and strategies for collection, (iii) Planning use of data, and (iv) Planning the assessment of the change activities.
Among these four issues, the second concerns the "data management" phase of the measurement system development process. According to Nadler, there are many types of data that can be collected in an organization; "...the possible range and volume of data that might be used for diagnostic and intervention purposes is staggering." Hence, the choice of which data to collect and which to ignore is an important one. Considering the measurement effort as a "change activity," the selection of the type of data to be collected has been facilitated by the previous steps of the effort.

The next step is to focus on those things to be borne in mind during the actual data collection process. A measurement system would require different types of data from different sources. Some of the data would be readily available in the existing information systems of the organizational unit (accounting, inventory, etc.) and other records; some other data would have to be collected from the members of the organization. This discussion is based on the latter type of data. Nadler summarizes his thoughts on data collection in the following quote (keep in mind that data are being collected to provide feedback). Measurement masters should learn from his wisdom.

"Data collection is not a neutral or a benign act. It is an intervention into organizational life and therefore needs to be planned for and conducted carefully. If done well, data collection can yield valid information while helping to build energy toward the feedback activities. If done poorly, data collection can create mistrust and suspicion and yield worthless data. The critical task is contracting. The consultant needs to identify who he or she is, create expectations that the data collection effort will yield payoffs, and finally build a bond of trust between him or herself and the respondents."

According to Nadler, two specific questions need to be considered when thinking about gathering data in organizations.

1. What is the (measurement master/team) trying to achieve during the period of data collection?

2. What kind of process should be used for data collection in order to meet those goals?

In response to the first question, the most important objective is to gain accurate, reliable and complete data. Beyond this, the data collection process can be used for consciousness raising; getting people thinking about issues concerning them and the organization. It can also
help build energy that is geared and directed toward using the measurement system. Finally, it can shape expectations that improvement is actually going to take place.

Where the process of collecting data is concerned (second question above), Nadler reports that in general, people in organizations like to provide data because it makes them feel their observations and feelings are valuable and that others value them also. These people are motivated by the hope that sharing data would bring about "positive change" in the organization. On the contrary, the data collection process can also result in discomfort for the individuals sharing data. This discomfort usually becomes fear and anxiety when the nature of data is "critical or threatening." Also a general distrust of management may also contribute to the anxiety. These reactions from the people can be alleviated by building what Nadler calls a "Data-Collection Contract." His description of the contract tends to be of the kind which clarifies the role of the "external consultant" and focuses on who this person is, what he's looking for, who he works for, whether he can be trusted, etc. However, for a measurement system which is being developed by a group of people belonging to the organization and for which the data would probably be available with the people themselves, the issue of confidentiality may not be as critical but would probably be significant enough. Hence a modified form of the "data-collection contract" could be designed to alleviate or eliminate any anxiety involved.

5.3.7: Other Supporting Information Gained from Research

5.3.7.1. Personal Measurement Systems: The last "result" in Table 5.1 states that

"Even in the presence of formal and effective group measurement systems, informal and personal measurement systems do exist at the individual level and are considered important."

IPC and Acme revealed that certain individuals relied on personal measurement systems to give them insight into their respective jobs. Some of them had already established these systems and had been using them. Some others were in the process of developing them. Essentially these systems delivered information to the user. In almost all cases the systems were referred to as "records." These records tended to be a part of the individuals' personal files and reflected past, present and predicted future information requirements. Personal measurement systems can have a couple of purposes. In some cases, information from this
system was used to report progress to the boss. Others indicated that they were "putting together a report" for themselves and it would contain pieces of information they needed in their daily work.

5.3.7.2. Measurement Terminology: A universal terminology for measurement is not evident in the results. Each data source appeared to adopt and use its own measurement terms. IPC and Acme faced difficulties while attempting to capture the actual meaning of terms. Other data sources (GSP&L and the literature) had their own informal measurement dictionaries and appeared consistent in using it. It is not clear if the measurement terminology in the literature had evolved over time or designed right the first time. Differences in terminology were noticed when an attempt was made to compare two or more data sources. In IPC for example, a "measure" does not refer directly to an "indicator." However, in GSP&L and two methodologies in the literature, "measures" and "indicators" were used interchangeably. The expert panel suggested that a universal measurement terminology does not exist and an organization would be better off using its own measurement dictionary.

5.3.7.3. Pilot Study while Implementing Measures: Once the measures have been generated, it would be advantageous to conduct a "pilot study" for their implementation. The sixth result in Table 5.1 states that

"The initial curiosity of the audience of the measurement system can be used to the system's advantage. Begin by selecting one or two critical measures to implement. Demonstrate that the system can actually generate useful information without significant delay."

Hence this study has shown that managing data for the entire list of measures generated can become quite cumbersome. In addition, as reflected in the result above, I observed that measurement efforts often failed because the participants in the effort were not able to "see" results. The pilot study is recommended to address these issues. It will establish credibility, be exemplary and also create and possibly sustain enthusiasm to work on the rest of the measures.
5.4. Summary of Results

The preceding subsections have described in detail the results obtained from this research. Tables 5.1 through 5.3 summarize the results from each of the three data sources. Table 5.4 attempts to synthesize the results from each data source. It gives an overall picture of the results as well as indicates the origin (data source) of each result. In addition Table 5.4 also indicates whether or not a result has been developed and built upon by the author.
Table 5.1: Results from the Case Studies

1. The GMM refers to the creation of suitable climate before embarking on a measurement effort. The climate in this context is necessary and useful. However, its creation is a difficult and time-consuming task and is usually tied to the organization's overall performance improvement process.

2. An important measure of success for the installed measurement system is how well a few critical initial design parameters are thought through. These parameters include the identification of: (a) the purpose of the measurement effort, (b) the unit of analysis which is being measured, (c) the measurement team within the unit of analysis and (d) the intended audience for the information generated from the resulting measurement system.

3. Information from the case studies reveals that measurement systems need to consider financial as well as non-financial measures as well. However, at a given time, certain selected criteria of performance may be more important to measure than other criteria. This will be evident in several aspects (number of people involved, amount of resources allocated, direction set by top management etc.) of the organization's measurement efforts at that time.

4. The "Key area-Information need-Measure" relationship should be understood and applied to the measurement system development process. Measures need to reflect the information needs of the users of the measurement system regarding key areas of performance. Information from the system should aid decision-making.

5. Few organizations can afford to devote sufficient resources specifically for a measurement effort. In most cases the activities involved in the development of the measurement process needs to be accomplished by members of the organization themselves. A conflict arises since these people already have other duties to perform. If this conflict is not managed well, resistance to the measurement system can result.
Table 5.1 (Cont'd): Results from the Case Studies

6. The initial curiosity of the audience of the measurement system can be used to the system's advantage. Begin by selecting one or two critical measures to implement (pilot study). Demonstrate that the system can actually generate useful information without significant delay.

7. The nature of various types of data and ways to manage them effectively are important elements of a measurement system. An understanding of the types of data as well as data collection and analysis tools (by the users/designers of the system) lend strong support to the success of the measurement system.

8. People with specific knowledge and skills are required to facilitate the process of designing, developing and implementing the measurement system.

9. The people participating in the measurement effort should receive appropriate "education" at all stages of the effort. Education in this context includes transfer of knowledge as well as skill development.

10. A universal terminology for measurement is not evident in the results. Each case study appeared to adopt and use its own measurement terms.

11. Measurement system design, development and implementation is a long-term effort and should be viewed as one. One of the first critical steps is to design a roadmap for the effort.

12. Even in the presence of formal and effective group measurement systems, informal and personal measurement systems do exist at the individual level and are considered important.
1. Performance needs to be viewed a multi-dimensional.

2. Knowledge to develop the measurement system exists with the users of the system.

3. The unit of analysis and the measurement team within it should be clearly defined.

4. The role(s) of the facilitator and/or measurement master should be clarified.

5. An "agenda" for the measurement effort needs to be formulated.

6. Identify measures for "processes" and "areas" that are important to the unit of analysis and the measurement team. Begin with a few measures.

7. Cost/benefit analysis applies to data availability also. Creating a whole data gathering system for one minor measure should be resisted.
<table>
<thead>
<tr>
<th>Design and Development</th>
<th>Implementation</th>
<th>Outcomes &amp; Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clear definition of the group.</td>
<td>1. Make sure implementation is carried out by the group and its &quot;natural leader.&quot;</td>
<td>1. Understand that some measurement systems support evaluation of employee performance and modification of employee behavior in ways which will benefit the organization.</td>
</tr>
<tr>
<td>2. Definition of purpose, plan direction</td>
<td>2. Use results in ways that are useful or beneficial to all concerned.</td>
<td>2. Effective measurement systems support decisions which generate cost savings or cost-effective performance which greatly exceeds the cost of maintaining the system.</td>
</tr>
<tr>
<td>3. Focus on improvement orientation.</td>
<td>3. Be aware that the first management action based on the newly-installed measurement system is critical. Recognize that in the beginning, poor performance may be reflected. This should be weathered out.</td>
<td>3. Effective measurement systems give employees a sense of knowledge of their own performance, and that management also knows their performance.</td>
</tr>
<tr>
<td>4. Make sure measures are not designed to become a &quot;license for meddling.&quot;</td>
<td>4. Tie formal and informal rewards to what is being measured. Be aware in most organizations reward systems are well-entrenched and do not change with a new measurement system.</td>
<td>4. In the short-term, there may be no consequences for not measuring. In the long term, failure will result.</td>
</tr>
<tr>
<td>5. Keep in mind that white-collar workers are hard to control; but they can be fairly easy to inspire with sensible propositions.</td>
<td>5. Incorporate measurement as part of management goal to achieve mission.</td>
<td>5. Organizations have few, if any measurement systems. Most of these are &quot;terrible&quot; and are usually put to counterproductive uses.</td>
</tr>
<tr>
<td>6. Distinguish between top management &quot;empowering&quot; the effort and being involved in the effort. Sometimes &quot;empowered&quot; staff groups need to proceed on their own.</td>
<td>6. A measurement system must be implemented with the support of levels.</td>
<td>6. Measurement systems should provide valuable information to strategic planners.</td>
</tr>
<tr>
<td>7. Do a thorough analysis of the group: mission, products, services, customers etc. Treat group as an &quot;independent business.&quot; Develop measures participatively. Make sure they reflect what is most important to the group.</td>
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<tr>
<td>8. Be prepared to do a lot of initial adjustment as well as continuous monitoring.</td>
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<tr>
<td>9. Ensure linkage between measures and behavior.</td>
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</tr>
<tr>
<td>10. Think through &quot;measurement team.&quot; Clarify meaning of measurement master.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Understand measurement is a natural part of the business enterprise.</td>
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<tr>
<td>Table 5.4: Summary and Synthesis of Results</td>
<td></td>
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<tr>
<td>------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IPC</strong></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>ACME</strong></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>GSP&amp;L</strong></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Literature Review</strong></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Expert Panel</strong></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Developed by Author</strong></td>
<td>D</td>
<td>D</td>
</tr>
</tbody>
</table>

- **Minim. part of improvement process**
- **Satisfying climate for mnst**
- **Role of top management**
- **Guidelines for participation**
- **Education: Knowledge and Skills**
- **"Agenda": crystallized Strategy**
- **Role of facilitators/mentor**
- **Effect of org./size/resource**
- **Effect of measure team interaction**
- **Terminology w.r.t. measurement**
- **Priorities for implementation**
- **Definition of Purpose**
- **Definition of Audience**
- **Definition of Team Composition**
- **Measurement of Key Areas**
- **Issues Concerning Measures**
- **Reflect Key Areas**
- **Process of developing them**
- **Measurement of performance**
- **Providing information**
- **Aiding measures**
- **Data Management**
- **Developing and improving methodology**
5.5: Closure

This chapter has presented the results from this research effort. It began by discussing the challenge involved in generating an improved GMM by incorporating the results. It was recognized that communicating the information gained about measurement is perhaps as important and valuable as using it to build a new model of measurement. Due to this reason, the format of the results in section 5.2 has taken the form of lessons learned and information gained about measurement. Each result was explained in detail following which the results from individual data sources were summarized and presented in tables.

The next chapter uses the information presented in this chapter supplemented by the author's own ideas to generate a roadmap for effective measurement system design, development and implementation. A pictorial representation of what this roadmap would look like is also presented. Areas for future research are also identified.
6. CONCLUSIONS

6.1. Actual Conclusions versus Planned Conclusions

This thesis had proposed to develop, depict and describe an improved version of the GMM as an output. The roadblocks associated with this task were explained in the previous chapter. These roadblocks combined with an absence of an opportunity to verify the improvements suggested for the GMM has led to a revision of the strategy to present this chapter on conclusions.

In place of an improved GMM, this chapter will now share with the reader the steps or a roadmap that might be considered during the design, development and implementation of a measurement effort. This roadmap is the author’s understanding of the steps toward measurement system implementation and is based on information gained and lessons learned during the course of this research.

6.2. The Roadmap has Three Stages

Table 6.1 shows that during a measurement effort there is a "diagnostic" stage which precedes a "design and development" stage which in turn precedes the successful implementation of the measurement system. The steps within each stage are not carved in stone; because of the unique nature of different organizational units, flexibility must be built in to the procedure or method to design, develop and implement a performance measurement system. That is the main reason why the development of a methodology which incorporates the roadmap in Table 6.1 can be a challenging task. The next two sections elaborate on the points made in Table 6.1.
Table 6.1: Steps Toward Effective Design, Development and Implementation of Measurement Systems

<table>
<thead>
<tr>
<th>DIAGNOSIS</th>
<th>DESIGN AND DEVELOPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Skill application of professional modes of functioning.</td>
<td>1. Continued application of professional modes of functioning.</td>
</tr>
<tr>
<td>2. Identifying the customer(s) of the measurement effort.</td>
<td>2. Continued assessment of the climate for measurement.</td>
</tr>
<tr>
<td>3. Assessing the level of knowledge about measurement particularly in relation to measurement for improvement.</td>
<td>3. Continued assessment of resource availability for the measurement effort.</td>
</tr>
<tr>
<td>6. Evaluating past trends with respect to performance improvement interventions.</td>
<td>6. Transfer of knowledge and skills.</td>
</tr>
<tr>
<td>7. Identifying existing measurement systems: formal, informal and personal measurement systems.</td>
<td>7. Constant contact between measurement-master and the client-group.</td>
</tr>
<tr>
<td>8. Understanding the unit of analysis.</td>
<td>8. Definition of unit of analysis and purpose.</td>
</tr>
<tr>
<td>9. Understanding the purpose of measurement.</td>
<td>9. Identification of key areas.</td>
</tr>
<tr>
<td></td>
<td>10. Definition of measures.</td>
</tr>
<tr>
<td></td>
<td>11. Selection and application of appropriate techniques for information portrayal.</td>
</tr>
<tr>
<td></td>
<td>12. Data Management.</td>
</tr>
<tr>
<td></td>
<td>13. Experimental approach to measurement (pilot study implementation).</td>
</tr>
<tr>
<td></td>
<td>14. Evaluating usefulness of information generated; appropriate modification and improvement of the measurement process.</td>
</tr>
</tbody>
</table>
6.3: Diagnosing Existing Conditions

Measurement system design, development and implementation should begin with a diagnosis of the existing environment. Environment in this context refers to the unit of analysis being considered and the conditions under which the need for a measurement system has been expressed. This diagnostic stage should typically occur before the start of the "methodological" issues related to the development of the measurement system. Essentially, during this stage, one is attempting to identify the forces for, the forces against, the strengths and weaknesses of that particular organizational unit with respect to the proposed measurement effort. The primary activity is the collection of data regarding several key issues that would help the developers recognize those factors that could be supportive as well as those that could be non-supportive of the measurement effort.

The diagnostic stage, by and large does not "change" or make an intervention on the organizational unit under consideration. The main advantage of this data collection process is that it enhances the preparedness of the organizational unit to proceed to the next stage of the measurement process. Other advantages of diagnosing include: (a) exposes points of leverage for the measurement effort, (b) exposes areas that are beyond the control of the organizational unit and in the presence of which the measurement effort has to take place, (c) predicts stages of potential difficulties, (d) determines resistance to change and in general plays the role of a catalyst in the success of the implementation of the measurement effort. I have identified the following parameters or critical issues that may be considered during the diagnostic stage. These have been discussed in the previous chapter. The parameters are:

1. Assessment of the climate for measurement,
2. Understanding purpose,
3. Identifying existing measurement systems; formal, informal and personal,
4. Understanding unit of analysis,
5. Identifying the customer of the measurement effort,
6. Assessment of resource availability,
7. Recognizing the existing level of knowledge about measurement particularly in relation to measurement for improvement,
(8) Assessing trend in the past of the response to performance improvement interventions, and
(9) Skillfully assuming professional modes of functioning (data-gatherer, acceptant-listener, challenger etc.),

6.4. Toward a Roadmap for Measurement System Design and Development

The objective of this section is to generate a description of the critical issues listed under the "design and development" stage in Table 6.1. This description is to facilitate a better understanding of how these critical issues can be put to practice. In addition it also helps explain how the issues relate to each other with respect to a measurement effort. Figure 6.1 is a representation of these relationships. It should be reiterated that no attempt has been made here to compare the roadmap described below with the General Measurement Methodology.

The purpose of the following pages is to incorporate the information gained from this research and describe for a performance measurement system, a design and development procedure which would support the successful implementation of the system.

6.4.1. Identification of Critical Initial Parameters

The First Design Session (FDS) is conducted to define the critical initial parameters for the measurement system. Who should attend the FDS? The response to this question depends on the target system or unit of analysis being considered. At the least, the measurement master(s), the top manager of the target system and one or two key members should attend. In the event that the measurement master is external, a person from the client group should be selected to work closely with the measurement master throughout the effort. The selection of the key members should be done carefully; because we are assuming that if the decisions made during the FDS are agreeable to the key members, they may be agreeable to the client group as well. This is a risky assumption to make and hence the greater the number of key members present in the FDS, the better.
Figure 6.1: Pictorial Representation of a Roadmap for a Measurement Effort
The FDS should first of all clarify the expectations of the key members. These expectations should as far as possible be representative of the client-group's expectations. The intent behind clarifying expectations is to clearly define the purpose of the measurement system. The definition of purpose, if done well, should reflect two important items; the specific audience and the answer to the question, "what is to be measured?" The audience issue should address the unit of analysis. Clearly identify the target system which is going to be measured as well as its boundaries. The top manager and key members should support the measurement master in identifying the specific group within the target system as well as its composition. Determine the extent of homogeneity or heterogeneity of the group and examine the decisions that will be made by the group on the basis of information from the measurement system. In response to "what is to be measured?"

The FDS could also be used as an opportunity to develop "key areas" for which measures are to be generated. Once again, this becomes a sensitive issue if there is inappropriate or low participation during the FDS. The development of key areas can be accomplished by brain storming if the FDS group is small (< 5) and by using the NGT if the group is larger. The next step is to identify information needs for each key area (Please see section 5.3 for a description of the importance of this step). The FDS will not be the appropriate time to do this step since more participation from the client-group is required. Hence it may have to wait until a later stage of the measurement effort. Keep a close watch on the number of key areas generated since too many of them will lead to the generation of a large unmanageable set of measures.

6.4.2. Development of a Plan for the Measurement Effort

The FDS should also develop an "agenda" or a plan for the entire measurement effort. An example of an agenda is presented in Table 6.2. As can be seen, the first cycle of the measurement effort is designed to have seven elements; FDS, Priming Session, Client-Group Preparation, 3-day Measurement Session, Pilot Study, System Monitoring and Review Meeting. There are two more design sessions that are conducted at periodic intervals. Please note that this is an example of an agenda and a starting point. The measurement master and the client group may want to modify and adjust it according to specific requirements.
<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 4</td>
<td><em>First Design Session (FDS)</em></td>
</tr>
<tr>
<td></td>
<td>• Expectations</td>
</tr>
<tr>
<td></td>
<td>• Purpose</td>
</tr>
<tr>
<td></td>
<td>• Unit of Analysis/Audience</td>
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<tr>
<td></td>
<td>• Key Areas and information needs regarding these areas</td>
</tr>
<tr>
<td></td>
<td>• Expected Results</td>
</tr>
<tr>
<td></td>
<td>• Planned use of Results</td>
</tr>
<tr>
<td></td>
<td>• Tentative Dates for the measurement effort</td>
</tr>
<tr>
<td></td>
<td>• Strategies for Education (Theory and Skills)</td>
</tr>
<tr>
<td>Jan 15</td>
<td><em>Priming Session</em></td>
</tr>
<tr>
<td></td>
<td>• Communicate output from FDS to rest of client-group</td>
</tr>
<tr>
<td></td>
<td>• Focus on expected results and planned use of results</td>
</tr>
<tr>
<td></td>
<td>• Overview of Agenda</td>
</tr>
<tr>
<td></td>
<td>• Communicate Agenda for Education</td>
</tr>
<tr>
<td></td>
<td>• Instructions for Measurement Session Preparation</td>
</tr>
<tr>
<td></td>
<td>• Assignment of &quot;home-work&quot;</td>
</tr>
<tr>
<td>Jan 15-Feb 15</td>
<td><em>Client-Group Preparation</em></td>
</tr>
<tr>
<td></td>
<td>• Familiarization with material distributed during Priming Session</td>
</tr>
<tr>
<td></td>
<td>• Organizational Systems Analysis† (Mission, Vision, Input/Output Analysis)</td>
</tr>
<tr>
<td>(Feb 1st week: Second Design Session)</td>
<td></td>
</tr>
<tr>
<td>Feb 16</td>
<td><em>Measurement Session Day 1</em></td>
</tr>
<tr>
<td></td>
<td>• Review OSA Output</td>
</tr>
<tr>
<td></td>
<td>• Discuss questions and comments from client group</td>
</tr>
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<td></td>
<td>• Review key areas</td>
</tr>
<tr>
<td></td>
<td>• Develop and Audit Measures</td>
</tr>
<tr>
<td>Feb 17</td>
<td><em>Measurement Session Day 2</em></td>
</tr>
<tr>
<td></td>
<td>• Education: Use of Portrayal Formats</td>
</tr>
<tr>
<td></td>
<td>• Form Design Teams</td>
</tr>
<tr>
<td></td>
<td>• Select Appropriate Technique (s)</td>
</tr>
<tr>
<td></td>
<td>• Education: Data Management</td>
</tr>
<tr>
<td>Feb 18</td>
<td><em>Measurement Session Day 3</em></td>
</tr>
<tr>
<td></td>
<td>• Identify data requirements</td>
</tr>
<tr>
<td></td>
<td>• Location of data sources</td>
</tr>
<tr>
<td></td>
<td>• Accountability assignment</td>
</tr>
<tr>
<td></td>
<td>• Devise data collection instruments</td>
</tr>
<tr>
<td></td>
<td>• Procedure for documentation and use session output</td>
</tr>
</tbody>
</table>

† Please see Appendix E for a description of Organizational Systems Analysis.
Table 6.2: Example of an Agenda (cont'd)

Feb 20-April 20  
*Pilot Study*  
- Selection of measures  
- Implementation  
- Periodic presentations and review meetings  
- Discussion of roadblocks and problems  
- Measurement Master-Client Group Contact to review, coach and counsel

(April 2nd week: Third Design Session)

Apr 20-May 20  
*System Monitoring*  
- Document strengths and weaknesses  
- Is there trend? Does it help?  
- Audit against purpose and audience. Are initial goals being met?  
- Modify as necessary  
- Measurement Master-Client Group Contact to review, coach and counsel

May 25  
*Review Meeting*  
- Discuss Results  
- Modify as necessary  
- Plan next steps  
- Introduce rest of measures  
- Measurement Master-Client Group Contact to review, coach and counsel

May 25 onwards  
*Continuously recycle and modify as necessary*
Notice that two more elements in the agenda should be accomplished before proceeding to developing measures for key areas. These include "Priming Session," and "Client Group Preparation." Consequent to the FDS the measurement master along with the participants in the FDS should have a priming session with the client group. The output of the FDS should be shared with the group; in particular the expected results from the measurement system and planned use of results should be communicated. During this session, the measurement master should be introduced to the group and given an opportunity to get a "feel" for its members. This could be facilitated by organizing an informal meeting following the priming session.

Client group preparation can be done over a period of 2-3 weeks. This is to ensure that the members of the client group do not go into the forthcoming measurement session (see Table 6.2), "cold" or unprepared. Hand-outs distributed during the priming session should support client group preparation. They should contain a summary of the outputs from the FDS as well as an overview of the activities during the forthcoming measurement session. The person designated to maintain close contact with the measurement master could be assigned the task of coordinating one or two client group meetings before the measurement session; the purpose of which is to review the handouts and initiate a discussion to reveal areas where there is inadequate or insufficient understanding of the subject matter. The measurement master could be informed appropriately and he or she could plan the measurement sessions accordingly. In addition, client group preparation could also be include an "Organizational Systems Analysis (OSA)" exercise where the group "looks inward" and attempts to crystallize the target system's mission, vision and gets a complete picture of its inputs and outputs. Input/Output Analysis (IOA) is a critical part of OSA and throws light on the target system's upstream systems (internal and external customers, suppliers, vendors), inputs, processes, outputs, downstream systems (customers, internal or external) and outcomes (what are we trying to accomplish, how do we define success.) IOA in particular is useful in that the results from it can be mapped and compared to the Key Areas identified earlier. A first cut of a list of information needs for key areas should also be generated during this period.
The Second Design Session (SDS) has been built in to occur during client group preparation. The main purpose of the SDS is to facilitate measurement master-client group contact and to provide a forum for the members of the client-group to discuss what has been learnt during client group preparation. Areas of insufficient and inadequate understanding could also be clarified. In addition, the SDS could be used as an opportunity to once again prime the group on the forthcoming three-day measurement session.

6.4.3. Development of Measures from Information Needs

The list of information needs generated during "client-group preparation" should be reviewed and finalized. Based on these information needs, measures for each key area are developed. The Nominal Group technique could be used to generate a prioritized list of measures. Avoid generating a long list of measures. Keep in mind that there may be several key areas and information needs which would automatically result in a very long list of measures. There is no formula for the exact number of measures. Depending on the size, population and resource capabilities of the unit of analysis, the total number of measures could vary. It is simpler and more effective to have fewer working measures rather than a long list of idle ones. Remember that for successful implementation of each measure on the list, extensive resources are required in terms of time, money and effort.

"Breaking down" measures is an option at this stage. The purpose is to identify the "countable" the measure. This may not be necessary or as important as it has previously been, since three critical issues that support the direct identification of the "countable" has already been addressed. These are (a) the accurate definition of the unit of analysis, (b) the right selection and composition of the group and (c) the definition of "what needs to be measured. Measures need to be audited next. Define a purpose for the "audit," and make sure the right things are audited against each other. The seven performance criteria (effectiveness, efficiency, quality, productivity, quality of work life, innovation and profitability) are useful and they should be included in the audit but it's important to determine which of those criteria are important for a particular organizational system or a client group. I suggest that at the least, three audits should be done. First, the key areas should be audited against selected performance
criteria. Second, the measures generated should be audited against selected performance criteria. Third, the measures generated should be audited against the key areas. The last audit may appear redundant since measures were developed for developed for key areas. However, as demonstrated by GSP&L, this audit will help identify overlapping measures thus streamlining the system of measures.

6.4.4. Generate Methods for Information Portrayal

Here the focus is on identifying the techniques necessary to capture, store, retrieve, process and portray the data necessary to create the information required/specified by the client group. It is facilitated during the second day of the measurement session. In Table 6.2 (agenda), you'll notice that the second day begins with an educational session on "portrayal formats." This session transfers more skills to the client group than theory on measurement. It should be considered a part of the "skill-kit" in the measurement process. In the past, the tendency has been to assume that the measurement master's job is complete as soon as the measures are developed. However the results indicate that the process should support further measurement master-client group contact by communicating guidelines to select specific portrayal formats (graphs, charts etc.; see Section 5.3.3.) The client group should know why one particular format could convey more or less information than another. Actual examples should be a part of the "skill-kit" and these should be shared with the members of the client group.

A review of the agenda will reveal that the next activity on the second day of the measurement session is to form design teams. Who constitutes this design team? My recommendation is the entire client group needs to be aware of information portrayal tools and techniques, although only a subset of the group needs to be actually involved in selecting the appropriate tools and techniques. Using a subset has a distinct advantage in the context of the modified design of the methodology; the remainder of the group could form another subset to work simultaneously on "Data Management." This has been depicted in Figure 6.1. Once the design team has been defined, appropriate techniques for information portrayal have to be chosen based on the measures generated earlier.
6.4.5. Determine Ways to Manage Data

Data collection is only one of the activities involved in the management of data. While one subset of the client group (the design team) works on determining methods for information portrayal, another subset could work on data management (this is especially possible since information requirements have already been generated).

The agenda shows that the second day of the measurement session concludes with an educational session on data management. Just like the session on the use of portrayalal formats in the previous step, the session on data management is another effort to strengthen the strategy for education as well as the "skill-kit" in the measurement process. Once again, the focus is on the transfer of appropriate skills to the client group by the measurement master. Skills transferred should impact all the four elements of Data Management; identifying data requirements, data sources location, accountability assignment and devising data collection methods (see Section 5.3.6)

6.4.6. Do a Pilot Study with Selected Measures

Now is the time to adopt an experimental approach to measurement. Conduct a pilot study with about three measures. Begin by using the last day of the measurement session to: (a) identify data requirements for the three measures, (b) identify the sources of data for them, (c) assign accountabilities for each, and (d) devise data collection method(s) for each of the three measures. An important point here is to make sure that the measurement session performs each of the four steps above as completely as possible. At the end of it, the client group should be in a position to go ahead and conduct the pilot study.

The results of this research as well as personal experience at IPC has shown that managing data for the entire list of measures generated can become quite cumbersome. In addition, I also observed that measurement efforts often failed because the participants in the effort were not able to "see" results. The pilot study is recommended to address these two issues. I believe that it will establish credibility, be exemplary and also create and possibly sustain enthusiasm to work on the rest of the measures. As shown in the agenda, the pilot study should be
conducted by the client group with guidance from the measurement master. Midway through the pilot study, I have built in the Third Design Session (TDS). The purpose of the TDS is to facilitate measurement master-client group contact during this important stage. The TDS could be a half to one day session at the site of the pilot study. It should be used as an opportunity to review what has been done so far in the pilot study as well as discuss roadblocks and problems that have come up.

6.4.7. Confirm that the System is Generating Useful Information

The element in the agenda corresponding to this step in the measurement process is "System Monitoring" (see Table 6.2). The main objective of here is to critique the emerging measurement system. Begin to audit the information obtained against the purpose, audience and goals generated during the FDS. Determine if the information which is generated is actually useful in decision making. Also determine if there is a DRIP (data rich information poor) problem. Document all findings to review with measurement master. Depending on the results of "standing back" and surveying the measurement system, the rest of the measures can be gradually implemented.

6.4.8. Link to Improvement

Four steps constitute this step. These are: (a) Track information, (b) Review Key Area Performance, (c) Track improvement in key area performance, and (d) Modify as necessary. The agenda shows the corresponding element as "Review Meeting." This is one of several meetings which should be held by the client group with assistance from the measurement master as and when necessary. These meetings should also provide an opportunity for the recycling and modification of the measurement system. At this stage in the measurement effort, the client group should be able to continue its work with minimal guidance from the measurement master. Measurement masters should have evolved within the client group to maintain and constantly improve the measurement system.
6.5: Areas for Future Research

6.5.1. Using the suggested roadmap in implementing a measurement effort:

One of the major areas for future research is to use the roadmap described in the previous section to design and implement a measurement effort. Due to time constraints, this was not possible to do as a part of this research. Who should be the person to facilitate the development of the measurement system? I realize that this can be a difficult question to answer in the absence of a "measurement master" described earlier in this chapter. The conceptualization of the measurement master does not imply that a measurement effort cannot be initiated without such a person. It can if a person or a group of people in a target system is genuinely interested and empowered to begin the measurement effort. Using the suggested roadmap to design and implement a measurement effort would probably shed light on a couple of other potential research areas that this thesis has not addressed; (a) Gain a better understanding of the role of the measurement master, (b) Gain a better understanding of linkages to other measurement systems in the organization, and (c) Gain a better understanding of the different types of "visibility systems."

6.5.2. Better understand the role and attributes of a measurement master:

Although this thesis has attempted to clarify the role of the measurement master, it has not fully determined how a person can become one. Neither has it determined some of the specific skills needed by the measurement master. For example, while discussing Data Management, I referred to broad categories of skills required to execute this phase. One of them was the skill to construct, read and interpret a variety of statistical charts. However, the results of this thesis did not lead to recommendations more specific than that. Hence another potential area for future research which would have an impact on Data Management would be to identify as well as describe specific skills required by the measurement master and the client group to execute "data management."
6.5.3. Gain better understanding of linkages to other measurement systems:

This research area should examine how a measurement system developed by using the approach described in this thesis can interface with other measurement systems in the organization. In particular, it will be useful to study how the measurement system can be linked to both formal and informal rewards.

6.5.4. Gain better understanding of the roles of different types of "visibility systems":

Another potential area for future research is an examination of the roles of different types of "visibility systems." During the course of my research, I came across three major types; personal measurement systems, visibility boards and rooms, and indicator books. I attempted to determine if information in any one type was portrayed for a specific audience. In a couple of cases I observed that pieces of information in personal measurement systems could help more people if they had been portrayed in visibility rooms. As another example, I noticed indicator books (which had a bigger audience) in GSP&L caused concern among a few members because they felt confidential information was being shared. As a third example, there was the visibility board in Acme which did not draw any attention from its intended audience. How can we choose effectively between these available visibility systems?

6.6. Closure

As explained in the introductory sections of this chapter, the initial plan to conclude this thesis by presenting an improved version of the GMM has not been implemented. After analyzing the data collected and attempting to improve the GMM, the author, in conjunction with the advisor of this research effort altered the initial plan to focus more on presenting the information gained from this research effort rather than building a new measurement model based on this information. The previous chapter explains in detail the lessons learned. This chapter has attempted to use these lessons to develop an example of a roadmap for a measurement effort. Areas for future research have also been identified.
7. REFERENCES

7.1: References for Chapter One


7.2: References for Chapter Two


7.3: References for Chapters Three, Four, Five and Six


APPENDICES
Table of Contents for Appendices

Appendix A: Plan of Study ........................................ 187
Appendix B: Reflections on Thesis Effort ...................... 188
Appendix C: Example of Interview Transcript and Trip Report 189
Appendix D: Literature Review Reports and Consolidated Report 200
Appendix E: The 7-Step Planning Process ...................... 234
Appendix F: The ME Department's Measures ................. 241
Appendix J: List of Members in the Expert Panel ............ 324
### APPENDIX A
**Plan of Study**

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**TOTAL** 56 (Qtr. Hrs) 6 (Sem. Hrs)
APPENDIX B
Reflections on Thesis Effort

- I enjoyed working on this thesis most during the last stages; when results began to emerge. I don’t know if this is the case with most thesis efforts. In retrospect, I think I might have enjoyed it more had I been more disciplined.

- Discipline plays a very big role in studies of this nature where huge amounts of data are collected in the field and brought home. Before you know it, that little file you had has grown at an incredibly fast pace. This is not a new finding; almost any book on qualitative data analysis will tell you to begin using the data you have from Day 1.

- I quite enjoyed the nature of this research. I think being out in the field blends with my personality type. I would have, at any time, preferred this type of study to a laboratory setting.

- Analyzing field data has a reputation of being hard to do. I agree; but I must also add that there are techniques available to do a good and satisfying job of figuring out what all the data means. No matter how much you read about qualitative data analysis, its actual power will be visible only after you’ve spent several frustrating hours with interview transcripts, trip reports, and other documentation. Keep looking. There are many gems of wisdom between those lines.
APPENDIX C
Selected Interview Transcripts and Trip Reports

Acme Interview #1

Roanoke, VA.
6 March 1989
0930-1130

JIM: As we had discussed we have another interesting anomaly in this whole process. You know, what behavior are we rewarding, regarding how you want to measure yourself against the normal industry. What's really important at the end of the year or the end of the quarter whatever the case might be, is the behavior the company has decided to reward. So when we got done talking, basically we are basically measuring operating income, ROA, Delta sales and some relationship of those which constitute profit growth plan (PGP) so whether our output or whether output per direct labor employee or output per indirect labor employee is X, Y, or Z relative to the world, if we're making more money than last year and if we're being rewarded against that then all the measurements in the world don't mean anything. It is my belief, looking at American industry that we tend to grow our businesses people-wise when things are good regardless of what the implications are; we want growth, growth becomes important and the only way you can get growth is to throw people at the front end of your organization. For a long period you get into a situation where those people are not returning anything to the business because they are just looking at new businesses, developing new businesses and you are carrying all that overhead and they are not returning anything and they might not for five years and that might have a devastating impact on the business itself because if the rest of the business that's supporting all this turns down, you really have a serious situation. Another thing is you're so close to it and you look at these measurements and you know exactly everything what causes what happens there whether they are important or just historical occurrences.

HARI: Historical occurrences?

JIM: Changes in the organization, changes in the market, changes in the supplier cost, a big order that comes in that's not going to be shipped till a year later and you collect all this inventory and when you ship that big blip leaves the graph.....

GARY: My goal was to take whatever current measurements we want to take, OI, Cost ratio or ROI or the three of them, and break them into elements and show what elements are making it good today and what elements are restricting it from being better than it is today

JIM: See, that's different; you are talking about using measurement as an analytical tool as opposed to a piece of many things that's showing you how your business is doing.

GARY: If you can show analytically what has happened, and project what you think will happen, and which measures will affect that then that become the measures that you want to use.

JIM: If you can create a model that works, then all the better for us.
HARI: Yes, that's what I'm attempting to do; I'm no longer saying the case studies have done the wrong things. I'm saying the methodology may be flawed in spots and could be improved.

GARY: I wouldn't say the methodology is flawed; I would say it is incomplete.

HARI: Right, incomplete and what I'm trying to do is get data from all my sources and saying, in the real world this is what's happening. Gary is telling me this. Jim is telling me this. What has this methodology not got what these people are saying.

JIM: And I guess what I would say to you is where perhaps you are stopping at is also where you should be looking at is what are the patterns of thinking, what are the motivational aspects, of why they are measuring their businesses the way they currently are. Perhaps the reason the model isn't working is they are driven by a reward system that doesn't recognize your methodology.

GARY: Not perhaps, it definitely is, really.

JIM: And so, when you look at a company, you need to go to the CEO and ask what's important to you. Then you go to the next level and say what's important to you. And then when you establish this historical chain of thinking and then you come up with the actual measurement system, apply it your model, what is missing in your model is what the CEO said is so important to his business and isn't represented in your model at all. And it might not have the slightest bit of rationality to it as far as if your model is measuring this company comparatively with the world, we don't care (what it shows?). There's only a couple of numbers that matter that compare to the world and that's profitability and market share and things like that. A lot of your output per employee, it might be the lowest in the world but you are able to get ten times as much money for your product.

GARY: That's another good point. I think the nature or the cycle of a business has an effect. If we were in a high world (?) business, where we were just growing, growing, growing, people wouldn't have the time to concern themselves as much as with some of the measures we've been thinking about here. We are a more mature market and our costs are more important now than someone in a tech field and their driving force is to get the product out of the door to the customer as fast as they can get it and continue that growth. So different businesses may different models. I don't know, or certainly different portions or different things are going to be important to them than may be output per employee etc.

JIM: Another issue is what's the culture of the business? And what kind of market is it operating in. If you are in a business where you are developing new products like in the high tech business, there's no competition for a period of time. And you make a bundle of money. I don't know if that model works (in such an environment). May be it's not important.

GARY: There's an interesting point here. You've got three different (sites). You've got the VPC which is an educational institution where I guess the driving force is to get more papers out and get more business for the facility and make VPC grow and become a viable productivity center. Here (in Acme) we are looking at cost ratios. And FPL probably is a controlled profit place and not as efficient as a place that's driven by the market. May be these (three sites) have a common theme of what made one successful and what made one not successful.

JIM: The danger with models and what you are trying to do is, sure, you can sit and rationalize some of the measurements from your model back to Acme or rationalize to
whatever situation you want. Where that thought process is flawed is the fact that it has to be a model which somebody can sit down and look at it and say this is going to work for me without having you explain how you rationalize the measurement. And otherwise, you know, it’s not a model; anybody can sit down with very generic terms about measurement and broaden them out as much as they want to catch everything. The fact remains that every company has its own individual personality, informal measurement systems and formal measurement systems.

HARI: They’ll need a tailored measurement system; the most anyone should and can do is to offer general methodologies and advice the companies or clients to tailor them to their own needs. Another issue with the manufacturing engineering department’s measurement system is that we really never asked for information needs. We didn’t ask the question “what sort of information would you like to see so that as a department you know you are in control over operations and constantly improving performance?”

JIM: That’s a very interesting point because as we’re going along we don’t know what we need to know. We don’t know what’s important; we only know what we’re told. But if you can come out with a study and come up with a measurement scheme or a model that really represents our business and what’s important or what should be important to our business.....I don’t know if that’s a manufacturing engineering function or an industrial engineering function; I think it’s more a function of a business analyst. The basic way we manufacture here can only change incrementally because it’s so capital intensive.

HARI: What about information needs from an internal perspective?

HARI: We’re talking about internal as well.

GARY: The issue I think that Jim’s bringing up and one of the reasons that we’re where we are with the measurement system in manufacturing engineering is what is driving the business. As you go through business cycles, each manager brings his own style and has his own important things and non important things. We tried to develop a system that was right for the manufacturing engineering department was something that I felt would work and something that Tim felt would work. He was manager at the time and we had specific reasons for that. There was no support for that with the exception may be of Jim outside the manufacturing engineering department. It was to prove a point and to help satisfy a need which we felt we had. Harry Shelton comes in now; he’s a different manager, has a different managerial style, has a different need, is still reporting to the same managers but he’s going to approach what he needs differently. And he’s got a whole different perspective on that (measurement) board down there. And he is going to be driven by what he perceives his managers want. And what they are asking for.

HARI: Weren’t the measures generated by the entire manufacturing engineering group?

GARY: It was developed by the group of supervisors; they came up with ideas. Then the team worked together basically with me to come up with the measurements. And we picked the ones that fit those certain criteria and they became the measures and then we added some more because we (Gary and Dick) didn’t feel that we were covering the whole department down there.

JIM: The other aspect of it that did not happen is that rewards were not tied into those measurements. Yes, a team developed them; yes, it was a good idea. Whether it changed the behavior, whether people felt partners in those measurements really made no difference.
GARY: That measurement system has not affected anyone in the department positively or there has been no incentive to keep it going from outside of the department. Tony or Ken doesn't come in and say your measurement system is behind, it doesn't mean anything to them. You've got to keep at us.

JIM: Let me just, as long as I have a chance to be on tape so that it can go down officially (laughter); my whole pet peeves about models, about training in general, or the whole change function, that's going on either moving from traditional manufacturing to CIM or cell technology or gainsharing, or whatever you want to call it, this new aspect; where businesses who utilize outside consultants fail, and people who utilize internal resources fail, all are targeted in one area, which I call the implementation bridge between where Hari Menon comes in and teaches myself and a group of our employees something. Does not one carry that training into the actual job. Number two is that not assured that the change we're asking the employees to do will be recognized slash rewarded, that the management say, well, I got smart people. They'll work it out for themselves; when we all know that human nature is to fall back to the track you were going before. Yes, the idea is planted in your mind and may be over a period of several years you would incrementally move in a new direction. But if we don't do it immediately, if it's enforced immediately, if it's not rewarded immediately it will fail. And I can show you time after time after time, where outside people have come in and given methods that were either abstract in thought, abstract in approach, were left (a lot?) for the individuals being trained to develop in their own minds and not stay around to see it happens. What I think is more important from a model standpoint, is that not only do you teach the people about the model and expose them to them, but half of that training should be, "Well, I'm going to go back to your desk with you while you are doing your job and we are going to do this and I'm going to show you how it works."

GARY: The point Jim made about the implementation bridge is a very good one and I agree with him; it's not just the VPC but a lot of these consultants, we get the methodology and we take it up to that bridge but the consultants are in the business to make money for themselves. They get paid for giving you this idea. They don't measure themselves or how many successful implementations they've had. If you had 10% success after 6 months it would be a hard knock. We in business see a lot of fads come and go. The current fad is CIM. Someone described CIM to me as people selling dreams and they've got an idea out here. No one has a CIM. There is no Computer Integrated Manufacturing facility anywhere in the world that you can go out and physically see. There are people who have computers linked to businesses, linked to machine tools, there are CAD/CAM systems but it (CIM) is a dream. I've been to courses and seminars and you sit there and say: "Gee, that makes a lot of sense; you pay $500 or $1000 or whatever it is and you come back to work and three months later you've forgotten it. You don't get over that implementation bridge. All these documents here are CIM plans. Arthur Andersen came in and said here is a plan and we've got a big book and we paid a lot of money for that. We have gone ahead and done some things and we're in the process and that's what we are up here for. But that's a little bit different case; they gave us an idea but didn't take us over the bridge. They were prepared to do that but for an X number of dollars. We chose in that case to do it on our own. And we are doing it. And we made a commitment to ourselves; our GM says we're going to have CIM and here's the team to do that. So there was a commitment from above to do that in that case.

HARI: How is the measurement system experience different from the CIM experience?

GARY: There's a couple of things: One I believe in business you have got to have a champion or as Dr. Sink says a "master." You've got to have something holding this whole thing together, driving it. What we didn't have sustainable in the measurement
methodology was a person, a master, a champion that survived. We left. When we left that department, it died. When I left, when Dick left, it went away. Had we stayed there and had we decided we were committed to that it would still be working today because we would make it an important thing for people to do down there and they would be rewarded or punished or whatever; I'm not saying we'd do that but it would be a goal we had in our minds. When we left, for the people that were left there that wasn't one of their goals.

HARI: Was it because the way in which it was set up was flawed? If so, what were the flaws?

GARY: I can't say that. I don't know that there is a flaw in the process or methodology. What we didn't have someone there to carry it through.

HARI: Why was the measurement system set up in the first place?

GARY: Dick was under pressure and it's part of the political environment here that you are not doing anything etc. You (ME department) are not productive, you've got these people down here; what are they doing all day long? So, from our point of view it was a thing that people really didn't know what we were doing. It was a way of saying, "Look, it's not that we are sitting around here doing nothing, we've got all of this stuff to do and this is what we are doing." The other part was it would give us focus on the things we thought were important and would hopefully guide us toward those goals. That was our logic behind it, my logic behind it, and I think it was a valid point. One of the areas it didn't take us through and I think this was a time constraint because we were working within the school year with the seniors; they really didn't get into the project till January; they did research and stuff before that and really had to it between January and April. And at the end there, we had time to get everything together; we got the measures together and we refined them but we only went through one cycle. We never went on to that implementation bridge. We got cut short before that. There were a couple of things. One, we thought we would be able to get a macintosh. We were not able to get a macintosh. They went ahead and set up the graphs on the mac; so when they transferred the data to us it was transferred on mac floppy. And we didn't have any way of translating that into something useful. We had to go back and recreate the information on another PC. I think one of the keys in the beginning of the implementation bridge or a foundation for that is you have the tools you need to do that and those tools (should) be available right there in that department when those couple of cycles are done with the people who are going to maintain this thing. They turned ownership over to me but we never turned ownership over to the department and got me out of the loop so that the department could take responsibility. That's where I think we failed. We didn't even get the first step on the bridge. I think there's more than just that but the hardware side or tools side was not implemented in the process and the process stopped before we could begin.

HARI: How sure are you that the measures portrayed on the measurement board downstairs is what the department wanted to see then (when it was set up) and how sure are you that's what they want to see today?

GARY: Let me answer the second part first. From my brief discussions with Harry Shelton, I don't think that's what he wants to see right now. And I say "he" instead of "they." He wants to change some of the measures; I don't know which ones or what. He's made a statement that he doesn't feel comfortable with it. As far as were they the right measures to begin with, and were they comfortable with them; the measures came from the management team which was the supervisors and Tim. During an NGT session these were the things that we felt were important. The senior team and I picked from those and put them into the methodology (criteria?). I don't recall right off the top whether we
included all of the top ten or not; so I felt comfortable with the measures; I think Tim felt comfortable with the measures. Whether the other members of the team (Harry Shelton, Paul and Chad) really understood the need or felt concerned about it; I would question if that really took place. Dick says, "Look, I think this is something we really need, I think this is something that can be helpful and we are going to contribute to it." Shelton all along had questions about it. I think Paul thought there was some value to it. And I'm not sure where Cliff stood on it. But I think that's a good point; you probably want to talk to each of these people.

HARI: Were data collection responsibilities and accountabilities set? You said that you played this role for some time.

GARY: I think that goes back to the implementation bridge we talked about. We never really got the tools. We went through one or two cycle; we made some updates which were improvements. We did do that because the initial charts and graphs weren't necessarily appropriate for us. Some of those changes were made after the team left. But we never really implemented or integrated it into the department itself so that a specific person in the department would collect the data, maintain the data. It was never put on a computer in the department so that it was just a matter of typing in the data and getting the output. We didn't simplify. We never really crossed that implementation bridge.

HARI: In your opinion, what will it take to cross it?

GARY: I think the key is to convince Harry Shelton that it is a viable tool or for him to take ownership of it and say it's something I need as part of my department. If he's not committed to it, it's not going to happen. If he or someone higher than him is not committed to it it's not going to happen.

HARI: What are some of the other "measurement" systems in Acme?

GARY: The only other measurement system which is not necessarily a formal defined one is that Larry (GM) of course is measured on return on investment, sales, cost ratios, profitability, that sort of thing. They are not clearly integrated into the rest of the facility. I think Jim went over that this morning. How does the guy on the shopfloor affect ROA? He doesn't know. His measurement system is based on what his foreman is telling him or asking him on a daily basis. There are informal measurement systems throughout the facility and they are developed basically on what questions you are asked by your supervisor. If your supervisor comes in and says I want you to generate this report on a daily basis. And he never asked you about that report and that report after a period of time will cease to exist. If that same supervisor comes in everyday and asks you how many hours you worked yesterday, you, after a period of time are going to realize that number of hours is important and when he comes in you are going to have a little listing of how many hours you worked the day before and what you worked on. Informal measurement. And that's the way these things develop. There aren't to my knowledge any formal measurement system other than the corporate ones and they are the standard financial ones.

HARI: Both you and Jimspoke about a lack of rewards tied to the measurement system? What sort of rewards are we talking about?

GARY: I'm not sure. A reward system needn't be dollars. A reward system can be someone who comes in and says hey, you're doing a good job. I think even that would have helped. It has to be important in someone's mind, a higher authority's mind, in my mind. And that has to be communicated to the people using the system. The rewards I
think can be very, very, informal. Most people want to do a good job and they are going to mold what they do to what they are asked to do.

HARI: Can you clearly define the information you need to do your job well?

GARY: Yes and no. I've got projects to work on. I can sit down here on those projects today and I can tell you that what I need to accomplish those projects; what my inputs are going to be and what my outputs are going to be because I have got in that specific project a specific defined goal in my mind. What Jim was talking about and where I have a problem is in an entire organization and I don't think we can break the ME department from out of this organization, it's a part of it, how that fits in the total goals of the organization. Case of point. We here, the GM here is basically paid on ROI, Sales and profitability etc. So he has defined measures. But what we don't have in this organization and what I don't have and what is very difficult to come up with and I've been playing with it for sometime and the more I play with it the more difficult it becomes is how do you relate performance measures in the different areas into the top goal. I have a project it is AI. I'm going to spend a lot of money on that. How does my performance on AI affect ROI? Well, I'm going to spend a lot of money and for this year probably there is very little output. So it's going to be a negative effect. I have no measurement way of knowing if what I'm doing is achieving the ultimate goal. I have no set of rules that say how it ties in with the higher levels of management. And no one in the organization does. And the lower you get in the organization, the more difficult it becomes. When the guy on the shop floor has to make a decision to make today, do I work on part A or part B, how does he decide, what rules does he follow to make that decision? May not be a good example but how does that decision tie into the higher levels and ROI? But there are things that manufacturing engineering know they have to do. (For example) They should be looking at new ways to save labor out in the shops but how does that tie into the upper goal? Should they move their emphasis from coming up with new concepts to generating tapes? How do they know? There isn't that link to the next higher level. It starts at the very top of our organization and goes all the way to the bottom. And that's the point Jim was making. I can come up with a set of measurements for myself and the ME department based on what they feel they should be doing and what we felt they should be doing. But are they valid? Do they cause you to make the direct decisions in the total environment? And that's where we are falling short.

HARI: (Reviewed Management System Model with Chad) If the old management team leaves and a new management team arrives to manage the same organizational unit, do information needs change? Did it happen in the ME department?

GARY: The work never changed down there (ME department). We still do NC programming, we still do tooling, we still do advanced manufacturing engineering etc. What is occurring in the department hasn't changed. So, the needs as far as the inputs and the outputs haven't changed. What has changed is probably the perceived importance of those needs. So, there are two issues there. One, we define the right needs to begin with. I think we need. Harry Shelton may think we didn't which is a difference in perception in needs. May be we didn't define the core values. May be. I don't know. But we certainly didn't define exactly what he feels he needs. So, the perceived needs are certainly different. Now, can we define the core needs that are going to be standard across there? I don't know. You probably should be able to. But that still doesn't solve the problem of a lack of driving force to keep it going. Having the needs defined does not constitute that driving force. There's a separate entity there whatever that entity is we've certainly lost it. May be we didn't loose it; may be we never had it. All these people are busy. They all have work to do. This is more work for them to do; however miniscule it is, it's something
additional. If there's something that's not driving them then they are going to eliminate the work they don't need to do.

**HARI:** What does this driving force look like?

**GARY:** Well, certainly you can put in monetary rewards. A certain portion of Larry's salary is based on ROI. The major managers working for Larry are on a bonus system. So, there are specific measurements that they are paid on. There is bonus system within the plant that pays individuals for plant wide performance but it's hard to identify how an individual affects that. So, he doesn't know how to modify his performance to make it better or worse.

**HARI:** Who are some of the people you think I should meet? What are the next steps?

**GARY:** Well, I certainly think you should talk to the supervisors (Harry Shelton, Paul, Chad and Tim). It would be valuable to talk to some higher level managers (Ken, Tony, Larry). These people are going to be more difficult. Jim, you and I need to talk strategy for those people. There's political ramifications. We can work out the lower level meetings. I think Jim needs to open the doors for you at the higher levels.

**HARI:** Do the higher levels know about the ME measurement system?

**GARY:** Not everybody. Ian knows the boards down there. Joe, I think also knows. Larry, I don't think knows.

**HARI:** What would be a good way for them to get know about it so that my meetings can be effective?

**GARY:** Well, I think you got to be careful there. My advice would be, review what we did this morning. Pick out what you think are some key issues. Then I would go to the supervisors. Try to verify whether some of the things we talked about this morning are either valid or invalid. After that you need to come up with some specific questions for those other levels and see what impact they have on the lower levels. I don't know what those questions are now. may be you and I and Jim should sit down and work on those. I think you want to use their time as efficiently as possible.
Trip Report of Acme's Interview #1

INTRODUCTION

I reached Acme at 0915 for a meeting with Mr. Gary D. The intention of this meeting was to discuss the interview strategy with him and possibly set up interviews with few selected individuals in the company. I began the conversation by giving Gary a thesis update. Mr. Jim G. walked in shortly. I wasn't expecting him. After exchanging pleasantries, I explained why I was there. Apparently, Jim and Gary had communicated earlier about my visit. Jim's presence indicated interest and curiosity and that helped the morning begin on a positive note. I had not planned on a formal interview for the day but since I had my tape-recorder with me I decided to take advantage of the situation. So I steered the conversation into something of a dialogue on performance measurement. What helped this was that Gary and Jim had been talking briefly that morning about some aspects of measurement.

PROCESS OBSERVATIONS

• Sometimes the discussion appeared to go off track with several issues that I felt were not directly related to my question. I tried not to interrupt these trains of thought with the hope of going back to the transcripts to crystallize my understanding.

• The interview revealed that Jim and Gary had the ability to do "relational-thinking." They were able to speak about Acme operations and simultaneously and very easily identify those operations that had measurement implications.

• Neither Jim nor Gary were hesitant in sharing information despite the tape-recorder.

• Jim's and Gary's background and training shows in their speech and their ideology. Gary thinks very rationally and logically exposing engineering traits. Jim's Human Resources background reveals a broad perspective and an understanding of the big picture.

• My job during this interview was relatively easy. I had to prompt more than question. Perhaps it was due to their familiarity with my research problem.

HIGHLIGHTS

1. Jim identified an "anomaly" in the process of measurement. As long as a company makes more money this year than it did last year and as long as rewards are based on this achievement, then measurement systems become insignificant.

2. In an organization where new bodies are consistently brought in without a staffing strategy, how can measurement be effective? How can measurement be effective in an environment where people are learning? Is this relevant to the ME department?

3. Visibility rooms and measurement boards are only a part of the entire gamut of tools available for information portrayal; implicit in Jim's comment that sometimes people look at these measurements and they know the exact causes of events whether they are important or just historical occurrences.
4. Acme’s organization level measurements are too broad. Examples are Cost Ratios and Return on Investment. These comments have implications for the need of a measurement hierarchy.

5. Is measurement an analytic tool? Probably yes. Depends on its purpose. According to Jim, it should show you how your business is doing. But he also says measurement is a piece of many things that’s showing you how the business is doing. What would be some other things that show you how your business is doing?

6. Why do organizations measure the way they do. Perhaps the General Measurement Methodology’s philosophy isn’t complete because organizations are driven by a reward system that doesn’t recognize the philosophy.

7. How does one take into account information needs at each level of the organization? Jim said unless one considers the CEO’s information needs while building measurement systems, he or she is not going to succeed. The message is about top management commitment and awareness, but how can we address this issue in light of a departmental measurement system.

8. From the point of view of competing with world markets, how can you define measurement? At these levels the only things that matter are profitability, market share etc. The link between these measurements and lower levels measurements is not clear.

9. Different businesses may require different measurement models. Culture and the nature of the business plays an important role.

10. The drawback with measurement methodologies is that they are rarely tailored to suit the organization. According to Jim, every company has its own individual personality, informal measurement systems and formal measurement systems.

11. Information needs are very hard to define for even top executives. They don’t know what’s important, only what they’re told. If there is a way by which you can tap the people to actually determine what’s important, then that will be very useful.

12. The acceptance of a particular improvement intervention for an organization, division or department is entirely dependent on what is driving business in that unit of analysis. If the top person on that team is not comfortable with it, there is a low chance of success. For example, the new management team in the ME department has more or less the same information needs as that of the previous team. But according to Emory, the new manager Harry Shelton has a different managerial style and will approach what he needs differently. Thus, Harry has a whole different perspective on the ME department’s measurement board.

13. Gary and Tim added a few new measures to the list generated by the manufacturing engineering group because as managers they felt the list wasn’t comprehensive. Apart from the drill of generating measures, attention wasn’t paid to determine whether it changed behavior and whether the group felt partners in those measurements. The soft side and the hard side of consensus generation has to be recognized and addressed. As I see it the hard side is the actual generation of measures. How can one address the philosophical question of creating loyalty and partnership in measurement system development?

14. The role of the person or organization bringing in a new performance improvement concept was discussed. Jim spoke about the need for ‘consultants’ to maintain longer contact with the client to see them through the implementation bridge. In Jim’s words; “What I think is more important from a model standpoint, is that not only do you teach the
people about the model and expose them to them, but half of that training should be, 'Well, I'm going to go back to your desk with you while you are doing your job and we are going to do this and I'm going to show you how it works.'" Arthur Andersen developed CIM plans for Ingersoll Rand but did not stay around to see it implemented. They said they would do that for a certain dollar figure. Acme declined the offer. But, in this case, the GM wanted CIM and allocated required resources to help them over the implementation bridge. So, in CIM's case, it succeeded or is succeeding because the GM was a "champion." I asked how the CIM experience was different from that of the measurement system and the response was simply "the lack of a champion who survived."

15. I asked Gary why the measurement system was set up in the first place. He said the culture at Acme frequently sent a message around that the departments and people were not productive. So, one of the intentions was to counter this message. The other was to help the ME department focus on those things that needed to be done.

16. Efforts by Gary and Dick to hold the system up while they were still in the ME department were let down by a lack of appropriate tools.

17. Gary believes the only way the ME department's measurement system can be made successful is to convince Harry Shelton that it is a viable tool or for him to take ownership of it and say it's something I need as part of his department.

18. I asked Gary if he knew about other measurement systems in Acme. The only ones he knew about were the General Manager's. The GM is measured on return on investment, sales, cost ratios and profitability. There are several informal measurement systems throughout the facility. The corporate level measurements and the informal ones are not integrated well. For example how does the guy on the shop floor affect ROI?
APPENDIX D

1. Literature Review Reports (p.200)
2. Comparison of GMM with the Methodologies in the Literature (p.224)
A Productivity and Quality Measurement Methodology

*Adam, Hershauer and Ruch (1986).*

Adam, Hershauer and Ruch (1986) strongly emphasize that measurement forms the basis and is a prerequisite for quality and productivity improvement. In terms of definitions, these researchers accurately observe that frequently, quality and productivity have been considered as two separate performance measures. They submit that a large part of the "productivity equation is quality." Hence, the measurement methodology they've developed attempts to measure the quality dimension of productivity. The methodology, which produces "quality-productivity ratios for any service group," draws from theories and experiences in operations management, socio-technical systems, structured group processes, quality control and productivity measurement; and according to the researchers has been developed, tested, revised, and successfully implemented.

Figure D-1 presents the protoypical measurement methodology developed by Adam, Hershauer and Ruch. According to them there is a lot of flexibility in group content and the role of the project coordinators. They advise that any modification should retain the basic procedure, which involves establishing system boundaries, identifying unit operations, generating key deviations, generating ratio measures and ranking the measures. The methodology is based on assumptions and prerequisites that echo the ideas contained in the GMM's guiding principles. These are listed below:

1. The approach provides a framework for creating a unique set of measures for each service and each organization to which it is applied.
2. It assumes that the knowledge needed to create a measurement system exists within the minds of current system managers.
3. Structured group procedures used throughout are vital to creating an appropriate atmosphere of openness and creative thought.
4. Productivity is considered a multidimensional construct and thus should be measured by sets of related measures rather than by a single index number.
5. The approach should be attempted only with strong top management support in assuring that all needed personnel can be made available without interruptions during group sessions. Management commitment to the approach and an intent to implement measures are also needed ingredients to the ultimate use of developed measures.
Figure D.1 Performance Measurement Methodology
(Adam, Hershauer, and Ruch; 1986)
1. **Gaining Top Management Commitment:** The fifth point in the list above briefly elaborates this step of the methodology. The book does not say more about what top management support means in terms of the using the measurement methodology to implement measurement systems. Perhaps, it's safe to assume that top management support in this context is not very different from top management support in other contexts. Allocation of resources, demonstration of genuine interest in the project, open mindedness, willingness and ability to accept and reward initial small successes, etc.; these are all indicators of top management support and commitment.

2. **Project Coordinator Selection:** Consequent to gaining commitment from the top, project coordinators need to be selected. The methodology specifies that two individuals are required to coordinate the development of the measurement system. These individuals need to be familiar with the particular unit of analysis (but must not currently belong to it) and the special terminology used within the unit. There are several objectives behind the selection of two project coordinators. First, each can keep track of the other’s comments and actions. Further, two people are also needed for "interactive development" and group sessions during some phases of the project. Project coordinators need to be well versed in understanding group processes. They should be able to facilitate discussions and should have the ability to grasp the functioning of the unit of analysis quickly and accurately. Most importantly, they need to possess adequate knowledge about "productivity and productivity measures." The authors claim that reading and understanding the book would be sufficient to acquire this knowledge.

3. **Familiarization with System:** In this step, the authors recommend that the project coordinators do three things: 1. Obtain data about the unit of analysis (organization). 2. Obtain technology information. 3. Visit the site for a one-day overview. **Obtaining organizational data** includes structure charts with names and position titles for all supervisors and managers, job descriptions, sample reports and their distribution, statements on policies, goals and objectives and any previous special managerial studies on the system. **Obtaining technology information** includes flow charts and layout diagrams, equipment and technology investment studies and plans for future technology developments and changes. **Visiting the site** involves an extensive tour of the physical facility followed by brief interviews with a vertical cross section of the system and the managerial levels above the system.
4. System Definition and Boundaries: Here, the authors point out the importance of having a clear definition of the unit of analysis. According to them,

"Before any organizational subsystem can be analyzed and measured as a unit, it is necessary that a precise definition exist for the subsystem to be measured. Confusion about what is or is not included in the system to be measured will lead to confusion about the nature and purpose of any resulting measurement system."

5. Participant Selection/Division into Groups: Adam, Hershauer and Ruch draw attention to the importance of making a careful selection of people and "forming groups correctly." They provide a method of choosing groups but I'm doubtful if the method is valid for any unit of analysis. The authors suggest that there should be two groups forming a vertical cross section of the unit of analysis (or of the system, in their words).

Group A (2-5 people) includes the manager immediately above the top level included in the system, the top manager within system boundaries, and representatives from managerial levels below the top system manager down to, but not including, the managers responsible for conducting daily or weekly operations. Group B (6-10 people) includes representatives of all staff levels up through the managers responsible for daily or weekly operations. It is important that key people in actual delivery of the service (to be measured) be members of the teams. It is also useful to have a mix of individuals with a variety of backgrounds and length of service.

6. Group Sessions: Eight sessions are held in all.

Session #1 Participants: Groups A & B and Project Coordinators

Purpose of Session #1: To introduce the project, explain concepts and terminology to be used, and finalize system boundaries. Introduction of the project involves explanation of who initiated the project and why, credentials of project coordinators, general steps to be followed and timing, results expected and planned use of results. Explanation of concepts and terminology involves priming the participants with basic theory about measurement. The authors recommend spending some time on the explanation of the concept of "throughput." Throughput refers to the demand for service to the conversion (transformation) process, and a modified throughput as some expected serviced output. I suspect that this is similar to doing an Input/Output Analysis of the organizational system. Further, the participants are briefed on what the authors call a "unit operation." Unit
operations refer to any one of the phases in a system in which an identifiable state change in
the throughput occurs. To help the reader understand this term, I'll use an example.
Consider the process of laundering a shirt. Checking for wrinkles and spots is not a unit
operation and neither is loading a washer. Unit operations include: receive and tag, wash
and clean, dry and press, and package and deliver.

Session #2 Participants: Group B and Project Coordinators

Purpose of Session #2: Consequent to the project introduction session, Group B alone is
convened to define unit operations for the unit of analysis which has been defined and
approved. Group B is divided into pairs on the basis of similar organizational level. Each
pair works independently of the other pairs in developing and thinking through various unit
operations. This is done by identifying "Entering State of Throughput," "Exiting Modified
State of Throughput" and the unit operation which comes between. For example if there is
a demand (D) or a user request (entering state) for a survey report (exiting state), then the
unit operation (U1,...Un) could be to conduct a feasibility study. Exiting states can
become entering states for a different unit operation. All pairs in Group B spend about a
day doing this and the project coordinators reconcile differences and similarities to
minimize the number of unit operations.

Session #3 Participants: Group B and Project Coordinators

Purpose of Session #3: Group B is convened again for a 2-3 hour session to generate a
prioritized list of deviations for the unit operations. The Nominal Group Technique (NGT)
is used for the purpose. A typical task statement would read:

"What deviations (variations) do you believe have an impact (on the process being
examined)? After listing the deviation, please note beside the deviation the point in the
process (D, U1, U2,...Un) where this deviation was introduced."

If the "process" is assumed to be Systems Development, for example, then one
deviation could be interfaces with other systems and projects. Another could be adequacy
of test systems. Following the generation of a prioritized list of deviations, a second
selection and ranking is done for quality deviations. According to the authors, this second
selection forces participants to consider the difference between quantity and quality. Now,
the methodology goes one step further to identify key quality deviations. Here the concern
is only for those deviations which are significant enough to affect the success of the normal business of the unit of analysis. This involves a collaborative effort between the participants and the project coordinator to focus carefully and clearly on the high ranked quality deviations generated in the previous step.

Session #4 Participants: Groups A & B and Project Coordinators

Purpose of Session #4: Groups A & B are convened again for a 2-3 hour session to generate a prioritized list of measures and indicators for the deviations identified earlier. The Nominal Group Technique (NGT) is used for the purpose. The following discussion is to be provided by the lead coordinator:

"Measures should deal with outcomes and resource use associated with a particular key quality deviation. Measures are needed for outputs, inputs, and output-input relationships. Output measures deal with the effect of the deviation on throughput and service output. Inputs deal with identifiable resources required to prevent the deviation or to deal with the result of the deviation. Some outcomes are directly associated with inputs used to attempt to avoid the outcome or to correct the outcome; such direct relationships can be measured by some ratio of output to input. Measures should deal with control, performance, actual versus standard, type of performance, degree of performance, count, cost impact, disruption impact, missed deadlines caused, both customer and internal impact, resources consumed in related social and technical subsystems for control, reduction, correction, prevention, percent of total effort on a particular deviation, and so on. What we want is a way to keep score for each of the key quality deviations."

Session #5 Participants: Group A and Project Coordinators

Purpose of Session #5: Group A is convened for a two hour meeting on the day following the measures session. The purpose of this session is to identify technical and social subsystems and actions related to the prevention and control of the key quality deviations. Technical subsystems include equipment, computer hardware and software, printed materials and manuals, development of procedures etc. Social systems include personnel policies and procedures. Group A members are asked the following sample questions regarding each of the key quality deviations. The coordinators need to take notes and probe where necessary and appropriate.
1. Which unit operations are involved in preventing, eliminating, and correcting the deviation and its organizational impact?

2. How much is the deviation prevented, eliminated, reduced, and corrected with current personnel systems and procedures?

3. What technical subsystems have been recently installed or are planned that deal with or have an influence on the deviation?

Session #6 Participants: Group A and Project Coordinators

Purpose of Session #6: This is a two hour session the purpose of which is simply to reorganize and clarify the various measures under each key quality deviation. Clarification only is allowed. Evaluation is not permitted at this time. Participation of Group B at this step is dependent on the organization's implementation plan for the quality measurement system. The authors suggest that if the organization is unsure of installing the measures or is planning a partial installment, then participation from Group A (top management) will do. If the organization is planning a complete installation, then it would be advisable to include Group B as well.

Session #7 Participants: Group A in conjunction with Group B, Project Coordinators & Productivity Ratio Expert.

Purpose of Session #7: Groups A & B is convened again to make the final selection of the measures. Typically there is a rating and ranking procedure involved here. The focus should be on selecting those measures that are relatively less difficult to implement. Once the final selection has been made, operational definitions must then be created for the numerator and the denominator for each measure/ratio.

Session #8 Participants: Group A and Project Coordinators

Purpose of Session #8: After ensuring data sources for each selected measure, Group A is reconvened to evaluate the ratios against the original system boundaries and unit operations. The authors suggest some potential questions to be explored: Have the boundaries been contracted and have key resources used in the unit operations been omitted from the ratios? Do the ratios incorporate user suggestions/opinions?
EG&G's Performance Measurement Methodology

The measurement methodology developed at EG&G, Idaho Inc. is of special interest. This one was selected because the article in which the methodology was presented described the development, implementation and most importantly the refinement of the methodology. The article also describes the company in detail but I will avoid reproducing that description here since it may be out of context. However, it is necessary that the reader get an overview of the company and the reasons why EG&G Idaho adopted performance measurement as an improvement technique.

One of the critical business areas of EG & G Idaho, a wholly-owned subsidiary of EG&G is to support the Department of Energy in the management of a variety of research and development operations and support services at the Idaho National Engineering Laboratory (INEL). EG&G Idaho research and development activities center on nuclear energy. There are extensive programs in radioactive waste management, reactor technology for space and ground applications, reactor safety and materials behavior. EG&G's initial work at the INEL began in 1976 with a 5-year cost-plus-award-fee contract (CPAF). Since then, it has received two 5-year extensions to the contract. An important feature of CPAF is that the amount of fee or profit made from the contract is directly proportional to the customer's evaluation of performance. Evaluation (done almost three times a year) includes an assessment of the effectiveness of almost all aspects of the operation of the organization.

The article reports that by 1982, the environment in which EG&G did business changed dramatically. With the change in presidential administration, the country placed less emphasis on developing alternate energy sources. Further, many nuclear research and test programs were being concluded and EG&G soon found itself in a position where business opportunities in its traditional areas of expertise were diminishing. When the business plan was reviewed in 1982, senior management recognized that at this rate, the size of EG&G with 4200 employees in 1982, would reduce to 2000 employees in 1987. This could be prevented only if: (1) the company could find and exploit other business opportunities and (2) if it worked harder to enhance the quality of products and services, cost-effectiveness and customer responsiveness. The article does not elaborate on how EG&G dealt with the issue of locating and expounding new business opportunities; the focus
was on how a performance measurement "model" was developed and implemented to achieve the latter objective.

Hopefully, the preceding paragraphs are adequate enough and have set the stage for the description of EG&G's performance measurement "model." According to EG&G, a performance model is "a tool to help a manager identify the actions needed to provide customers with products that are superior to the competition's in terms of cost, quality and responsiveness." In other words, the methodology or model supported the measurement of cost effectiveness, quality and responsiveness. In EG&G's terminology, cost effectiveness is defined as the cost to produce a unit of product or service; a quality product is one that fully conforms to the customer's requirements. Anything exceeding those requirements is unnecessary cost and may result in added cost to the customer, and anything falling short of those requirements may, of course, result in dissatisfaction; responsiveness is the ability of a department in EG&G, Idaho to respond to changes in the customer's needs or in market conditions.

The measurement methodology has three parts: a strategic summary, milestones and unit measurements. The strategic summary (Figure D-2) is a concise, one page statement of the strategy of the unit of analysis which is being measured. It should typically describe its products and customers, summarize major strategic factors (e.g., outlook, customer options), and provide succinct statements of strategy. Notice that the framework of the strategic summary is customer oriented. A critical aspect of the strategic summary is a clear definition of outstanding unit performance from the customer's perspective. To do a good job on the strategic summary, each manager at EG&G, Idaho needs to work directly with his customers (both internal and external) and fully understand their needs and their perceptions of his unit's performance. This is a key issue because actions are taken on the basis of understanding the customer and the competition; a strategic summary which does not "measure" this well may lead to wrong actions being taken. Consequent to the formulation of the strategic summary, a chart is prepared summarizing the major milestones necessary to achieve the strategies identified earlier. Step-by-step actions and a time frame for their implementation are identified.

According to EG&G, the heart of the performance measurement system is composed of the "unit measurements." For each product or service, the manager develops a set of measurements in three areas: cost effectiveness, quality and responsiveness. The article
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Product and/or Service (specify output)</td>
<td>5. Customer options (specify actual or potential)</td>
</tr>
<tr>
<td>2. Customers and % of Unit's business</td>
<td>6. Strengths/Advantages (relative to customer expectations)</td>
</tr>
<tr>
<td>3. Customer's standards for outstanding performance</td>
<td>7. Weaknesses/Disadvantages (relative to customer expectations)</td>
</tr>
<tr>
<td>4. Outlook for unit</td>
<td>8. Summary of strategy (detailed schedule to be on milestone form)</td>
</tr>
</tbody>
</table>

Date: _______________  Unit: _______________

Figure D.2: Performance Measurement Methodology; Strategic Summary Worksheet, (EG&G Idaho, 1988)
<table>
<thead>
<tr>
<th>Product/Service</th>
<th>Requirements</th>
<th>Measures</th>
<th>Goal</th>
<th>Current Month</th>
<th>Fiscal YTD</th>
<th>Prior FY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost effectiveness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsiveness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date: _______________  Unit: _______________

Figure D.2a: Performance Measurement Methodology; Unit Measurements, (EG&G Idaho, 1988)
does not say how these measures are generated. However it does mention that the measures:

- provide a unit manager with a clear understanding of customers' needs, unit's performance in meeting the customers' needs and also the competitors' performance in meeting those needs.
- determine the differences between actual and desired performance in meeting customer's needs and
- develops unit strategies that will close performance gaps or extend advantages over the leading competitor.

The performance measurement process initially established in 1982 continued to be used until recently (1988), when the company decided to stand back and review the efficacy of the measurement system and its performance so far. Although the system had experienced overall success, the review team noticed a couple of general deficiencies. These were: (1) inadequate rigor in its application and (2) the perception by some managers that the system was not useful. On closer examination, management detected some of the key causes which contributed to these deficiencies:

1. Performance models had been driven top-down and as a result, managers perceived no ownership of their performance models.

2. The models were not perceived as flexible enough to adequately serve the needs of a large variety of managers.

3. Direction on preparing performance models was verbal and was given inconsistently to managers company-wide.

The causes listed above shed some light on some of the weaknesses of the methodology:

1. Incomplete understanding of a customer's requirements and, as a consequence, unclear or inaccurate understanding of an organization's strengths and weaknesses.
2. Lack of specific unit cost for some products and services. Obviously, unit cost can be very difficult to determine for functions such as research, development and consulting.

3. Lack of specific data on the unit cost competitors incur for furnishing similar products and services.

The deficiencies of the system, the causes for the deficiencies and the identified weaknesses of the methodology (model) are summarized in Table D-1. In response to the situation depicted in Table D-1, EG&G, Idaho has initiated the "Performance Model Enhancement Project" (PMEP). The main objective of PMEP is to provide each unit manager the guidance to ensure that he or she effectively utilizes a performance model. One of the first concerns addressed was that of the "top-down-driven" models. The PMEP aggressively worked to remove the notion/fact that there was little involvement and participation in the implementation of the performance models. Managers of departments who had demonstrated an understanding and interest in the measurement system were invited to be in the Performance Model Committee (PMC). PMC had the task of redefining, revising and rewriting the procedures to use the measurement system in a handbook. The members of PMC also serve as the facilitators in workshops explaining PMEP to all company managers.

The management had learned from past mistakes and made sure to do initiate a pilot study before re-implementing the system organization wide. Each PMC member worked with another unit manager to help him or her develop a department prototype of the measurement system for inclusion in the handbook. Customers (both internal and external) played a key role in the improvement of the measurement system methodology. The old version distinctly lacked customer input as was obvious in the past when unit managers had only presumed what their customers wanted instead of actually asking their customers what they wanted in quality products and services. The clarified role of customers and their increased participation helped the revitalization and improvement of strategic summaries, a critical component of EG&G's performance measurement system. Recall it was mentioned earlier that an inaccurate strategic summary could almost completely lead the measurement system off track; obviously without an accurate assessment of customers' needs and their standards for outstanding performance, measures of a unit's strengths and weaknesses in the eyes of its customers are erroneous and result in ill-conceived strategies and misdirected resources. The article reports that no longer do strategies reflect only the unit manager's
<table>
<thead>
<tr>
<th>Deficiencies of the methodology</th>
<th>Causes that led to the deficiencies</th>
<th>Weaknesses of the methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate rigor in application</td>
<td>Top-down driven approach; hence managers perceived no ownership of their performance models</td>
<td>Incomplete understanding of customers' requirements</td>
</tr>
<tr>
<td>Perception by some managers that the system was not useful</td>
<td>Models not perceived as flexible to serve the needs of a variety of managers.</td>
<td>Inability to measure specific unit cost for some products and services.</td>
</tr>
<tr>
<td></td>
<td>Directions on using the methodology were verbal and given inconsistently to managers company-wide.</td>
<td>Inability to measure/determine specific unit cost for competitors' products and services.</td>
</tr>
</tbody>
</table>
view of his or her service; now the manager includes specific information obtained from his or her internal and external customers.

Another important issue which EG&G looked into was that gaining realistic performance information about the competition and the competitive environment. Competitive benchmarking was used for this purpose and it involved three steps: (1) specifically identifying the measures to be benchmarked, making certain they are clear and appropriate. (2) Selecting the competitors to be studied and (3) obtaining competitive information directly or through a consultant hired for the purpose. Competitors who may be reluctant to provide data directly may be willing to share the same information through a third party who would handle the results confidentially. The data is stored in central data base in EG&G, Idaho. Current unit performance would then be compared with that of the best competitor after performance measures derived from customer requirements have been developed and after a value for each measure has been determined for the unit and its leading competitor. This comparison would typically result in a listing of performance gaps and advantages, which would help in the further refinement of strategies, milestones and possibly the measures themselves.

This concludes the description of EG&G's performance measurement system development procedure. I believe the nature of the information source (an article in Industrial Management) did not support a comprehensive description of the methodology. A few questions particularly regarding the the third step (development of measures) remain unanswered; how are they developed? who are involved? how is data collected for each measure? how are the measures tracked? In any case, EG&G's procedure was chosen primarily since it appears to exhibit portions of the measurement philosophy used by the General Measurement Methodology. The article describing EG&G's measurement methodology concludes with the following:

"Even though there are still major imperfections in some of the company's performance models, the management at EG&G Idaho is convinced more than ever that such a process is mandatory if any company is to achieve high performance uniformly across the organization. This company, like many others, has not been able to define measures in some areas, such as one-of-a-kind research engineering or development activities. However, it is having success in convincing its managers that outstanding performance cannot be achieved unless one can define and measure performance."
A Methodology for Developing White-Collar Performance Measures

Boyett and Conn, 1988

Boyett and Conn have been experimenting with a proprietary white-collar measurement development process for almost eight years. In an article entitled, "Developing White-Collar Performance Measures" in the National Productivity Review, the authors have described this measurement process. Along with the description the authors have also presented a certain amount of background information about the problems associated with white-collar performance measurement and a few guidelines to combat these problems. In addition, Boyett and Conn have reported a tremendous variety in white-collar work and have classified it into five types. Before discussing the measurement methodology (or process), a brief overview of the guidelines to measure white-collar work will be presented; the objective of which is to support the description of the methodology which is based on these guidelines.

Boyett and Conn have developed four major guidelines to be followed while measuring white-collar work: (1) involve white-collar employees in developing their own measures (2) measure results, not activities (3) use group or team-based measures (4) use a "family of indicators."

*Involve white-collar employees in developing their own measures:* The authors have recognized that participation in developing measures is critical to success during implementation. They point out that the only way to overcome the common problem of resistance to measures is to involve employees in the design and development of the measures. Additionally, participation also helps in agreement on desired results or accomplishments for the group; a critical step before embarking on developing measures.

*Measure results, not activities:* Boyett and Conn note that earlier efforts in white-collar measurement have focused on measuring activities while actually needing to focus on the measurement of services. They quote an example of a mistake commonly made while measuring programmers. Programmers, they say, have been measured by "lines of code or function points." In reality, "lines of code" have no value to the organization; it's only the result of writing lines of code which matters. In the authors' words, "...activities such as writing code are a cost to the company and should be minimized, not encouraged. We do not need more activity but only the minimum activity needed to produce the desired
result. Results count. Results are valuable. Results, and results alone, should be measured."

*Use group or team-based measures:* Here the authors distinguish between measurement in blue- and white-collar environments by observing that in manufacturing, measurement frequently starts at the level of the individual employee. These measurements are then aggregated to derive shift, department, division, and plant totals. However, the authors caution against doing this in a white-collar environment since "white-collar workers traditionally work in teams." Most results in a white-collar environment come from groups and not individuals and hence measures should be based accordingly.

*Use a "family of indicators:"* Performance in a white-collar environment is usually multidimensional and measurement systems should be designed to reflect this and have multiple indicators of performance.

Boyett and Conn's measurement methodology is outlined in Figure D-3. It essentially consists of two major steps: (1) consensus building regarding Key Results and (2) development of a family of measures of performance in these areas. The process is completed by a representative group of 12-15 employees from the area to be measured. A trained person is needed to facilitate the process.

*Consensus Building:* The first step involves gaining agreement on the Key Result Areas. The authors distinguish between "results" and "key results" by pointing out that for any group, several results can exist but there can be only few "key results." Key results typically appear in five basic areas: quality, quantity, timeliness, cost and customer service. Key result areas are identified after reviewing corporate goals, direction, business strategy, departmental mission statements and objectives. Internal and external customers of the group are also identified along with Key Results as defined by these customers. Once the Key Results are identified, they need to be prioritized. Prioritization is done by using the Nominal Group Technique and Consensus Decision Making.

In the first round of gaining consensus, the NGT is administered to the group. This technique begins with the statement of a problem or task. For example, in the context of Boyett and Conn's methodology, this statement would read, "Given our understanding of corporate strategy, departmental mission, and our customers' needs, what are the most important results this department must obtain for the company?" Each member of the
Figure D.3 Performance Measurement Methodology (Boyett & Conn; 1988)
group responds to this statement and this forms the first of the four steps of NGT. These steps are: (1) Silent generation of ideas without interaction among participants. (2) Round-robin presentation of ideas. (Each participant presents one idea at a time without discussion.) (3) Clarification of each idea. (4) Voting and ranking. (Each participant picks what he or she considers to be the "n" most important results and ranks these in order of importance.)

Following these four steps, there is additional discussion to reach an agreement. If consensus hasn't been reached despite the discussion, the authors suggest the use of Consensus Decision Making to determine which of the disputed ideas should be selected.

"In (Consensus Decision Making) the facilitator writes a disputed item at the top of a page of flip chart paper and draws a line down the middle of the page to create two columns. One column is labeled 'Pro' and the other 'Con.' The team is then asked to suggest the pros and cons of including the item as a Key Result. Team members are encouraged by the facilitator to voice their opinion and to be open to opposing views. If no consensus emerges after everyone has been allowed to participate and all relevant points have been discussed, the final decision on the item is then made by majority vote."

**Development of a Family of Measures:** Consequent to the generation of Key Results, measures are developed as indicators of performance in the various areas. NGT and Consensus Decision Making are used again to enable the group to reach consensus on one or more measures in each of the areas.

Table D-2 shows examples of Key Result Areas, Key Results and Measures (Indicators). These examples are from an advertising department of a major U.S. corporation and were developed by department managers, supervisors, and employees in a cooperative effort.
<table>
<thead>
<tr>
<th>Key Results</th>
<th>Key Result Areas</th>
<th>Measures/Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>QUALITY</td>
<td>Average Order Size</td>
</tr>
<tr>
<td>Ease of Use</td>
<td></td>
<td>Customer Order Error</td>
</tr>
<tr>
<td>Novelty/Uniqueness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schedule Compliance</td>
<td>TIMELINESS</td>
<td>% of Due Dates Met</td>
</tr>
<tr>
<td>Reducing Cost/Order</td>
<td>COST (REDUCTION)</td>
<td>Unit Costs</td>
</tr>
<tr>
<td>Improved Operating-Profit</td>
<td></td>
<td>Costs as % of Sales</td>
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<td></td>
<td></td>
<td>Revision Costs</td>
</tr>
<tr>
<td></td>
<td>CUSTOMER-SATISFACTION</td>
<td>Average Order Size</td>
</tr>
</tbody>
</table>
The APQC Improvement Methodology

The American Productivity & Quality Center

The American Productivity & Quality Center has developed a process to develop "comprehensive and effective performance measurement system(s)." The process is part (Step 3) of the APQC Improvement Methodology (Belcher, 1987) which is shown in Figure D-4. This step is described below.

The basic aim of this step is to develop a family of measures for each service identified in the previous step. The approach used is the Nominal Group Technique (NGT). A cross-section of employees involved in the delivery of the service is brought together to brainstorm and rank ideas for measures. Members of the group are selected for their ability to contribute to the process. It is generally advisable to invite users of the service to participate as well, to ensure that their viewpoint is represented.

The service statement along with the objectives is posted and discussed with the group to ensure proper focus, and the facilitator provides some brief education on measurement in general. The outcome of the process is a long list or family of measures, rank-ordered by the participants to reflect their judgment regarding the various measures' appropriateness and usefulness as indicators, given the objectives already established.

The final step in the measurement step is the selection by management of the handful of measures that, when considered in the aggregate, are deemed to represent the best overall indicators of effectiveness in the delivery of service in question. Given the multidimensional aspect of performance, it is important that management selects its family of measures to ensure that all the important aspects of performance are included.

APQC's Measurement system development process is based on ten rules. The first six rules are for planning the measurement and the remaining four are for installing and managing a measurement system.

Rule 1: Identify purposes of measuring. APQC defines three categories of performance measures; reporting measures, control measures and measures for performance
Figure D.4: APQC's Improvement methodology with Measurement Phase Highlighted
improvement. An example of a reporting measure would be the ROI figure needed by the chairperson. Control measures concern those things that need to be "monitored or contained." In an organization budget variance can be an example of a control measure. On the highway, speed can be a control measure for travelers. Improvement measures directly impact the "motivation" of the work-force and are dependent on "feedback of performance." So, the first step of the APQC methodology involves the management team thinking through clearly and documenting the purpose of measurement.

Rule 2: Unit of Analysis. Choose an appropriate balance between individual and group measures: To explain this rule, APQC distinguishes between past and present "reward systems." In the past, the focus was entirely on the individual; in terms of both capacity and performance. Hence traditional measurement practices have been done at the individual level. Today's management practices are heavily oriented toward and focused on the capacities and performance of groups of individuals. The unit of analysis therefore is different today than what it was yesterday and the change should be considered seriously while designing present and future measurement systems. Of course, this doesn't preclude the fact that there is "still room for individual measurement and motivation."

Rule 3: Measure all the key elements of performance: APQC emphasizes the need to build a "measurement cockpit," or generate a "family of measures." According to them, it is rare that a single measure adequately describes good or bad performance. Strategic measures such as ROI are important but "local measures" or "leverage points" are equally critical. These measures tell you those things that are the most important and most likely to improve once people start paying attention to them.

Rule 4: Ensure that measures reflect internal and external customers' views. According to APQC, the identification of measures for internal operations is relatively easy and more commonly done. Examples of measures of internal operations are errors, cycle time, space occupied and sales calls. Some of these internal measurements are probably made with the belief or assumption that they measure external customer satisfaction too. APQC warns that this assumption may be an expensive one to make. The management team needs to ensure that measures developed for external customers truly satisfy that particular audience. Another problem may also arise; some white-collar groups understand that they have internal customers. Others don't and are trained to do their specialized piece of work of the work and not to see the whole. Hence measurement systems should be tailored to support
the pervasive understanding of internal customers and the measurement of their satisfaction.

Rule 5: Use care in generating competitive benchmarks. The operating principle of the APQC methodology warns against the use of competitive benchmarks. APQC argues that no two companies operate in identical environments or do exactly the same thing; hence the likelihood that competitive benchmarks chosen as measures of internal and/or external performance being very accurate is very low.

Rule 6: Give some time to tedious adjustments. These adjustments fall into three major categories; (1) Technical, (2) Mix Shifts and (3) Make or buy.¹

Rule 7: Develop (or modify) the system as participatively as possible: This rule points out that the management team should attempt to achieve a balance between no participation and extreme participation in developing measures. A participative style helps in gaining the support and commitment from the people and also gives them a feeling of ownership for the measurement system. On the other hand, an attitude which says "everyone go measure whatever you want," will be detrimental. The process should be facilitated appropriately so that there is an opportunity to decide the "right" things; those things that support decision-making in the business.

Rule 8: Cost/benefit analysis applies to data availability also. This rule encourages the use of data which is already available. APQC says, "Creating a whole-data gathering system for one minor measure should be resisted." On the other hand if a critical measure or a

¹ Examples of "technical adjustments" are the following; (1) any measure denominated in a particular currency cannot be generally be used in trend comparisons without removing specific inflation effects. (2) Cost per unit service does not have to actually fall for there to be productivity improvement. If there has been a large price inflation for one of the inputs, a slight worsening in unit cost may actually represent good performance because you've off-set that inflation. As an example of "mix shift adjustments" consider Number of widgets per employee. This might go up because the mix of widgets is shifting to easier-to-make widgets. Weighting systems are needed in such situations. In "Make or buy adjustments" the organization needs to recognize that different amounts of specific inputs goes into the same outputs, based on whether the outputs are made inhouse or bought outside.
leverage point needs data that is not immediately available, then systems need to be put in place so that this data can be acquired.

Rule 9: If strategies change, measures can change too. Measures need to reflect changes and new decisions made by the organization. For example, if the goal of the sales force is changed from volume to market share targets, then the salesperson measures need to reflect that change.

Rule 10: Recognize that performance improvement is a long-term process. Everybody involved needs to be patient and persistent with the new measurement system. Newly available results from the system should be viewed with caution. According to APQC, "The urge to do something about it coupled with unquestioned faith in computer print-out material will almost always result in premature action followed by data disguise and smoothing by middle managers to keep it from happening again."

Comparing the GMM with the methodologies in the Literature

The literature offered ideas to impact each phase of the GMM; however they did not emerge directly from the data. Initially, the comparison yielded a long list of descriptive observations that were not arranged or categorized in any specific order. I sifted through the comparisons in an effort to categorize them according to the phases of the GMM. The results are shown below.

Phase 0 (Preparation)

Guiding Principles: The GMM draws from theories and experiences in operations management, socio-technical systems, structured group processes, quality control and performance measurement; so does the methodology developed by Adam, Hershauer and Ruch.\(^2\) None of the remaining methodologies explicitly stated that they were based on any theoretical or experiential foundations. All the methodologies were based on one or more clearly stated guiding principle(s). Ruch's measurement methodology operates under important guiding principles such as: (a) performance being multi-dimensional, (b) knowledge to develop the measurement system exists with the users of the system, (c)

\(^2\) Hereafter, for brevity this will be called Ruch's methodology.
structured group processes are essential to the development of the system and (d) top management support is critical to the measurement effort's success. The measurement methodology developed by EG&G is based on the principle that measurement should accurately reflect internal and external customers' needs and their satisfaction; this is also one of APQC's important guiding principle. Christopher as well Boyett\(^3\) echo similar thoughts in terms of guiding principles.

On comparing GMM's guiding principles with those of the other measurement methodologies similarities were noticed. This was expected because each of the five methodologies from the literature was audited against the guiding principles of the GMM before using it to make this comparison. Although the GMM also operates under most of these principles it appears as though the different methodologies have subtle differences in their interpretations of the guiding principles. For example, all except one (Christopher's) recognize that performance is multidimensional. The GMM implicitly recognizes and defines performance as having about seven dimensions: effectiveness, efficiency, quality, productivity, innovation, quality of work-life and profitability. Ruch's methodology is mainly concerned with the quality and productivity dimensions of performance. EG&G is mainly concerned with cost-effectiveness, quality and responsiveness. APQC recommends the use of a "family of measures;" so does Boyett.

*Top Management Commitment and Involvement:* Three of the measurement methodologies (Ruch's, EG&G's and Christopher's) emphasized the need for top management commitment and involvement. Methodologies developed by APQC and Boyett do not specify the need probably because these could be used by middle management as well. EG&G initiated the measurement effort after the senior management board recognized the

\(^3\) For brevity, Boyett's and Conn's methodology will be referred to as Boyett's methodology.
need to regain competitiveness. Christopher sums it up in the following statement; "...provide leadership committed to achievement (of the measurement system) and supportive of subordinates." Ruch's methodology lists "Top Management Commitment" as the first step; it's not clear if Ruch's methodology, like the ones developed by APQC and Boyett could do without gaining top management commitment. The GMM elaborates on what top management commitment actually means in a measurement effort. Whether or not this elaboration is redundant or unnecessary is a mute point. However, from the practitioner's viewpoint, guidance at every step will be valuable.4

*Unit of Analysis:* Three of the five methodologies (Ruch, EG&G and APQC) provide a framework or guideline for creating measures for a defined unit of analysis; the GMM does not direct the user to doing this critical step. The GMM alludes to the management team or the measurement team while specifying the group; this is not very clear and on occasions can be misleading. This problem has been addressed in the improved methodology. Ruch defines the "system and its boundaries." It also specifies how participants should be selected and divided into groups. This ensures that the team which develops the measures is carefully selected thus avoiding difficulties that arise from having a heterogeneous group develop measures; but it also creates a problem in that the "group selection and division" criteria may not be universally applicable. To substantiate this point consider the following description which is an example of Ruch's way of selecting measurement teams:

Group A (2-5 people) includes the manager immediately above the top level included in the system, the top manager within system boundaries, and representatives from managerial levels below the top system manager down to, but not including, the managers responsible for conducting daily or weekly operations. Group B (6-10 people) includes representatives of all staff levels up through the managers responsible for daily or weekly

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4 This entire comparison is based on that premise; that the user shouldn't have to read between lines to actually implement the methodology.
operations. It is important that key people in actual delivery of the service (to be measured) be members of the teams. It is also useful to have a mix of individuals with a variety of backgrounds and length of service.

In EG&G’s case, the "strategic summary" helps to define the unit of analysis. The strategic summary is a concise, one-page statement of the strategy of the unit of analysis which is being measured. It should typically describe its products and customers, summarize major strategic factors (e.g., outlook, customer options), and provide succinct statements of strategy. The framework of the strategic summary is customer oriented. A critical aspect of the strategic summary is a clear definition of outstanding unit performance from the customer’s perspective. To do a good job on the strategic summary, each manager at EG&G needs to work directly with his or her customers (both internal and external) and fully understand their needs and their perceptions of his or her unit’s performance. This is a key issue because actions are taken on the basis of understanding the customer and the competition; a strategic summary which does not "measure" this well may lead to wrong actions being taken. Although the unit of analysis is clearly defined here, EG&G does not indicate clearly how participants within the unit should be selected prior to developing measures. The manager appears to be completely in charge.

APQC directs the measurement team to choose an appropriate balance between individual and group measures. In the past, the focus was entirely on the individual, in terms of both capacity and performance. Hence traditional measurement practices have been done at the individual level. The trend in today’s management practices is oriented toward and focused on the capacities and performance of groups of individuals. The unit of analysis therefore is beginning to appear different today than what it was yesterday and the change should be considered while designing present and future measurement systems.
Measurement Teams: In terms of choosing a team from within the unit of analysis, APQC recommends the selection of people who have the ability to contribute. However they caution against "no participation" and "extreme participation." A participative style helps in gaining the support and commitment from the people and also gives them a feeling of ownership for the measurement system. On the other hand, an attitude which says "everyone go measure whatever you want," will be detrimental. As mentioned earlier, the GMM's specification of the management team or the measurement team is not clear and an attempt has been made to address this in Chapter 5. Ruch defines the "system and its boundaries." He also specifies how participants should be selected and divided into groups. This ensures that the team which develops the measures is carefully selected thus avoiding difficulties that arise from having a heterogeneous group develop measures; but it also creates a problem in that the "group selection and division" criteria may not be universally applicable.

Role of the Measurement Master: Familiarization and Agenda Setting

"Project Coordinator Selection" in Ruch's methodology; "Trained Facilitator" in Boyett's methodology; and "Facilitator" in APQC's methodology, to a certain extent compares with the GMM's "Form Measurement Teams." All four emphasize the need for "measurement masters" who should have very good facilitation skills, ability to grasp the organization's or the unit's functioning and most importantly possess knowledge about "productivity and its measurement (Ruch)" and "performance and its measurement (GMM)." APQC and Boyett don't specify specific skills required by the facilitator. This is another potential improvement area for the GMM; what should be the specific skills of a "facilitator" or a "measurement master?"

Only two of the methodologies (APQC and Ruch) presented ways in which the facilitator or the measurement master could familiarize with the rest of the measurement
team and also prime the team about the measurement effort. While APQC suggests an initial discussion of the problem and a brief education session for the group, Ruch's methodology recommends a rather elaborate way for the project coordinator to familiarize with the unit to be measured. This includes obtaining data about the unit of analysis, obtaining technology information and visiting the site for a one-day interview. A clear specification is that these project coordinators need to be familiar with the particular unit but should not belong to it. The GMM does not clearly specify the composition of measurement or management teams nor does it impose any restriction on the number or type of people involved.

Only Ruch's methodology formalizes the agenda for the entire process of developing measures (an agenda in this sense would be "roadmap" which the group could follow through the entire process). As the description of the article will show (Appendix D), this is done well. One of the important items on this agenda is Session #1 where everybody involved gets together to receive a primer on the entire effort. This introductory session involves explanation of who initiated the project and why, credentials of the project coordinators, general steps to be followed and timing, notes on terminology, results expected and planned use of results. This step is not so formalized in the GMM. A primer or "educational intervention" usually precedes a session but the primer typically communicates the philosophy of measurement rather than specify the actual purpose of the measurement session and its outputs and outcomes.

Phase 1 (What to Measure)

The Nature of Measures: Ruch's measurement methodology is primarily concerned with tracking measures for those "quality deviations" which are significant enough to affect the success of the normal business of the unit of analysis. Quality deviations are generated
based on thinking through the various "unit operations" or "processes."\textsuperscript{5} Quality deviations as well as measures or indicators for them are generated using the Nominal group technique.

Boyett tracks measures or indicators for "Key Results." Key Results have been defined in several "Key Result Areas" (see description of Boyett's methodology in Appendix D). The authors distinguish between "results" and "key results" by pointing out that for any group, several results can exist but there can be only few "key results." Key results typically appear in five basic areas: quality, quantity, timeliness, cost and customer service. Key result areas are identified after reviewing corporate goals, direction, business strategy, departmental mission statements and objectives. Internal and external customers of the group are also identified along with Key Results as defined by these customers. Once the Key Results are identified, they need to be prioritized. Prioritization is done by using the Nominal Group Technique and Consensus Decision Making.

EG&G's methodology supports the measurement of cost effectiveness, quality and responsiveness. In EG&G's terminology, \textit{cost effectiveness} is defined as the cost to produce a unit of product or service; a \textit{quality} product is one that fully conforms to the customer's requirements. Anything exceeding those requirements is unnecessary cost and may result in added cost to the customer, and anything falling short of those requirements may, of course, result in dissatisfaction; \textit{responsiveness} is the ability of a department in EG&G to respond to changes in the customer's needs or in market conditions.

\textsuperscript{5} Unit operations have three main characteristics: (1) They refer to any one of the processes in a unit in which an identifiable state change in the throughput occurs. (2) Defining unit operations requires that the system is analyzed in terms of the state changes to the throughput and (3) Each unit operation describes a different transformation to the demand for service item that does not overlap with the other unit operations.
Breaking Down Measures and Hierarchy Issues: The GMM's approach to identifying indicators is more complex primarily due to the fact that measures and indicators are typically generated for all dimensions of performance and not for quality or productivity alone. While this is plus for the GMM, it may also be related to a problem which is the accurate identification of the "countable" or the indicator. Difficulties in defining a "hierarchy for measures" while using the GMM have been prevalent for some time. Measures identified during the NGT have been frequently too broad to be counted "as is." These are typically redefined or broken down into one or more sub-components that can be directly counted or measured. However, this "redefinition" and "breaking down" of measures has not been easy to do while using the GMM. It has probably been easier for example, in Ruch's methodology due to the fact that a homogeneous group of people is attempting to generate indicators for one specific problem area; "key quality deviations." Notice the measurement hierarchy in the Ruch methodology is almost automatically lean (two-tiered) and simple. The GMM's objective of generating indicators for several dimensions of performance is perhaps a more useful one than the other methodologies' focus on a fewer dimensions.

Phase 2 (Develop Process)

GMM's critical Phase 2 is captured only in two methodologies (clearly in Ruch's methodology and less so in Christopher's). Step 6.5 in Ruch's methodology identifies technical and social subsystems to support the measurement effort once the indicators have been developed. Technical subsystems include equipment, computer hardware and software, printed materials and manuals and development of procedures etc. Social systems include personnel policies and procedures. In this context, Christopher states simply; "...employ office technology in the appropriate ways."
Phase 3 (Data Collection)

The equivalent of GMM's Phase 3 is not clearly specified in any of the methodologies. They assume that data sources have been located and responsibilities and accountabilities for data collection have been set before proceeding to the next step. This assumption is a risky one to make, since most organizations and all three case studies in this research emphasized the need for counsel in the area of data management. As may be clear from the EG&G case study, two of the major weaknesses of the methodology resulted from insufficient attention to data management. APQC rules that "cost/benefit analysis applies to data availability also." and encourages the use of data which is already available. APQC comments further that "...creating a whole data gathering system for one minor measure should be resisted." On the other hand if a critical measure or a leverage point needs data that is not immediately available, then systems need to be put in place so that this data can be acquired. The GMM reflects a similar philosophy and is relatively more advanced in detailing the data management process. However, the treatment is not rigorous in that the GMM doesn't specify exactly how data management can be done effectively. Procedures would surely vary from one site to another but basic guidelines are desirable and essential.

Phase 4 (Process and Output Validation) and Phase 5 (Link to Improvement)

Step 6.8 in Ruch's methodology combines GMM's Phase 4 and Phase 5. However, in Ruch's methodology, efforts to validate process and output are more visible than efforts to link to improvement. This appears to be the case with all the five methodologies, although Boyett and Christopher don't spell it out. EG&G is a very good example of a measurement system improving considerably after people got a chance to "stand back and look at what they had created." In terms of philosophy, all five measurement methodologies view measurement as a means for performance improvement. The GMM and APQC's methodology are more effective in outlining ways to achieve this; one of their strong points being that they emphasize that measurement should be seen as part of an
overall improvement process. All five methodologies, like the GMM, point out (some implicitly) the importance of recycling, modifying and improving the measurement process continuously.
APPENDIX E
The 7-Step Performance Improvement Planning Process

Source:
"Strategic Management at Naval Ordnance Station Indian Head"

by

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&
Michael Shapiro
STRATEGIC MANAGEMENT AT NAVAL ORDNANCE STATION INDIAN HEAD

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INTRODUCTION
The Naval Ordnance Station at Indian Head is entering the third cycle of its Planning, Programming, and Budgeting System. This System integrates the strategic plans for the Station's 19 Programs (business lines), 20 Departments (functions), and the Station's Strategic Plan in a bottom-up, top-down fashion. The System also sequences planning at the various levels to feed the budgeting process and reduce redundancy in compiling information needs for reporting requirements. This paper will describe the station planning system and Department strategic planning process as they now exist, incorporating many of the lessons learned during the first two cycles.

NAVAL ORDNANCE STATION INDIAN HEAD
The Naval Ordnance Station is a Navy Industrial Funded field activity reporting to the Naval Sea Systems Command. It employs 2,700 civilian personnel, and since 1890 has been a major contributor to the Department of Defense (DOD) in the development, engineering, and manufacturing of chemical propulsion and explosive ordnance systems and devices. Over the last 20 years, the station has undergone a significant transition from primarily production work to engineering services and pilot manufacturing process development. In addition, the recent increased focus on environmental protection, health and safety, security, and encroachment combined with shrinking budgets have resulted in considerable management challenges.

THE SYSTEM APPROACH TO PLANNING, PROGRAMMING, AND BUDGETING
All organizations, whether private or public sector, perform at least some level of planning. For field activities in the Executive Branch of the Federal Government, planning is conducted to satisfy two basic requirements: (1) internal and (2) external. Internal planning requirements address the particular needs of the activity and focus on maintaining and/or expanding the business and improving performance. The outputs of internal planning generally remain within the organization. Effective internal planning requires commit-

ment and discipline because it is driven from within and usually competes with day-to-day crisis management for a manager's time and energy.

External planning requirements for a field activity originate outside the organization and satisfy the needs of various corporate headquarters, organizations or sponsors. These requirements are rarely negotiable and thus ensure that every field activity will perform at least some level of planning. In most cases, the planning requirements serve as a vehicle for justifying the receipt of resources or as a way of controlling the expenditure of resources. In some cases, there are as many as 20 plans that must be submitted to higher authorities. Thus, the "system" forces an organization to at least prepare plans. The quality of these plans often determines success in obtaining desired resources. In situations where it is difficult for sponsors to make objective resource allocation decisions, the field activity that has provided good plans, justification, and appears to have their act together will often come out ahead. Generally, responsibility for the preparation of these multitudes of plans is scattered throughout the field activity's organization and there is seldom an opportunity to ensure adequate centralized review and consistency. The challenge facing a government field activity in this type of planning environment is to fully understand all aspects of the system and how to use it most effectively to achieve its desired goals.

In March 1987, the station implemented a major reorganization which realigned a number of departments, functions, and responsibilities. As a part of this reorganization, a Corporate Planning Division within the Resources and Planning Department was formed. The allocation of dedicated personnel and financial resources to specifically focus on the development and implementation of station-wide planning systems provided a clear indication of senior management's strong commitment to planning.

At the very outset, the Corporate Planning Division decided to take a comprehensive systems approach to the station's
planning rather than just develop a station strategic plan. The desired outcome was to make a significant improvement in the way the station performed its planning, programming, budgeting, and work execution.

The overall approach consisted of four steps. The first step was to identify all of the internal and external requirements associated with planning, programming, budgeting, and reporting. A requirement was considered real if it resulted in a physical product. The second step of the approach was to integrate all of the requirements with regard to their function or purpose, the time they were due, and their informational flow relationships. The third step consisted of developing and documenting a schedule of all the activities necessary to produce the internal and external required products. The key factors in determining the schedule were the due dates for the external requirements. All of the due dates for internal requirements were generated to be compatible with the external requirements schedule. The fourth step was the implementation of the system on a yearly cycle basis.

For the planning part of the system, we defined 3 planning time horizons and 3 planning levels. The 3 time horizons are (1) corporate which extends out to 20 years; (2) strategic which extends out to 7 years; and (3) tactical which extends out to 2 years. The 3 levels of planning are (1) station which covers our entire field activity; (2) programmatic which is planning performed for each of our 19 major programs or business lines; and (3) departmental which is planning conducted for each of our 20 organizational departments. Strategic and tactical planning are conducted for all three levels, namely station, programmatic, and departmental. Corporate planning is only required at the station level.

The station’s corporate (20-year) and strategic (7-year) objectives are provided as guidance to the programs and departments. The program managers do their business planning first. They lay out 7-year business plans for workload, funds, and resources. These plans are then reviewed by the departments to determine what is necessary to execute the program requirements. Using the station’s corporate and strategic objectives as guidance and the program plans for requirements, the departments then do their planning.

The major products are shown sequentially (Figure 1) with respect to time and information flow. The sequence starts each February and takes 15 months to complete. Therefore, the station is always working on two cycles concurrently.

The Corporate Planning Guidance Document is the first step in the cycle. It is prepared by and actually signed by all members of the station’s Senior Management Board (SMB). This document provides the station’s long-range corporate (20-year) input to the rest of the planning process.

The Internal Plan Specifications provide detailed instructions for the preparation of 19 Program and 20 Department Strategic Plans. The specifications very clearly and specifically define the plans’ contents and formats which ensure consistency between programs and between departments.

The Program Strategic Plans are prepared first, by each of the Program Managers. The plans cover a seven-year time horizon and include an executive summary, program history, current program structure, current accomplishments, external planning factors, program mission, program strategic objectives, program strategy, current and potential program workload, and program resources. Two weeks after the plans are due, the Program Managers formally present a summary of their plans and current outstanding issues to senior management.

The Department Strategic Plans are prepared next. These plans also cover a seven-year period and include an executive summary, department history, recent accomplishments, planning environment and assumptions, department mission, strategic objectives, strategic plans of action for each objective, personnel requirements, funding requirements, facility, equipment, and office space requirements, department organizational structure, training and recruiting, materials procurement, receipt, storage and transportation requirements, and information systems plans.

It is fairly apparent that the plans contain more information than is typical of a strategic plan. The intention is to use the plans as a data base to satisfy as many internal and external data requirements as possible. Any department that needs information from other departments can get the necessary data by including the request as part of the Department Strategic Plan Specification. By assembling all of the data at one time in one document, there is a much improved probability that the data will be consistent. The plans are generated without resource constrains. This
allows the departments to present their best ideas and market for more resources. The plans serve as a basis for resource distribution and decision making.

An overall Review and Analysis of the Program and Department Strategic Plans is performed by the Resources and Planning Department. Specific sections of the plans are reviewed in detail by the departments requiring the data to perform their functions (e.g., recruitment is reviewed by the Civilian Personnel Department and procurement is reviewed by the Supply Department).

Resource Prioritization and Allocation is the next major step in the planning system. It is conducted whenever there are insufficient resources to satisfy all of the desired objectives. In the current environment, direct sponsor supported workload only requires prioritization, while indirect workyears, Military Construction, facilities, and equipment funds require both prioritization and allocation. The allocation methodologies incorporate scoring algorithms that are weighted by the station’s corporate and strategic objectives. The final prioritizations and allocations are approved by the SMB Executive Committee. The allocations then feed into the annual internal and external planning and budgeting documents.

The Station Strategic Plan is drafted by the Corporate Planning Division with final approval by the SMB. It contains an executive summary, brief station history, recent accomplishments, planning environment and assumptions, station missions, station strategic objectives, strategy, workload and funding forecasts, and the results of the resource allocations.

The station’s External Plans are prepared by various departments depending upon the subject matter. Examples of External Plans are the ORD-NIF Workload Plan, Military Construction Plan, Asset Capitalization Program Plan, Ordnance Modernization Plan, Automated Information Systems Plan, Advanced Acquisition Plan, and the Station Master Plan. One of the primary reasons for having a disciplined planning system is to ensure that all of these External Plans are consistent and accurate.

One of the most important documents is the annual Budget submission which is the basis for authorization to expand funds. The Budget must be consistent with all of our External Planning Documents.

The last major planning system products consist of Status Reports which are required by upline headquarters sponsors. These probably have the least amount of certainty in terms of what will be required and when they will be due.

Once all the key planning, programming, and budgeting activities were identified and characterized, a master planning calendar was developed. The sequence and timing of activities was determined by first placing the due dates for the External Plans and the Budget on the calendar and then moving back in time to perform all of the activities necessary to support their preparation.

Implementation of the new Corporate Planning System was considered to be a major undertaking requiring total management commitment and a considerable investment of time, energy, and resources. The system involves a very high level of participation across every station program and department. Educating all of these players and getting a “buy-in” was very challenging and occasionally frustrating. Persistence, patience, and exercising attention to detail were key ingredients to maintaining progress.

The remainder of this paper focuses on Department Strategic Planning, one of the most challenging components of the planning system.

DEPARTMENT STRATEGIC PLANNING

In the rush of the first cycle, departments were left mostly to their own devices for development of department strategic plans. Technical assistance was available on request, but only one department was chosen as a pilot for outside assistance. This outside assistance consisted of the introduction of a structured planning process and use of an outside facilitator from VPC. An earlier version of this same process had been used to develop the U.S. Navy’s Productivity Action Plan [1]. The use of this participative process during a two-day facilitated planning retreat produced raw input for the plan’s major discretionary components (e.g., assumptions, strategic objectives, and tactical objectives). The department management team also found the information sharing inherent to the process to be invaluable. After submitting their first plans, several departments expressed interest in receiving similar assistance for the next cycle.

To provide impartial facilitation services to twenty departments required acquiring the services of a cadre of outside facilitators, who could play the role of “honest broker.” [3] Seven outside facilitators were brought together to prepare for the second cycle. Preparations included understanding the clients’ expectations, review of the planning process, and establishment of operating procedures. VPC functioned as outside “systems integrator” [2] coordinating the activities of the facilitators and interfacing with the Corporate Planning Division. The Corporate Planning Division functioned as the inside systems integrator, interfacing with VPC and coordinating the activities of the departments.

For some departments, taking the entire management team off-site for a retreat was a new experience. Even those that had previously had retreats generally limited attendance to a subset of the management team. At these planning retreats it was not uncommon for all branch managers and above to be present, as well as others selected for their technical or administrative knowledge. Discussions were lively; many management teams had never discussed things such as department mission, vision of the future, or guiding principles in such an open forum.
A common problem was getting midlevel and lower-level managers to think from a departmental viewpoint, rather than that of their division or branch. In situations where one unit (e.g., branch) is the customer of another, an optimal solution for the branch may be a suboptimal solution for the department. Getting managers to understand this new paradigm was not always easy. An Input/Output Analysis was used to get the participants to operationally define the unit of analysis, the department. An Input/Output Analysis graphically illustrates the department through identification of desired outcomes, downstream systems, outputs, transformation processes, inputs, and upstream systems. Development and discussion of the I/O Analysis forced the participants to consider the reasons their department existed (desired outcomes) and what its most important outputs were. Identification of upstream and downstream systems forced participants to consider entities whose performance might be reflected in or influenced by the department's performance. "Improved understanding of the big picture" was a frequently stated comment when participants were asked what they individually gained from the retreat.

Our objective during the second cycle was to better establish the process for developing departmental plans. Having each department hold a facilitated off-site retreat certainly contributed to accomplishing this objective. The departments followed similar agendas during their retreats and nearly all produced the same major components (department mission, vision, Input/output Analysis, assumptions, strategic objectives, and tactical objectives). Many departments also developed first-cut plans of action for implementing their tactical objectives. In addition to an external facilitator, a support person was provided to assist the facilitator, manage facility logistics, and collect the output data. After each session, this output data was organized into a report that followed the agenda and described the techniques used to generate the output. Department heads and strategic planners utilized these reports to fit their needs. Most selectively edited excerpts from their reports and combined them with information from their internal sources to produce their departmental strategic plan. In November, a one-day review of departmental strategic plans was held. Over one hundred of the Station's top managers attended, including the Executive Committee, the Department Heads and Division Directors, the Department Strategic Planners, and more. Each Department Head was given approximately 20 minutes to present an overview of their department strategic plan and allow for questions and answers. Never had so much information been shared to this large an audience.

Of particular note was the presentation by the head of the Supply Department, who used this as an opportunity to show what his department was doing to better serve the rest of the Station.

A lot was learned during the second cycle and not all of it can be described here. One important lesson was that the departments could not be treated as a single client, but must be treated as twenty different clients with a lot in common. This was particularly challenging given that our objective for the third cycle was to reduce variance across the departments in terms of quality of planning and quality of plans. The following section describes the planning process as it was used during the third cycle and how our earlier experiences influenced its design.

**THE STRATEGIC PLANNING PROCESS**

The strategic planning process adopted at Indian Head in 1987 has been evolving for nearly ten years [3]. Our experience at Indian Head has certainly contributed to that evolution. Our most recent iteration of the planning process was developed based on these guiding principles:

- The process by which you plan is as important as the plan itself.
- Those who must implement the plan must be involved in the development of the plan.
- We are more likely to act our way into a new way of thinking than to think our way into a new way of acting.
- Top management support and involvement is a prerequisite for success.

Committing our beliefs about planning to paper helped focus our attention while revising the model. We will now briefly describe the July 1985 model of the strategic planning process.

Step 1, Organizational Systems Analysis, is intended to prepare the management team for planning by improving the collective understanding of the organization. We have identified eight areas that may be examined to accomplish this, shown in table 1. Certainly this is not an exhaustive list, an organization must tailor it to their needs. At Indian Head, many departments have added a review of relevant Program Plans as a part of their external strategic analyses. An organization is not expected to examine every area during the first cycle. Trade-offs must be made between time constraints and the need to share information.

<table>
<thead>
<tr>
<th>Table 1: Areas of Organizational Systems Analysis (OSA)</th>
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<tbody>
<tr>
<td>1. Mission</td>
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<tr>
<td>2. Vision of the Future</td>
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<td>3. Input/Output Analysis</td>
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<td>4. Guiding Principles</td>
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<td>5. Roadblocks to Improvement</td>
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<tr>
<td>6. Current and Future Performance Levels</td>
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<tr>
<td>7. Internal and External Strategic Analyses</td>
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<tr>
<td>8. Strategic Assumptions</td>
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</table>

A minor revision we have made is to present the eight areas of OSA in the approximate sequence they should be examined. Many readers and planning participants asked in what order should they be examined. While this needs to be determined based on the organization and the audience, we have provided the above sequence as a starting point. Here are some other revisions we have made for 1989: We added the consideration of future performance levels to area 6 to get the participants to recognize the gap that may exist between current and future performance levels. We combined Internal and External Strategic Analyses into one
area because few organizations chose to examine one and not the other. In some cases, these were examined simultaneously. We made Strategic Assumptions a part of OSA. In the past, planning assumptions had been Step 2 of the process. Our experience and research have shown that developing planning assumptions is not always a step to be completed by the entire planning team. Often, a more appropriate approach is to have a knowledgeable subset of the team develop assumptions to be presented and reviewed by the entire team. We also found that developing planning assumptions was not appropriate for every planning team. Some teams were more likely to benefit from a thorough examination of unqualified plans (external strategic analysis), which already include many relevant assumptions.

Step 2, Strategic Objectives, defines what the department wishes to accomplish in the next 7 years. In the past, we have advocated the use of the Nominal Group Technique (NGT) [4] for developing strategic objectives. The NGT is particularly effective for designating who don’t have articulated objectives or are uncomfortable with their current objectives. The facilitators and departments at Indian Head have been very resourceful in developing techniques for reviewing rather than regenerating strategic objectives during their third cycle. While the NGT is great for getting ideas out in the open and prioritizing them to concentrate on the "mighty few," it often produces somewhat cryptic statements for strategic objectives. During the discussion that follows, these statements are generally understood by the participants. But the strategic planner is often left with the task of taking these statements, several days or weeks afterwards, and translating them into a comprehensive description of what is to be accomplished. To alleviate this problem, we have added two sub-steps: the development of expanded definitions and strategy statements for each top-ranked strategic objective. All activities to this point have been for developing tactical objectives. Individuals should be influenced by the vision, mission, roadblocks, strategic objectives, etc. developed previously. They are told not to constrain themselves with their strategic objectives, although some choose to do so. This open-ended approach is more likely to produce tactical objectives that support more than one strategic objective. These synergetic objectives might have been omitted if tactical objectives were developed for only one strategic objective at a time. A potential danger with the rational approach of developing a list tactical objectives for each strategic objective is overload. Time is a precious resource. An organization with 6 strategic objectives might develop 3 to 5 tactical objectives for each strategic objective. The resulting list of 24 to 40 tactical objectives could paralyze a planning team of 15 managers. While some organizations are successfully implementing this systematic approach, the resource requirements for coordination, as well as implementation, are more intense. In our holistic approach, we audit the resulting tactical objectives against our top-ranked strategic objectives. If we identify a strategic objective with no tactical objectives supporting it, we ask if one is required. Maybe nothing can be done in the next 0-2 years toward accomplishing this strategic objective. When that is not the case, we force an additional tactical objective onto our list. When we find a tactical objective that doesn’t support any of our strategic objectives we ask these two questions: Are we missing a strategic objective? If not, knowing that resources are constrained, is this tactical objective something we should be devoting resources to in the next 0-2 years?

The purpose of Step 4, Implementation Planning, is to determine how to proceed with implementation of the tactical objectives. The audit of tactical objectives against strategic objectives described above is actually a part of step 4. The audit forces a review and discussion which produces an enhanced list of tactical objectives to be implemented. In preparation for assignment, the planning team should identify which tactical objectives are currently being worked on, which have "fallen in a cranny," and which are new. An accountability matrix is a useful tool for sorting tactical objectives. The matrix lists all the tactical objectives down the rows. The columns are headed: ongoing activity, action plan, table, monitor & maintain, individual job, functional lead, and action team. The first four represent the current status or next steps to be used for each tactical objective. The last three columns represent how the tactical objective is to be assigned. Is this objective part of an individual’s job? Is this objective within the domain of a specific function? Or do we need an ad-hoc action team for this objective? Care should be taken in the assignment of tactical objectives. Our experience has shown that no one should be on more than one action team; otherwise, they become overextended. Remember, the action team is an ad-hoc assignment beyond the members’ everyday jobs. Assignment of accountability for a tactical objective does not imply that the individual or group assigned must physically implement the objective; however, does mean they are accountable for managing implementation.
The next task is the development of action plans or scopes of proposals for those tactical objectives identified as requiring them. Every tactical objective assigned to an action team requires an action plan. For those assigned to an individual or function, the planning team will have to decide if an action plan is needed. Complexity of the objective may be the deciding factor.

When the agenda allows, draft action plans are developed and presented during the planning session. If not, the teams are given a deadline to have their action plans ready. At the latest, this should be the 1st Quarterly Planning Review.

Step 5: Implementation Management, is the doing step. It consists of planning, organizing, executing, measuring, and evaluating. Team members assigned tactical objectives are expected to self-manage implementation. They should seek help or approval as needed. They can bring others onto the project, but must themselves remain involved. Complete delegation of a tactical objective to someone not involved in developing the tactical objectives is often ineffective. At the 1st Quarterly Planning Review, the individual or group will be expected to report on progress.

Step 6: Performance Measurement, is intended to enhance the organization's system for telling the management team how they are performing, if they are improving, and/or if they are "in control." We say enhance because all organizations have some form of measurement system, no matter how informal or incomplete. Our objective in Step 6 is to get the management team to operationally define performance for their organization. Once they have translated performance into desired outcomes or major performance dimensions (MPDs), we ask them to identify the pieces of information required for each of these. In a workshop setting, we often assign a group of 2 to 5 people to each of the MPDs. Their task is to prepare a presentation that shows the information they would share if given 10 minutes and 7 overhead transparencies to report on the status of their assigned MPD.

The group should focus on information that can be used by managers to solve problems and make decisions. An output of these workshops is a new tactical objective: design and implement a system for collecting and processing the data to portray this information in a visibility room (often the organization's conference room).

Step 7: Implementation, Review, and Evaluation, is the continued application of the process throughout the year. It is broader than just the implementation of tactical objectives (Step 5). It is intended to share information, review, and evaluate progress, and promote effective implementation. These implementation review sessions last from one-half to one day each. Some organizations hold reviews more often, others hold longer reviews, but the important thing is that regular reviews are held. At these meetings, the planning team reviews where the organization is in the process. They continuously look for ways to improve the process. Those accountable present progress on tactical objectives. Information sharing is encouraged within the time available. At the 3rd Quarter review, the team should begin thinking about the next cycle. The Annual Recycle should build on, but not be constrained by, the previous year's work. Many organizations use the recycle as a time to expand participation, by inviting more participants or integrating the session with a lower level's planning effort. The process is refined to fit the organization and become ingrained in the way business is conducted.

The Future

Strategic management is becoming a way of life at Indian Head. As the products of the system have become more clearly defined, quality has improved, resulting in increased management effectiveness and efficiency. Quality here is meant in the broadest sense, not only conformance to specifications, but proactively providing information to manage with and compete for resources. In addition to the efficiencies of an integrated system, many managers enjoy the developmental benefits of the planning process. What better forum to allow leaders to emerge, to share information, and resolve conflicts. Planning at the station and department levels promotes corporate thinking and helps break down the "segmental" paragons that handicap many older American organizations [5].

Where do we turn our attentions next? The continued development of the planning process for Station Strategic Planning is a priority. Many of the departments lead the station in planning sophistication. Capitalizing on what the departments have learned while tailoring it to the station as a whole will be challenging. Another area for future development is the continued enhancement of departmental performance measurement systems. Organizational performance measurement does not have one right "answer." It requires knowledge and a tolerance for ambiguity. The last two and a half years have been enlightening, our belief in continuous improvement leads us to believe the future will be even better.

APPENDIX F
The Manufacturing Engineering Department's Measures

Source:
White-Collar Performance Measurement for Acme Manufacturing Co.

by

D. R. Capur,
S. Godbole,
Mary Kocuiba and
Andrea Wellman
NO. OF TOOLS, FIXTURES, GAUGES

- CHANGED TOOL DESIGN
- NEW TOOL DESIGN

ANNUAL RUNNING TOTAL = 253
PERCENT OF TOTAL TIME SPENT ON PRIORITY PROJECTS

Week Beginning

- Time spent on other

- Time spent on priority projects

4/4  58%  4.2%

4/11 64%  3.5%

4/18 55%  4.5%
ECN|DRO TURNOVER TREND

FORMULA = OUT / (IN + WIP)
PERCENT OF TIME SPENT "TIME SHARING"

19.3%  22%  12.3%

4/4  4/11  4/18

WEEK BEGINNING
TOTAL BUDGET = $3,300,000
WRITTEN to date = $2,342,153
APPROVED to date = $454,381
EXPENDITURE to date = $184,677
TREND OF TASK LOADING CHANGES

◊ (127)

• - NC PROGRAMMING
∞ - TOOLING
◊ - PROCESSING
x - ADV. MFG.

WEEK BEGINNING

N/A  4/4  4/11  4/18
APPENDIX G


2. Consolidated Report from IPC p. 260
IPC's MANAGEMENT PRACTICES

I. Introduction

Chapter 4 presented the results obtained from the panel interview in IPC. There I indicated that IPC's measurement efforts should be seen in the light of the Center's overall Performance Improvement Planning Process. This process is facilitated by the 7-Step planning methodology described in Appendix E. In this Appendix I have attempted to give the reader a view of IPC's management practices to help him or her understand the role of measurement at the Center. I've begun by presenting a description of IPC which includes its business areas, mission, vision, guiding principles, and an overview of its strategic planning effort. This is followed by presenting selected components of IPC's strategic and business plan. The measurement component has been highlighted.

II. Description of IPC

The IPC is in the business of researching, designing, developing, and implementing management systems aimed at improving quality and productivity. The IPC was initiated by the Commonwealth of Virginia in 1980 to become a self-supporting R&D Center for the world, nation, region, and Commonwealth. IPC's major business thrusts are in the areas of 1) strategic planning for performance improvement, 2) measurement and evaluation, 3) management of participation, 4) compensation management, and 5) management systems engineering as it relates to Total Quality and Productivity improvement. We are researching the Organization of the Future. IPC's objective is bridge the gap between theory and practice and to develop and communicate knowledge about how organizations can be managed to constantly and continuously improve performance. To accomplish this object, IPC conducts research with organizations; publishes books, the journal QPM (Quality and Productivity Management), articles, and software; provides continuing management development workshops and seminars; engages in development projects with organizations; and, provides "extension" related services.
Mission

IPC has three missions:

- Improve the performance and competitiveness of selected state, national, and international organizations.

- Engineer management systems: design and develop strategies and techniques that will enable managers to improve their measurement, evaluation, control, and improvement systems, and thus improve their organizations.

- Transfer knowledge: provide professional development for a select group of associates and transfer knowledge and wisdom on performance management effectively.

Guiding Principles

IPC operates with a clear and explicit set of guiding principles. Its culture supports a constant critical audit to ensure the Center's performance is congruent with these established principles. Specifically, IPC strives to:

- focus on continuous development and improvement of our products, services, and performance;

- exemplify, in all respects, the concept of "the organization of the future";

- share information, rewards, power, and knowledge and move accountability for problem solving and decision making to the lowest appropriate level;

- employ the six-quality checkpoint process in pro-actively managing total quality; (see Sink and Tuttle, 1989) for an account of the six-quality checkpoint framework.
• maintain a long-term view of growth and development in the face of short-term pressures and issues;

• practice what IPC preaches (all IPC products and services are used internally);

• foster a culture that respects quality of work life and quality of life;

• provide products and services: 1) at a surplus if we can, to fund further research and development; 2) at a loss or at total cost break even if we must, to work on an important project; 3) always at the highest level of quality and professionalism.

**Vision**

IPC's vision is to be the best international center of its kind. IPC will be a leader in the following areas:

- Strategic planning for performance improvement
- **Performance Measurement**
- Compensation management systems (gainsharing, performance appraisals, performance development)
- Management of participation
- Total Quality Management/Total Performance Management
- Effective Implementation/management of Change/OD
- Small group behavior/process, motivation
- Management Systems Engineering
- Total Factor Productivity Measurement
- Multi-attribute Measurement System Development
- **Visibility room design and development**

IPC's potential products and services are:

- Video tapes to support short courses.
- New course on individual performance management.
- New course on just how to do PRFORM.
• New course on just how to develop measurement systems. (General Measurement Methodology).
• Consulting/development assistance to develop measurement systems and visibility systems.
• New software, SCORBORD & PRFORM will be major successes that spawn major new software development.
• New monographs.
• Our own "on the road" offering of short course(s).
• Quality and Productivity audits.

Notice that the importance of measurement systems is emphasized in the mission, vision and the guiding principles. IPC has initiated a measurement effort within the organization; it is also constantly improving its knowledge about measurement to provide sufficient expertise to its internal and external customers. AMERIKA is a step toward achieving one of the elements of IPC's vision; which is to develop a new course on how to develop measurement systems.

**IPC Activities**

IPC devotes resources to the areas of endeavor below. These activities support IPC's mission, vision and strategic plan. (a) Research, (b) Developmental Projects, (c) Publications, (d) Software Development, (e) Management Process Development, (f) Extension, (g) Service, (h) Internal Research and Development, (i) Operations and IPC Performance Improvement, and (j) Management Systems Engineering Options Support.

The 7-Step Planning Process and IPC's Performance Improvement Plan is a result of its efforts in the area of "management process development." IPC designs, "engineers," develops, and tests management processes. The primary management processes IPC devotes attention to are planning, measurement, compensation management and the management of participation. The 7-Step Planning process rests upon the principle that those who most often implement the plan are the best qualified to develop the plan. As
described in Appendix E, the process leads the participants through a series of steps. First, they must understand the system being studied. Organizational Systems Analysis looks at the areas mentioned above; mission, vision, guiding principles etc. Following this, strategic and tactical horizon objectives are developed. Action teams are formed to implement action items. Responsibilities and accountabilities are assigned. A measurement system is established, and tracking progress toward objectives begin. IPC will not promote a management process which it does not use on itself. Hence all IPC staff members spend 3-5 days per year off-site, working through the 7-Step Planning process. What follows is based on the output from this process.

III. IPC's Strategic Planning Effort

IPC Planning and Budgeting Cycle for 1989

The IPC Planning and Budgeting Cycle for calendar year 1989 is shown below. This represents a single cycle of the Planning and Budgeting System. IPC's Planning and Budgeting System integrates its strategic planning process and budgeting process so the "plan drives the budget." This calendar shows the planning and budgeting milestones.

1989

| January 5-7  | Strategic Planning Retreat |
| February 28  | Mid-Year Budget Review with 1st cut at 89-90 Budget Strategic Plan (Internal/red loop) |
| April 14     | 1st Quarterly Plan Review |
| April 21     | State University Top Management Team Review |
| May          | 1989-90 Budget Finalized/Initialized |
| June 30      | Mid-Year Plan Review |
| July         | End of FY Budget Analysis |
|              | 1989-90 Budget Update |
| September 29 | 3rd Quarter Planning Review Session |
| October      | 1st Quarter Budget Review |
| January 1990 | Strategic Planning Retreat |
While using the planning process the Nominal Group Technique is used to identify and prioritize IPC's Strategic Objectives (to be accomplished within 5-7 years) and Tactical Objectives. Tactical Objectives are those objectives IPC should/will devote resources to in the next 18 months. Responsibility for managing implementation of each tactical objectives is assigned to an individual, a business unit, an existing committee, or an ad-hoc action team. Progress is communicated/monitored through our visibility system and at our quarterly review sessions.

**Superordinate (must do) Strategic Objectives**

• To have established and improved management systems for operation of the Center and smooth delivery of products and services. To improve our management systems:

  - At the individual level: professionalism, time management, training, and professional development, understanding of clients and suppliers needs and wants.

  - At the project and business unit level: focus on Q1 & Q5, effective time management, teamwork, and performance measurement.

  - At the Center level: internal communication, recruitment, selection and placement of personnel, training, compensation, performance measurement, Q1 and Q5, Quality of Work Life, information/material/equipment management.

• To strengthen IPC's support to the "academic mission" of Virginia Tech. The IPC will be directly involved with applied and action research, applied development, teaching (instruction), transfer of knowledge outside the classroom/feedback of real world experience, student and faculty professional development.
• To define, design, implement, and maintain measurement and visibility systems throughout IPC.
  - Build measurement systems in IPC to ensure we are performing, are in control, and constantly improving our performance.
  - Design measurement system so it encourages internal customers to achieve.
  - Identifying measures is easy. Focus on effective implementation.

_Superordinate (must do) Tactical Objectives_

• Continue improving IPC’s visibility system. The desired outcome is to improve the quality and quantity of information shared within the Center.

• Formalize the compensation system and continue the gainsharing experiment into the overall compensation system.

• Continue improving the management of IPC’s accounting system.

• Develop and execute a public offering of the 3-day workshop, _Total Quality and Performance Management_.

• Complete the installation of a user-friendly mailbase so it can be accessed from any IPC workstation. Document and establish a process for real-time updating of our mailbase.

On reviewing the lists of superordinate strategic and tactical objectives one can see that improving internal measurement systems is a key issue at IPC. A description of several aspects of this important issue was presented while discussing the results from the IPC interview. This thesis research, in my opinion has made a contribution to IPC’s quest for knowledge about the design and implementation of measurement systems. It has not made made as much a contribution to the actual improvement of IPC’s measurement system. However, I believe IGMM can be applied to this end.
IV. Consolidated Report from Panel Meeting In IPC

A Picture of the Evolution of Measurement at IPC: The measurement effort at IPC has been ongoing almost since its inception in 1984. Initially the effort was oriented toward measuring the financial aspect of the business; keeping track of deposits and withdrawals from the company’s account. During the latter part of 1986, IPC moved away from measuring only financial performance to tracking non-financial indicators as well. The first attempt which was made to support the additional measurement effort was to use the Delphi Technique to arrive at a list of measures with which everybody at IPC was comfortable. Table G.1 shows the general approach adopted while administering the Delphi Technique.

Table G.2 shows the final list of eleven measures generated as a result of the Delphi Technique. The measures reflected both financial and non-financial dimensions of performance. Financial measures included IPC’s profitability; examples of non-financial measures included quality, innovation, quality of work life and so forth. Participation was low for the entire process. The response rate was about 25%. Reasons for low participation were not fully clear. It is suspected that it was either due to a lack of understanding or the busy schedules of people who were involved or as a panel-member put it, "...it was not on anyone’s priority list." It was not because measurement was seen as threatening. This is an important point which came across clearly during the interview.

Once the list of measures had been finalized, one person in IPC was assigned the task of coordinating the rest of the measurement effort; gathering data, deciding portrayal formats and installing charts on visibility boards. This person solicited the support of others in IPC for the effort. Meetings were held to decide next steps but there was a lack of continuity of effort. Hence, actual implementation was continuously delayed and the measurement effort lost its momentum. On the surface, the reasons for the failure appear
Table G.1: The General Approach to the Application of the Delphi Technique at IPC

*Four memos were circulated at approximately one week intervals.*

**Round 1 Task Statement**

Please list below specific measures/key performance indicators we can/should use to help us know whether IPC is getting better and how well it is doing.

Enclosed are two lists you may want to look over as you answer this question. You may select measures right from these lists, create your own, or a combination of the two.

**Round 2 Task Statement**

Enclosed is a compiled list of measures that were sent back by the seven who chose to participate. Out at the right side of each measure is a tally of how many identified that as a measure to look at for the IPC. The purpose of this next step is to: clarify, if necessary; combine, modify, delete, and add measures we should look at. I underline combine, because I believe this is the major objective for this particular application.

**Round 3 Task Statement**

Listed below you will find a reasonably complete and mutually exclusive set of potential measures of performance of the IPC (unit of analysis). Again, we are trying to develop a measurement system to give us insights into our performance against quality, QWL, innovation and other less tangible aspects of our Center's total performance.

**Round 4 Steps**

*Step 1:* From the list of 35 measures, select the nine that you feel are most important as indicators of how the IPC is doing. List them below.

*Step 2:* Now that you have selected your nine most important in outside-in fashion, rank the nine. First, select the most important, give it a nine. Then, from the eight remaining, select the least important, give it a 1. Proceed in like fashion until all are ranked.
<table>
<thead>
<tr>
<th>MEASURES</th>
<th>RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Progress towards plan budget.</td>
<td>100</td>
</tr>
<tr>
<td>2. Revenue analysis (eg. research division dollars).</td>
<td>90</td>
</tr>
<tr>
<td>3. Percent of jobs done without director.</td>
<td>80</td>
</tr>
<tr>
<td>4. Number of roadblocks removed.</td>
<td>80</td>
</tr>
<tr>
<td>5. Net surplus as a percent of total revenue.</td>
<td>80</td>
</tr>
<tr>
<td>6. Proposals accepted/proposals prepared.</td>
<td>70</td>
</tr>
<tr>
<td>7. Total quality management effort.</td>
<td>70</td>
</tr>
<tr>
<td>8. Quality and Productivity Management (eg. timeliness)</td>
<td>60</td>
</tr>
<tr>
<td>9. Average no. of hours reported works/position/project/week.</td>
<td>40</td>
</tr>
<tr>
<td>10. Development foundation balance by category.</td>
<td>40</td>
</tr>
<tr>
<td>11. Employee professional development dollars as percent of total revenue per employee.</td>
<td></td>
</tr>
</tbody>
</table>
simplistic. However, when the panel made an attempt to recall and probe the circumstances, useful findings were made.

One person thought that the Delphi effort had the appearance of an academic exercise. The measurement effort did not look real and most people could not see the consequences of it. It wasn't tied to evaluation of any kind and hence no rewards. The measurement effort made an attempt to communicate purpose but could have done a better job. Another panel member made the observation that in most organizations financial measurement systems were well in place before they embarked on an effort like this one. However, in IPC the financial measurement component was still in a state of infancy while the other components were being added on. Being a young organization, financial information was critical and more and more resources and time were devoted to improving this particular component. Still another member of the panel observed that IPC was experiencing tremendous growth during that period; and as a result each person had incredible line of sight on everybody else's performance. So, the need for a "formal" measurement system to track non-financial measures may have been redundant. Another person in the panel commented that the effort was initiated because IPC was trying to practice what it preached. As indicated earlier, one of IPC's areas of expertise is in the area of building measurement systems.

At about the same time, IPC defined "levels of measurement;" Level 1, 2 & 3. Level 1 measurement was seen at the organization level; Level 2 measurement was for projects; and Level 3 was measurement at the individual level. Level 1 measurement was manifest in the Delphi approach described earlier; examples of measures at this level can be found in Table G.2. Level 2 measurement was for specific projects and programs; the purpose was to show how projects and programs performed on an individual basis. Was the client happy? Was IPC producing the deliverables? Was IPC learning from the project or
program? Were projects and programs running within budget? How much surplus was created? Level 3 measurement focused on how individuals were performing at IPC. Individual performance measurement was done using a "Level 3 report" or a "Performance Development Report (PDR)," which would be initiated by a group of IPC employees for another employee who was seen as slacking off in performance. The PDR is presented in Figure G.1. As shown, it has several dimensions of individual performance and the employee would be evaluated against each dimension. This way feedback would not be necessarily all negative since there would be dimensions along which the individual would be performing either satisfactorily or at motivated performance levels. The interrelationships between Levels 1, 2, and 3 measurement emphasize company level performance as most important; IPC will not succeed, long-term, unless it performs as an organization. Projects and programs are next in importance since the employees must manage performance at this level to satisfy clients and improve the quality of products and services. However, project and program performance must be evaluated relative to what is happening at the company level; it's possible to perform well on projects and programs and not succeed as an organization. Individual performance is also very important. However, individual performance is necessary, but not sufficient, for group performance; everyone doing their best is not enough (Deming, 1986).

The panel meeting once again revealed points about these levels of measurement that I had not thought about. For example, one of the panel members observed that although Level 2 measurement was the weakest in terms of direct efforts, there had been many informal efforts at measuring project and program performance. Level 3 (individual measurement) was usually carried out for all IPC employees with information from project and program performance. IPC works on different projects and programs and each project or program manager manages at least one of these with support from operations management (see Figure 4.2). Level 3 reports were usually initiated as a result of unsatisfactory performance on projects and programs. Of course, project and program
**Figure G.1: IPC's Performance Development Report**
Efficiency: "Right" amount of resources

<table>
<thead>
<tr>
<th>resources</th>
<th>underused</th>
<th>just right</th>
<th>no waste</th>
<th>GW</th>
<th>MSQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

- Quality

**Quality**

<table>
<thead>
<tr>
<th>Upstream communication &amp; coordination</th>
<th>unacceptable</th>
<th>O.K.</th>
<th>great</th>
<th>GW</th>
<th>MSQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

**Quality** "Right" inputs

<table>
<thead>
<tr>
<th>rarely</th>
<th>often</th>
<th>always</th>
<th>GW</th>
<th>MSQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

**Quality**

<table>
<thead>
<tr>
<th>Quality of work</th>
<th>fair</th>
<th>good</th>
<th>excellent</th>
<th>GW</th>
<th>MSQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

**Quality** Zero defects sent, Output quality

<table>
<thead>
<tr>
<th>fair</th>
<th>good</th>
<th>excellent</th>
<th>GW</th>
<th>MSQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

**Quality** Proactive downstream system communication, coordination, endorsement of satisfaction (Pre, During, Post)

<table>
<thead>
<tr>
<th>unacceptable</th>
<th>O.K.</th>
<th>great</th>
<th>GW</th>
<th>MSQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

Figure G.1: IPC's Performance Development Report (Cont'd)
### Quality Improvement Orientation and Actions

<table>
<thead>
<tr>
<th></th>
<th>Acceptable</th>
<th>Motivated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Just</td>
<td></td>
<td></td>
</tr>
<tr>
<td>get by</td>
<td></td>
<td></td>
</tr>
<tr>
<td>imp. efforts</td>
<td></td>
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</tr>
<tr>
<td>imp. efforts</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW</td>
<td></td>
</tr>
<tr>
<td>MSQ</td>
<td></td>
</tr>
</tbody>
</table>

**Specifics:**

What you may need to do:

- Personal productivity (Output not activity * Input [hrs])

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mediocre</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW</td>
<td></td>
</tr>
<tr>
<td>MSQ</td>
<td></td>
</tr>
</tbody>
</table>

**Specifics:**

What you may need to do:

- Innovation

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mediocre</td>
<td></td>
<td></td>
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<th></th>
<th>GB</th>
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</thead>
<tbody>
<tr>
<td>GW</td>
<td></td>
</tr>
<tr>
<td>MSQ</td>
<td></td>
</tr>
</tbody>
</table>

**Specifics:**

What you may need to do:

- Budgetability

<table>
<thead>
<tr>
<th></th>
<th>Fair</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW</td>
<td></td>
</tr>
<tr>
<td>MSQ</td>
<td></td>
</tr>
</tbody>
</table>

**Specifics:**

What you may need to do:

- Miscellaneous performance indicators

<table>
<thead>
<tr>
<th></th>
<th>Fair</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW</td>
<td></td>
</tr>
<tr>
<td>MSQ</td>
<td></td>
</tr>
</tbody>
</table>

**Specifics:**

What you may need to do:

- Leadership performance indicators

<table>
<thead>
<tr>
<th></th>
<th>Weak</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW</td>
<td></td>
</tr>
<tr>
<td>MSQ</td>
<td></td>
</tr>
</tbody>
</table>

**Specifics:**

What you may need to do:

**Figure G.1:** IPC's Performance Development Report (Cont'd)
### P13 Flexibility and responsiveness

<table>
<thead>
<tr>
<th></th>
<th>fair</th>
<th>good</th>
<th>excellent</th>
<th>GW</th>
<th>MSQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

### P14 Maturity, judgment, and discretion

<table>
<thead>
<tr>
<th></th>
<th>fair</th>
<th>good</th>
<th>excellent</th>
<th>GW</th>
<th>MSQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

### P15 Situational lead, manage, follow

<table>
<thead>
<tr>
<th></th>
<th>fair</th>
<th>good</th>
<th>excellent</th>
<th>GW</th>
<th>MSQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

### P16 Personal responsibility for work output and outcomes

<table>
<thead>
<tr>
<th></th>
<th>fair</th>
<th>good</th>
<th>excellent</th>
<th>GW</th>
<th>MSQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

### P17 Monitor own performance

<table>
<thead>
<tr>
<th></th>
<th>rarely</th>
<th>often</th>
<th>always</th>
<th>GW</th>
<th>MSQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

### P18 Manage own performance

<table>
<thead>
<tr>
<th></th>
<th>inadequate</th>
<th>just get by</th>
<th>excellent</th>
<th>GW</th>
<th>MSQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

### P19 Seek "right" assistance and resources to ensure quality

<table>
<thead>
<tr>
<th></th>
<th>rarely</th>
<th>often</th>
<th>always</th>
<th>GW</th>
<th>MSQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics: What you may need to do:

---

Figure G.1: IPC's Performance Development Report (Cont'd)
Pi10 Cooperate, help other associates if and only if own responsibilities are being met; initiative to do so

<table>
<thead>
<tr>
<th>indifferent</th>
<th>midway</th>
<th>helpful</th>
<th>GW</th>
<th>MBQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

Pi11 Personal and professional development; rate of progress

<table>
<thead>
<tr>
<th>low</th>
<th>moderate</th>
<th>high</th>
<th>GW</th>
<th>MBQ</th>
<th>GB</th>
</tr>
</thead>
</table>

Specifics:

What you may need to do:

Other Criteria (Design your own scale)

Figure G.1: IPC's Performance Development Report (Cont'd)
managers formed only a part of the total work force of IPC but they were and continue to be a critical and large part. One panel member sums it up;"...in fact, we never thought about any level. Not much of Level 1 except for financial things. Not much of Level 3 either. It was all level 2. Everything else sprang from Level 2 incidents." Another panel member noted that when IPC started, there were only projects. A little later however, "projects became individuals; so instead of thinking about IPC's projects, people began to refer to projects as this person's or that person's projects." This created a problem in that instead of identifying IPC's problems, energy was focused on individual problems. The panel agreed that this was true and that systems and procedures at IPC were overlooked while identifying problems. It was usually the individual who was held responsible for doing a poor job. However, the focus on the individual has been changing gradually at IPC. Currently, it recognizes that for effective and efficient project and program management, adequate systems needed to be in place in addition to skilled individuals. These systems include documenting common guidelines for executing projects and programs.

The members of the panel had mixed opinions on whether or not effective measurement systems would have helped them during the initial years of IPC. One person commented that the operations of IPC were relatively uncomplicated; and hence he would have probably managed well. The same person, however, indicated that it all depended on the different types of measurement. For example, measuring the Quality of Work Life of IPC's employees (Level 1) does in no way help him manage a project better. If it were labor costs (Level 2) that were being measured, then sure, that would probably contribute to how effectively he managed a project. He was evidently alluding to the purpose of the measurement effort, the use of the measures for him, and also the audience for a specific measurement effort. A similar view came from another panel member. This person believes that although the current operations of IPC are far more complex than they were in
1986 or 1987, measurement was necessary then and would have probably made project management much easier; particularly in the area of determining the actual value of projects and how much each should be charged. There was overall consensus that the current (1989) financial and project measurement systems would have been "overkill" two or three years ago. The improvement in the financial measurement system has been particularly useful over the past year. This is so since IPC's Director has less visibility on projects and programs than he has had in the past; primarily because he was previously directly involved with almost every project and/or program. This has changed to a situation where a few projects are currently implemented with minimal or no involvement from the Director.

Currently, IPC continues to have difficulties with Level 1 measurement. Despite improvement in the clarity and crystallization at this level of measurement, IPC is still not sure as to exactly what information this level of measurement needs to portray. Further, there is also no certainty about the audience. Is it the Director alone or a group of key people or the entire IPC? The need for measurement systems continue to be a high priority action item generated during the company's annual planning retreats. Action teams to work on the Level 1 measurement system have been assigned several times but all have come away with different ideas as to how to do it. One panel member said the following, "...we seem to form a team to do something and we give them X number of days. And after a while we say, well, they haven't done anything. So let's form another team. Suddenly we have another team working on the same thing and I don't know if they pick up on what the first team learnt or start from scratch again." This has implications on the the "data management" phase of a measurement methodology. How can a team effectively assign responsibilities and accountabilities for collecting, storing, retrieving, processing and portraying data? The issue of top management commitment and involvement was brought up in the discussion. One panel member pointed out that key members including the
Director were involved in the definition stage but "ownership" was passed on during the implementation stage. This brings up the interesting issue of differentiating between top management *commitment* and *involvement*. During this research, I've observed that organizations often confuse between the two, hoping for involvement from top management when commitment and empowerment only were necessary for a group to proceed and implement an idea or in this case, design and implement a measurement system.

Although problems continue to remain in Level 1 measurement, IPC has taken several strides in the financial and Level 2 measurement systems. The current financial measurement system has the ability to provide reasonably accurate and timely financial information on all projects and programs of the company. The panel agrees that there is lot more potential to it than there is now. They are confident that with a little more time and accurate and timely input data, the system can maximize the accuracy and timeliness of financial information for its users. Level 2 measurement has noticeably improved despite the increased complexity and volume of IPC's business. "Disaggregated" or personal measurement systems have been created by most project and program managers and staff members. Since almost nobody is threatened by measurement at IPC, creation of one's own "visibility system" appears to be a natural outcome of the existing environment.

*IPC's critique of the General Measurement Methodology:* The GMM was regarded as a "conceptualization" by most of the panel. One observation was that the methodology is not a result of previous efforts and that it is a result of someone thinking about a logical way of "doing" performance measurement. One of the primary concerns was that it was not clear as to what type of measurement the GMM was suitable for. If measurement is regarded as a tool for decision making, then it was not completely certain that the GMM when used could produce measures to give information that would support decision
making. Perhaps the methodology could give the information but certain members of the panel felt that on occasions there would be no necessity to go through the process as depicted by the GMM. If the need for information came from a person A and he or she knew that the particular piece of information was available with another person B, then the GMM did not come into the picture. So first of all, there needs to be a better definition for what "general" means in the context of the GMM. Where is the methodology applicable and where is it not applicable?

Another observation related to information being tied to decision making was also worth noting. One of the panel members quoted an author who wrote that all measurement systems are based on the assumption that managers know what decisions they need to make. If this is true, then care needs to be taken while choosing the group who will finally develop the measures which will support the group's decision making. Having a heterogeneous group can result in complexity because how does one determine what common decisions need to be made and if there were any at all. The way the GMM or versions of it have been used, thought may not have been given to this concern. If the indicators which result from the measurement effort are those that are sort of "nice to see" then, this is not a problem. However, it does become a problem when the team needs to base decisions on the information portrayed by the measurement system. Another panel member noted that the most important customer of a Level 1 measurement system in any organization is probably top management; he was of the opinion that these were the people who made decisions based on the information from Level 1 measurement. For others, Level 1 information would be simply "nice to see." Another panel member observed that this visualization may be looking at black and white and omitting the grey area. He said that pieces of information like safety or QWL records, which may be nice to see may initiate an indirect decision-making process. For example a person could infer from Level 1 measurements that safety was low; this could influence him or her to take safer actions.
Further although only a "handful" of people would actually make decisions based on information from Level 1, the rest of the people could use Level 1 measurements to understand why some decisions were being made and why some others were not.

One of the panel members doubted if the phases were in the right order. The question which asks if measurement is necessary at all is not posed by the GMM. The implicit assumption of the GMM that planning of some kind precedes measurement is important but should be portrayed better. In addition to finding out if measurement is necessary, it was also suggested that the determinants of the decision to measure are also important and should be identified. These two steps would make the task of generating measures much less difficult. The entire panel agreed that these were crucial points. Another person found it interesting that "measurement teams" were formed before "creating a suitable climate." According to him, "...seems to me if you don't have a climate why bother forming a team." There was no consensus on who constituted measurement teams and what constituted a suitable climate. I believe that this depends on the organization, its people and the purpose of the measurement effort. Depending on these factors the measurement team could be a name given to a specific group of people, the management teams or the entire organization. The improved measurement methodology has attempted to clarify these terms in Chapter 5.

The issue of "creating a climate" sparked a couple of other good points. One of the panel objected to "creating suitable climates" as part of the GMM. He said that "creating a suitable climate is not something we do just like that." This person pointed out that there is a need to change and improve processes before changing cultures or creating suitable climates. So, directing the user of the GMM to create suitable climates before starting the measurement effort will not be the logical thing to do. It is an integral part of the measurement process but somehow should be shown differently. Another panel member believed that the creation of suitable climates is linked to the purpose of measurement. In
his words, "If this is couched in the context of an improvement planning effort, if we want to know how well we are implementing our plans, then that's one thing. If we want to know how well we are doing on a project, so we can figure out where to spend more money or where to spend less money, then that's another issue altogether. If we're doing this because we want to sell something to people upline, then that's another issue. The assumption here (in creating a suitable climate) is almost that all measurement is threatening." Another comment concerning the creation of the suitable climate was that in a way, a piece of the climate was the measurement team itself. To substantiate his point, the respondent went on to explain that calling a group of selected people the measurement team may be incorrect because it does not in any way empower them to use the information from the measurement system. Another panel member supported this observation with data; he said that may be true because several people in IPC who were probably impatient with the slow progress on the Level 1 measurement system were relying on disaggregated measurement systems to feed them with information only they needed.

The way the methodology is portrayed gives one an impression that developing a measurement system consists of a series of steps which if followed would result in the measurement system. The point is, according to a member of the panel, "...when we do measurement it doesn't seem like there's a way we can do it with a real step by step methodology." This person suggests that there should be a list of possible stages or just a grand strategy and/or a list of guideline questions or conditions that the measurement team should be able to fulfill to be able to develop a measurement system. The panel agreed that the GMM portrayed a better "how to" picture of measurement system development than the Management Systems Model described in Chapter 2. Recall that the GMM is an "exploded" form of steps 3 through 5 of Management Systems Analysis (MSA). Although MSM/MSA was conceptually very strong it took a lot of "reading between lines" to understand the specific steps involved in developing a measurement system.
An Evaluation of IPC's Measurement Experience with Clients: As indicated in IPC's description, one of its areas of expertise is helping organizations in the design, development and implementation of measurement and evaluation systems. In fact, the panel agreed that IPC may be more known for measurement than for anything else. There is a reason for this; in 1984, when the current Director of IPC joined the organization, he brought along with him a wealth of knowledge and experience in the use of specific measurement techniques like the Total Factor Productivity Model (TFPM) and the Multi-Criteria Performance Measurement Technique (MCPMT). These techniques are different from the concept of measurement systems design in that in the case of TFPM and/or MCPMT, it was more or less decided as to what was going to be measured. In most TFPM cases it was productivity and/or profitability. The MCPMT considered various other dimensions of performance but it continued to be a developing measurement tool and not a methodology which explicitly took into account the design, development and implementation stages of a measurement effort.

The GMM has not been directly used with clients in the form in which it is now. Prior to a measurement session the methodology was however presented to the client to show the various stages involved in measurement system design. Consequently, the Nominal Group Technique would be administered to the client-group for the purpose of generating measures. Once measures had been generated, each measure would be reviewed individually to determine the a "measurement hierarchy" or "level" of the measure. Identifying level was simply to force the clients to arrive at the "countable" in the measure. As explained in Chapter 2 under "significance of research," most measures when first generated were found to be broad and the location of the actual item to be tracked required a focused effort. This was an area with which IPC struggled quite a bit initially but has achieved more clarity now. However, the thinking on a "measurement hierarchy" has
improved considerably and IPC now has levels defined that make it easier for the client to identify the "countable" directly (see p.16-18 in Chapter 1 for a description of the evolution of the measurement hierarchy). Another factor which made this process difficult was that a typical measurement workshop conducted by IPC would be designed for two days and on occasions would have large groups that were difficult and strenous to facilitate.

So, there were two problems there; one of a big group and another of a shortage of time. In fact, in most cases, there was just enough time to develop the measures, identify the levels and take an initial cut at developing the portrayal format of the measure. In some cases the agenda didn't even allow this much to happen. Once measures were generated, brief instructions were given on how to develop information portrayal formats and how to collect, store and retrieve data. Large groups were another problem. Not only did it make the entire process tedious for both the facilitator(s) and the group; but it also raised questions about the right composition of the group and its ability to identify the "right" measures. The panel observed that having the wrong mix of people in the room could start the entire effort in the wrong direction. This is because the actual "purpose" for such a large group would be difficult to define; and if the purpose is defined incorrectly, their first output (the list of measures) could be the wrong initial input into the measurement system design.

IPC has noticed that most of their clients have failed to do a good job of continuing the measurement effort after the measurement workshop. One of the better examples of where IPC has been successful in teaching measurement has been with one of its biggest clients. Measurement workshops have been held in various departments of this client-organization. Discussions with facilitators and support staff at these sessions indicate that progress to date in most departments has been good. However, there has been performance variance between departments in how measurement teams have been continuing the work of IPC.
Some of this variance, according to a panel-member is due to the selection of the measurement team from the department. Another portion of the variance, according to another panel-member is due to the variance in the teaching approach adopted by the different facilitators employed by IPC. This probably highlights another weakness. While a procedure to design a measurement system should be a flexible one, there probably has to be some consistency even between the various modifications. Still another portion of the variance was attributed to the skill and the preparedness of the different facilitators.

The panel also discussed proposals that were written for measurement workshops; members were of the opinion that for measurement, IPC may have been adopting the strategy it adopts for its performance improvement planning workshops. It was pointed out that the outputs from planning workshops were easier to follow thorough without the expert’s assistance. However, measurement differed in that first of all, it was a topic which took time to sink into people’s minds and second, the post-workshop steps in the measurement methodology probably required as much or more effort than the activities during the workshop. Hence, in the context of the measurement proposal which IPC sent out to clients, it was suggested that the basic design of proposals be re-examined. Measurement workshops need to be designed to be a longer-term effort than it has been so far. These suggestions are incorporated in the improved methodology.
APPENDIX H

1. Management Practices in Acme (Source: Acme) p.280
2. Consolidated Report from Acme p. 286
ACME's MANAGEMENT PRACTICES

I. Introduction

The results from researching the ME department in Acme were presented in Chapter 4. A description of the ME department was also presented; however an overview of the entire organization was deferred to this Appendix the purpose of which is two-fold; 
(a) to provide the reader with an overview of Acme, the organization and (b) to provide the reader with a description of company-wide performance improvement programs within Acme. One of the findings of this thesis is that a measurement effort in an organization should be seen in the context of an overall performance improvement effort. In IPC as well as GSP&L, this link was evident and relatively easy to identify. However, Acme's case is different. It is not directly evident that the measurement effort in the Manufacturing Engineering department is tied to a specific component of Acme's "Productivity Plan" described on the following pages. The plan has four "core values." These are (a) Employee Involvement, (b) True Partnerships, (c) Reciprocal Credibility and (d) Utilization of Technology and Advanced Manufacturing Methods.

I believe the linkage between these core values and the ME department's measurement system is not readily apparent since there is a difference in the unit of analysis. While the Productivity Plan has been written at the organizational level, the measurement system has been developed at the departmental level. Hence, when one considers a departmental performance improvement intervention, its exact relationship to the corporate improvement effort is perhaps relatively difficult to identify. In Acme's case, I believe the role of the ME department's measurement system in the Productivity Plan is important. Although not clearly defined, the measurement system appears to form a part of the first three core values of the Productivity Plan. The following pages presents descriptions of Acme as well as the components of its performance improvement efforts.
GENERAL

The Acme Company is a nearly three billion dollar U.S. based, multi-national corporation involved basically in the manufacture of compressors, pumps, construction equipment, bearings, tools and lock hardware.

The Rock Drill Division has two manufacturing sites, the primary manufacturing facility in Roanoke, as well as a plant in Yokohama, Japan.

The Rock Drill product line consists of track-mounted, air and hydraulically powered rock drills, down-hole drills, pavement breakers, jack drills and the components, accessories and drill bits necessary to support these products. The equipment is used primarily in construction, quarrying, and mining applications.

Approximately 60% of the market is off-shore.

The Rock Drill Division relocated from Phillipsburg, N.J. to the Roanoke facility in the latter part of 1983.

Completed in 1969, the physical plant at Roanoke has over 250,000 square feet of environmentally controlled manufacturing space, as well as 50,000 square feet for administrative purposes. The Roanoke facility currently has one of the largest full-scope machine shops in the Southeastern United States.

Working a three shift, five day week, the facility employs in excess of 525 people.

Included in its two-hundred-eighty machine tools are sixty-two technologically advanced NC and CNC numerically controlled tools. The facility also utilizes one of the first automated flexible manufacturing systems in the world; capable of machining 17 different parts at any one time.

MANUFACTURING PLAN

The Rock Drill Division Manufacturing Plan is based on the utilization of advanced technology and modern manufacturing methods coupled with a committed, involved and skilled workforce to provide quality products at an internationally competitive cost.

This Plan was developed in the context of real change from the old "smokestack" industry approach which dominated the Division's past. Through aggressive, progressive and flexible conceptual development, this dynamic plan was created.

PRODUCTIVITY PLAN

Within the Manufacturing Plan was created a concept and direction of how we would facilitate and encourage the attainment of our goals. Known as the Productivity Plan, it is based on four core values:

I. Employee involvement, in the business at its optimum impact level. (At the individual person's responsibility level.)

II. "True partnerships" in the decisions, risks and rewards of the business.

III. Reciprocal credibility as a result of commitment and open communication between all groups, levels and individuals involved in the business.

IV. Utilize technology and advanced manufacturing methods where they are needed and where they are cost effective.

The Productivity Plan is a dynamic concept constantly being redefined and refocused within its strategic framework as people issues, technology and business circumstances change. The Plan as previously outlined, is discussed in detail in the following four sections.

I. Encourage employee involvement in the business at its optimum impact level.

The foundation program to encourage and realize this "value" was our "Work Improvement Teams" or WIT process.

We have chosen to emphasize the participation aspect of the process rather than the cost-savings issue. The evolved "participatory" aspect of this process has helped make us more competitive by providing quantum leaps in productivity and quality resulting in literally millions of dollars of cost avoidance and savings. These savings are the end product of inherent culture and motivational changes; thousands of individual ideas, decisions and actions made on an hourly, daily and weekly basis by hundreds of concerned and committed Rock drill people.

The W.I.T. process is the foundation of our productivity plan. Its success in accomplishing its goals and its ability to help create a viable medium in which to encourage positive change is a key reason we are able to compete successfully world-wide.
11. "True Partnerships" in the decisions, risks and rewards of the business

The W.I.T. vehicle is successfully changing the work environment and changing both our people's and our leadership's commitment to involvement. The next logical step to "True Partnerships" was a tangible, reinforcing override on the W.I.T. process. This action would further encourage our people to make necessary cost-effective decisions, take calculated risks and as a result share monetary rewards for their successes. When employees become true "stakeholders" in the business the credibility of the process is enhanced dramatically.

Conceived in 1984, the Rock Drill Division Performance Bonus Plan was the way we chose to attain the aforementioned goals. The Bonus Plan is a unique variation of the "Gainsharing" concept.

**THE ROCK DRILL DIVISION PERFORMANCE BONUS PLAN**

**STRATEGIC GOAL** - Create a sharing-driven commitment by all Rock Drill people to competitiveness, improved performance and cost reduction.

**SPECIFIC OBJECTIVES**
- Create a tangible foundation, both literally and emotionally, for our people to become "true partners" in the business.
- Have a plan that is understandable, creditable, and "touchable".
- Have a plan that is cost-effective and is directly related to how well the business is doing.

**UNIQUE FEATURES:**

- **ANNUAL PLAN** - Goals reviewed and can be modified annually.
- **"TOUCHABLE" CRITERIA** - Measured areas can be impacted directly by all participants.
- **BUSINESS SENSITIVE** - Payout percent maximum annually variable to coincide with the business situation.
- **SALES/INVOICING SENSITIVE** - Measured areas impacted by sales/invoicing volume.
- **SHARABLE INFORMATION FORMAT** - In-depth information can be shared without compromising competition sensitive/proprietary data.

The other unique feature of the Bonus Plan is the effect on our compensation policy. Since the Plan provides potential earning opportunity well above our normal wage or salary guidelines, future wage and salary planning takes into account a portion of the expected bonus payout.

This accomplishes incrementally, over the long-term, wage and salary planning based somewhat more on the performance of the business, which, in concert with progressive appraisal and merit programs provides a more rational and business sensitive approach to compensation.

**JOB EVALUATION**

In order for our people to operate most effectively within the Productivity Plan it was necessary to review and revise all our manufacturing shop positions as to function, direction and scope.

A comprehensive evaluation process was commenced early in 1984. The specific goals of this process were:

A. To provide shop position descriptions and classifications that:
   - Support the Productivity Plan.
   - Provide flexibility through the creation of generic-type functional positions.
   - Coincide with the technology and methods inherent in the Manufacturing Plan.

B. To provide a structure utilizing the rate range progression for the wage advancement based on performance rather than more traditional "time-phase" method.

To understand the evaluation dilemma one must realize that manufacturing technology has taken major leaps forward in the last 10 - 20 years.

New technology has caused a revolution in productivity and utilization. Where we once were bound to a "one-machine/one-man" concept, the new technology provides highly productive equipment that requires greatly reduced or no manning by an individual operator. Further, cell technology or the combining of equipment and processes into an integral unit, that takes raw material to finished product in one operation has caused an additional evaluation problem of significant proportion. The aforementioned was the case in the Roanoke facility. Existing evaluation systems were not designed to cope with these advancements. As a consequence, we were forced to create a system that worked in this environment.

282
SHOP PERFORMANCE APPRAISAL SYSTEM

Our ability to come up with a creative alternative to a "time phased" rate progression was based on our
negative experience using traditional procedures. As a practice, comprehensive performance appraisals of
shop people are overlooked. Through past practice, union contracts, etc., a shop employee tended to be a
"performance island". After enough time had passed they would receive an incremental wage increase within
their rate range called a wage progression, regardless of the quality of his performance.

We determined that this situation provided an opportunity to further announce and support our
Productivity Plan, what was outlined at Roanoke as a result of this opportunity is stated in the following:
1. All shop people are given a formal appraisal by their supervisor every six months.
2. Meaningful two-way communication on a persons individual performance is emphasized.
3. An opportunity every six months to receive a substantial wage progression based solely on individual
   performance was accomplished.

QUALITY PROGRAMS

Within the framework of our Manufacturing Plan the emphasis on quality is a bedrock consideration. The
drive for excellent quality has become an obsession fueled by the W.I.T. process, the Bonus Plan and via
management initiative.

Our current quality programs are based on four foundation considerations:
A. No Formal In-Process Inspection
B. Quality Audit and Sampling Program
C. Quality Task Force Involvement Group
A. No Formal In-Process Inspection

In late 1985 all in-process quality inspector classifications were eliminated. This action was taken for
four reasons:
1. The belief that every person is responsible and accountable for their own quality.
2. Advanced technology and methods obsoleted the process.
4. Reduced overhead costs.
B. QUALITY AUDIT AND SAMPLING PROGRAM

As a result of the in-process inspection being reassigned from the Q.A. Department to the individual
operators, an overview procedure needed to be developed.
In response to this need an Auditing and Sampling Program was instituted by Quality Assurance. Auditing
by Q.A. people is currently being performed on a sample basis at the Receiving, Final Inspection, and
Shipping phases of manufacturing process.
C. QUALITY TASK FORCE

Since the decision was made to re-inject responsibility and accountability back into the workforce an
action-oriented vehicle was needed to help accomplish this goal. The Quality Task Force (Q.T.F.) was formed
in late 1985 to assume this role.
Q.T.F. is made up of members who represent a broad cross-section of the entire workforce. Its tactical
mission is to address quality from an involvement or "bottom-up" standpoint.
Specifically, the object of the Q.T.F. is to:
* Identify quality problems.
* Analyze their causes.
* Analyze their solutions.
* Implement those solutions.

M.I.R.F.T.

In concert with the aforementioned factors a unique Quality awareness and development program was
devised. Known as M.I.R.F.T. (Make It Right The First Time), it addresses the often overlooked "block and
tackling" quality-related issues. The M.I.R.F.T. program consists of:
* Vision examination for all applicable persons.
* Written tests on the use and reading of measuring instruments (micrometers, calipers, versiers, etc.).
* Written test on use and reading of blueprints and schematics.
* Training for those people found deficient in measuring instruments or blueprint reading.
* Training on how to perform a good first piece inspection.
* A communication "awareness" program emphasizing the concept "Make It Right the First Time".

283
III. Reciprocal credibility as a result of commitment and open communication between all groups, levels and individuals involved in the business.

The ability to effectively communicate with our people is critical to the success of our Productivity Plan. In the work environment created by the other aspects of the Plan a credible in-depth knowledge of the direction, successes and failures of the business provides the “glue” that holds the whole thing together:

Our communication network is based on eight base programs:

A. Individual Contact/Open Door Policy
B. Small Group Meetings
C. W.I.T. Process
D. Quarterly “State of the Business” Meetings
E. Attitude/Climate Surveys/Feedback
F. In-house Organs
G. Spouse Meetings
H. Bulletin Board/Electronic Message Board

IV. Utilize technology and advanced manufacturing methods where they are needed and where they are cost effective.

The history of the Rock Drill Division is inclusive from the very beginning with formation and success of Acme. Simon Ingersoll, our founder, invented the first steam powered rock drill back in the mid-nineteenth century. In those days manufacturing methods were crude and required tremendous amounts of manual labor to manufacture products.

As time passed, methods and equipment improved, and heavy manufacturing gradually changed from labor intensive to capital intensive, machines and technology were making a difference.

When the Rock Drill Division left the Northeast and its old “smokestack” origins, another moment for real change was at hand.

Utilizing “state of the art” concepts, our overall plan for technology and methods was based on two (2) key points:

A. To optimize production output by effective integration of machines and manpower.
B. Provide a greater degree of employee involvement and participation in the evolution and sustaining of our manufacturing operation.

To accomplish these two goals several exhaustive manufacturing engineering tasks had to be accomplished:

1. Review the machine tools at our old site and the existing machines to determine commonsality...
2. Then eliminate the least productive similar machine.
3. Analyze the interdependent relationships between operations performed by the various machine tools.
4. From these relationships develop broad flow patterns of the work going over these machines.
5. Arrange machine tools in such a way as to minimize material handling and to optimize work flow.

From these basic studies and processes evolved the opportunity to implement one of the most modern of manufacturing technologies... known as Cell Technology.

DEFINITION:
CELL - A grouping of two or more machines and/or processes performing sequential manufacturing functions in one operation; with minimal set-up, reduced manning, no indirect labor and virtually no in-process inventory.

In order to implement this technology four additional planning steps were accomplished:

1. Determination of parts or products suitable for manufacture in cells (family of parts)
2. Selection of appropriate equipment to be utilized in cells
3. Work flow studies to generate cell configuration
4. Machine-cycle balancing to uniformly distribute work to cell operators

Cell technology demanded a broader scope of responsibility and a wider variety of skills by the individual operator. Therefore, the evaluation process provided more "generic" classifications. As a result the total number of individual classifications were reduced by almost 40% providing maximum operator flexibility and exceptional utilization.

Cell technology provides a viable and highly cost effective medium of significantly increasing productivity while reducing cost and fostering in-depth employee involvement and participation at the maximum impact level.
Another process within the facility that provides significant productivity gains is known as the Flexible Manufacturing System (FMS).

FMS is a number of machine tools performing different operations which are controlled by a host computer. The computer is capable of sequential scheduling a wide variety of parts through its machine tools.

The host computer contains NC programs for all the components programmed to run on the machine tools captive to the complete FMS. As suitable machine capacity becomes available the host schedules and downloads individual programs to the appropriate captive machine tools. This enables the activation of the relevant machine cycle and the subsequent machining of the scheduled component. In this way machine tool utilization is maximized.

FMS eliminates all indirect labor (except maintenance) in its manufacturing process.

Training

To bring our people up to the level of expertise necessary to operate successfully within our manufacturing system a major training program was undertaken.

Initially the problem was finding enough skilled machine tool operators. We overcame this situation by utilizing the Virginia Employment Commission to screen and test applicants using the General Test Battery as an indicator of mechanical aptitude.

During this period of heightened employment activity the Industrial Training Division of the State of Virginia conducted machine tool operator training programs for new employees to provide the needed skills.

The next phase of the program involved our "in-house", on-the-job training. New employees were trained by the Group Leaders in the departments to which they were assigned. New or transferred people will receive three weeks of closely supervised intensive OJT.

Within the cell concept is the requirement for cross-training in order to obtain expertise in all the operations which make-up the cell. This final phase is accomplished via on-the-job-peer training with the cell operators sharing their individual expertise.

MANUFACTURING SYSTEMS:

The impact of these manufacturing advances provides the Division significantly greater productivity and cost-effectiveness. The advent of cell technology, flexible machining systems and robotics also put new and unique pressures on our manufacturing control and support systems.

Proprietary MRP (Manufacturing Resource Planning) and PP&G (Production Planning and Control System) computerized control systems were implemented at Roanoke.

The Roanoke Engineering/Manufacturing/Financial Control System is an integrated group of subsystems incorporating an efficiently constructed master database which allows the centralization of information required by the variety of functions at the facility.

Marketing forecasts, distribution center requirements, customer orders, stock objectives, and stock are all utilized to determine a production plan. The production plan has conflicting goals, maximizing customer service, yet minimizing inventory. From the "ideal" production plan a "realistic" master schedule is formulated. The formulation of this schedule considers machine tool backing, machine tool breakdown, material delivery, lead-time, quality problems, etc. While the production plan is a long-term plan (1-1/2 - 2 years) the master schedule considers the short term (3 - 4 months).
II. Consolidated Report from Field Interviews In Acme

In order to write an account of performance measurement in Acme, I had to sift through a massive amount of data found in the interview transcripts; this is a characteristic of the unstructured interview (Burgess, 1984). Although each interview was guided by a list of basic questions (Table H.1), respondents were encouraged not to be constrained in any way while sharing information. Most questions asked were variations of or exactly those depicted in Table H.1. I did not find it either comfortable or useful to go from one question to another in a mechanical fashion. On several occasions, one question led to another issue that needed to be addressed, reflecting an important characteristic of the open-ended interview. Many "how," "what," "why," and "when," questions had to be supplemented to the list of basic questions during the interview. (A list of these modified and additional questions are presented in Table H.2.) The intent was to initiate and maintain a dialogue or a conversation rather than a question and answer session. The analytic strategy designed and adopted for this study was partly based on the expectation that the interviews would generate a lot of data and would not necessarily follow a pre-designed list of questions. After doing several interviews and being close to inundated
Table H.1: Questions used to support Field Interviews

**DESIGN**

Who constitutes a measurement team in an organization? What are the skills required by a measurement team? What is the role of the "measurement master"?

How does top management see its role in measurement system development?

How can an organization elicit the commitment and cooperation of its people to successfully perform measurement?

Is the concept of performance measurement communicable? If not, why? If so, how?

How does an organization know if it is measuring performance and doing it right?

**IMPLEMENTATION**

Why don’t organizations measure performance? Why don’t they do it right?

What are some of the “critical incidents” that occur during the implementation of a measurement system?

Why is there a tendency toward a fear of measurement?

What are some organizational factors that support performance measurement?

What are some organizational factors that fail to support performance measurement?

How can an organization elicit the commitment and cooperation of its people to successfully perform measurement?

Is the concept of performance measurement communicable? If not, why? If so, how?

**OUTCOMES AND OBSERVATIONS**

Why do organizations measure performance? What principles guide the setting up of measurement systems in organizations?

How do current measurement philosophies differ from traditional/classical measurement beliefs?

How can one distinguish between effective and ineffective performance measurement systems?

How pervasive are performance measurement systems in organizations that you’ve been in?

For an organization, what are some of the short-term and long-term consequences of not measuring performance?

How do reward systems tie to measurement systems?

How can we develop a consistent terminology with respect to measurement?
Table H.2: Examples of Supplementary Questions asked During Field Interviews

- From your perspective what measurements should take place in this department/company?
- What are some examples of "subjective" and "financial" measurements?
- How would you describe measurement at the different levels of your organization?
- What are your views on financial measurements as a motivator for improving performance?
- How does performance appraisal link to group level measurement?
- Would your measurement process or methodology be transferable?
- In your organization, what is the equivalent of an airplane cockpit?
- Please describe your personal measurement systems for me and tell me how you use them?
- What do you think is the main purpose of the measurement systems you have in your organization?
- What are some of the performance improvement interventions that have worked well in your organization?
- What was your initial reaction when you were told that a measurement system was going to be put in place?
- What did you see your role as in the measurement system design and implementation stages?
- Do you have a gut feel for why this (measurement) was performed?
- What would you have done differently if you had been given the responsibility?
- In a white-collar environment, what needs to be measured?
- Did your department measure the right things? If not what would you have liked to see on the board?
- What are some of the systems you have in place to collect data?
- What proof did you, the providers of data, have to tell what you were providing was useful?
- How could we tie some sort of an incentive to a measurement system?
- Why was the measurement system set up in the first place?
with data, the author is convinced that for this thesis-problem, the "conversational" approach to interviewing was probably most appropriate.

The strategy of the unstructured interview, however, had its own drawbacks. The most important and major one is that a sizable amount of unnecessary or quasi-irrelevant data crept into each interview transcript. Trip reports helped filter these pieces of data to a certain extent. However, they were not "lost" because they continued to be in the interview transcripts which were regularly referred to for an elaboration of points made in the Trip report. Once the trip reports had been written I proceeded to the next level of data examination. How could I extract relevant information from the transcripts and the trip reports? Relevant information in this context would refer to those pieces of information generated from all the interviews that I believe could contribute to the improvement of the GMM.

In IPC, since I used the structured interview technique the categories under which I had wanted to capture information were defined prior to the panel meeting. However, at Acme I had adopted the unstructured interview technique and the task of categorization was done after the interviews. This is a second procedural difference encountered while researching IPC and Acme (the first one was concerned with the unit of analysis). In section 4.5, I have attempted to address this difference also. There, I've explained why the interview techniques used at the two sites were different. I've also supported the use of varying data categorization methods and predicted the effects they can have on the results of this research.

As suggested in the proposal of this thesis, for Acme, a coding technique was used to arrange the various pieces of data to support the objective of improving the GMM as well as to form a coherent, accurate description of the case studied. The coding technique used
consisted of: (1) reading each interview transcript and accompanying trip report several times, (2) forming categories or major "information-generating" topics or categories in trip reports and transcripts, (3) reviewing each trip report for pieces of data that fell under each of these codes and (4) arranging and rearranging codes and pieces of data to form "some kind of expository and sociological coherence" (see Section 3.3.3.3). In all, ten categories were generated.

(1) Top management commitment and involvement is important but should be anticipated and used appropriately.

(2) Educating the people involved should be stressed throughout the measurement system development process.

(3) The role of the nature of the business and individuals' responsibilities should be taken into account.

(4) Need/Purpose of the measurement system should be crystallized, understood and communicated.

(5) Unit of analysis should be clearly defined.

(6) The nature of the measures generated should be examined to fit audience, operation and organization appropriately.

(7) Data and information management.

(8) Importance/existence of "personal" measurement systems.

(9) Characteristics of the methodology used.

(10) Roadblocks in the path of successful implementation.
The following pages contain an account of my findings under each category.

**Top management commitment and involvement:** Of the seven interviews conducted two were members with Acme's top management (outside the ME department). In retrospect, the author believes that the discussions with these two individuals were useful from the point of view of getting a picture of top management perceptions and beliefs about measurement systems. However, on scanning the interview transcripts and trip reports, it is not immediately evident that these meetings generated specific information about the ME department's performance measurement system.

In any case, the response from top management was both enlightening and disappointing. Enlightening because, several comments from this level carried with them wisdom accrued from experience and knowledge. Disappointing because it was expected that top management would have been a little more involved and informed about the performance measurement effort in the ME department. It is not clear if this expectation is a justified one. Beyond approval and initiation, did these people have to be actually involved? The analysis of the interviews shows that there is general agreement that the departmental measurement effort was approved and initiated from the top with the expectation that a prototype in the ME department would be a starting point for developing similar measurement systems in other departments. Support from key people at the top, outside the ME department, continued to remain throughout the effort. It appears as though their involvement was not expected after the approval stage. From here on, it was a departmental effort and commitment and involvement needed to come from everybody within the department, particularly from key people like the manager and the supervisors.

The interviews reveal that inadequate involvement by key people may have been a cause for implementation difficulties. It appears to have been a case where only a minority of key people were actually interested in keeping up the system which was established.
These people were closely involved from the first stages, understood the design and also had a vision for what it could eventually become. Unfortunately, the interest in these people and the lack of it in others led to one or two people coordinating the entire effort. This coordination involved making sure that each employee in the department handed in data at specified intervals and ensuring that charts, graphs etc., were updated periodically. Seemingly, there was no effort by these people to reiterate or communicate the purpose of the system when it was noticed that participation and involvement were decreasing.

Another major problem has its roots in a departmental reshuffle which occurred soon after the measurement system had been designed. A supervisor replaced the manager of the department who was transferred to another department. Also another supervisor in the ME department (one of the people who coordinated the effort) left too, to take up another position in Acme. The supervisor (who is currently manager) admitted during the interview that he did not understand the measurement system or its purpose. In his words "...my attitude may have passed on to my subordinates." Despite these changes, the original coordinators of the effort continued their work; it was more difficult this time because of their physical and work-related separation from the ME department. Inevitably (perhaps) the measurement effort came to a standstill.

Education: "Education" relates to how much teaching was done into the effort prior to starting it, during the design stage and also after the system has been set up. For all the effort which has gone into the ME department's measurement system design, it was not clear from the interviews that everybody had at least a moderate understanding of current philosophies and practices in the area of white-collar performance measurement. Most of the respondents spoke eloquently about time standards and financial measurements.
I did not notice, for example that in the ME department performance was viewed as multi-dimensional. One of the basic premises of the methodology which was used to develop the department's measurement system, is that performance has several aspects to it. A concern of one of the top managers interviewed was that apart from the "drill" of generating measures and similar activities, attention wasn't paid to determine whether it changed behavior and whether the group felt partners in those measurements. It is clear that prior to starting the measurement effort, the senior design group did have an initial session where an attempt to communicate the meaning and purpose of the effort was made. One respondent pointed out that education was critical not only while embarking on an effort, but also during the effort. A combination of a lack of time and a weak strategy for teaching the people in the ME department may have led to inadequate knowledge and skill transfer.  

*Nature of the business:* Although people were not in complete agreement with the measurement system design in the ME department, most of them pointed out that it was important for them, if done right. They recalled the nature of their jobs when there had been a single-task orientation and compared it to the current multiple-task orientation and agreed that the present orientation is definitely in line with the philosophy of white-collar performance measurement. In terms of the nature of the entire business, a top manager made a comment. He said that Acme as a whole was doing very well. In his words, the company was going through a "high management cycle." During these cycles companies typically made a lot of money; the bottom-line. Under these circumstances, how could one expect a performance measurement system such as the one in the ME department (within Acme) to succeed/survive? The implication apparently is that people all over the

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6 While making this point, it must be kept in mind that the "facilitators" or "measurement masters" in this case were a group of seniors. It would probably be unfair to assume that the group possessed the required amount of knowledge and skill.
organization is looking at the bottom line of the company which is profitability. They probably find it difficult to understand the need for improvement interventions such as measurement systems. According to the top manager, in "low management cycles," organizations tend to be more receptive to such interventions.

*Need/Purpose of Measurement:* I found that there was no commonality in each person's understanding of the measurement effort. Some respondents found a *need to measure* and their *definitions* of the measurement system's purpose were *based on these needs*. Innovative thinking about measurement was apparent when people were asked about the need to measure. Some of the respondents viewed measurement as an "analytic tool," to help portray how the company was doing; however, one of them cautioned against relying solely on measurement to determine this. What would be some other ways to show how a business is doing? Doesn't any way involve the act of measuring?

The manager of the ME department pointed out that although he needed several pieces of information to make decisions with, he did not believe that everybody else in the department could put that information to any good use. However, he thought that it was important for other employees to at least "see" this information because this way they would understand how decisions were made. Another important observation was that measurement helps people focus on what needs to be done and lends direction to those efforts. Several respondents felt that measurement should be used as a work-load scheduling tool; this was a sensitive issue in the department. A few of the people I spoke to claimed to be overworked and their first impression when the department decided on the measurement system was that it may have been a work-load leveling effort. From the manager's perspective, work-load scheduling was important because the charts gave people an opportunity to "see" for example, why they were either being moved from their current positions. The same manager said, "...in today's management practices, you don't always
have the time to tell people why you are doing what you are doing. Measurement can be used to do this."

Although not explicitly stated, most people mentioned purposes of measurement which had an "improvement-orientation." Only one person alluded to "gaming" the system when he said, "...one of the advantages of having a measurement system is that people will be made to keep busy since the results of their efforts are being made visible through the use of charts."

**Unit of Analysis:** A majority of the respondents were not clear that the measurement system which was developed was intended to be a departmental system. The ME department is comprised of four separate groups: new products, processes, N.C. programmers and tool designers. Although these are distinct groups, the work they do is interrelated. The design of the measurement system has attempted to "attach a progress record to the department;" or in other words, it has attempted to build measures that would be common for the entire department. Most respondents agreed that the goal of the measurement system was valid and would be possible to achieve, but for some reason or the other, the "common" set of measures appear to have been built for the wrong unit of analysis. One of them even suggested that a more useful version of the measurement board would be one in which there would be separate indicators for each group in the department. That would have been more helpful. One of the respondents made an important point that even if a departmental project was hailed as a success, it was difficult to measure the different problems and conflicts that arose during the execution of the project. For example, one group typically was always busier than the other. A second group was always heavily dependent on another group to do its work well. A measurement board such as the one in the ME department should be able to track such problems.
The preceding paragraph listed some of the measurement system-specific problems related to the unit of analysis. In terms of a general awareness for this critical issue in measurement, I noticed both knowledge and ignorance. One of the respondents had some good insights on the link between measurement at different levels of the organization. He said that in his experience, at the organizational level it was possible to have a single indicator to tell you how the organization was doing. However, as you go lower and lower, the need to shift from a single indicator strategy to a multiple indicator strategy becomes essential. The fact was that the ME department attempted to do this but retained an old paradigm of keeping to "concrete" indicators that measured individual performance. The problem was that these indicators did not really measure the department's contribution to Acme. At the other extreme, I found some people comparing and equating the departmental measurement effort with individual performance appraisal which is done in Acme.

**Nature of the measures generated:** There were some people who said that they did not find the measures on the measurement board (please see Appendix E for the ME department's measures) useful at all; there were others who said they found them partially so; nobody felt that all the measures were meaningful. Problems related to the nature of the measures were cited the most often. One of the respondents found the measurement board "too general." According to him it was like taking a picture from an airplane. "There's a forest out there, but you can't tell if the trees are pine, oak or redwood." The trick is to achieve a balance between being "general" and "too specific or burdening the board with details." One of the more insightful statements in this regard was made by a top manager, "If there's a way by which you can tap the people to actually determine what's important, then that will be very useful."
Another respondent was of the opinion that although called a "white-collar measurement system," the ME department's system did not actually measure the intangible aspects of performance so commonly found in the white-collar setting. He felt that in retrospect, the department had come up with quantitative measures which almost singled out individuals in the event of both good and poor performance. Another respondent (a top manager) made a point related to the previous one. He was speaking about organizational level financial measures and the relative ease with which they could be developed; perhaps the quantitative nature of the measures in the ME department was due to the fact that they were easier to develop. This person also observed that financial measures were not only easily developed but they were also easily measured. According to him, some non-financial or "subjective" measures (his example: measuring the performance of team or group activities) is difficult because one doesn't notice the effect immediately. These kind of measurements convey information only in the long run because one needs to follow trends for a certain period of time before making an evaluative judgments.

**Data and information management:** Difficulty in the collection of data for the measures was a major problem in the ME department's measurement effort. The senior design group did a good job of designing data collecting instruments. The issue of setting responsibilities and accountabilities was perhaps not given as much importance. This has been a commonly observed phenomenon during the course of this research. In Acme, the members of the ME department were initially consistent in filling out the data collection sheets distributed to them. One of the coordinators would compile and summarize the data to update the charts on the measurement board.

The interviews reveal that although there were quite a few reservations against the measurement system initially, people appeared willing to give it a chance. However, their efforts to cooperate dwindled when they noticed that the charts were not being updated
periodically. Several respondents asked the question that if a result (trend in performance levels as defined by the measurement board) could not be observed, how could people be expected to participate. Now the issue of why the board was not updated arises. As mentioned earlier the design of the measurement system assigned the entire responsibility of compiling data and updating charts to one person. The senior design group's report as well as the interviews indicate that under the then prevailing circumstances there was perhaps no alternative; but it's not certain. The person assigned to updating charts said that the task did not reveal its actual size until all the data from employees started pouring in. It was overwhelming and he suddenly realized that there was no way he could manage alone. How could this dilemma be resolved given the circumstances as well as the resources available?

*Presence/importance of "personal" measurement systems:* A few of the respondents revealed that they depended to a large extent on "personal" measurement and visibility systems to give them insight into their respective jobs. Some of these people had already established these systems and had been using them. Some others were found to be in the process of developing them. The presence of the personal system was noticed when the respondents were asked if they had a need for critical pieces of information to manage with. Most agreed this need was very much present and they received these pieces of information from "their own records." These records typically tended to be a part of the respondents' personal files and reflected past, present and predicted future information requirements.

For example, the manager of the department had records telling him what he needed to know. Some of these were: number of engineering changes per week, average of how long it takes to do an engineering change, how many new jobs came in and how many were processed, how many rate changes for the shop came in and how many were
processed etc. Another respondent appeared very excited and proud about his personal measurement system. Most of the information from this person's system was used to report progress to his boss. Quarterly and annual reports were developed as a result of using this information. This person was of the opinion that personal systems such as the ones that he had established should be developed by every manager. Only when that had been done could measurement systems at the departmental level succeed. Another respondent made it clear that he was "putting together a report" for himself and this would contain pieces of information that he needed in his daily work. Notice that there can be different purposes for personal measurement systems.

**Characteristics of the methodology used:** As described in Section 4.2.2.5, the procedure which was used to develop the measurement system in the ME department was adapted from the GMM and consisted of the steps in Phases 1, 2 and 3 of the methodology. None of the respondents could offer a comprehensive critique of this procedure. A few believed that it was not "complete." They could not actually pinpoint what was needed but they thought it ended rather abruptly after a couple of activity-filled steps. Some others believed that the procedure was not designed to take the group across the "implementation bridge." These people were of the opinion that for an effort like this one to succeed, people with knowledge about the actual working principles need to associate longer with the client-group. Either this or they need to transfer knowledge and skills adequately. Another flaw in the methodology was that purpose was never clearly defined. However, there is evidence that this was done during the initial stages but there appears to be no way of assessing how effectively it was done.

Another drawback reported was that the methodology was not tailored to this particular organization. However, this was verified not to be completely true because the procedure described in Section 4.2.2.5 does reflect modifications to suit Acme. In any case, this
observation emphasized and reinforced the fact that design principles for measurement need to be very flexible and should take the form of a set of guidelines which can be moulded to suit the client's most important needs.

Referring to another problem area, a few of the respondents observed that involvement was low during the measurement system design and development stages. It was reported that in addition to low involvement by the right people there might have been a certain amount of "negotiation" in the process of generating the list of measures. The Nominal Group Technique was used (most people enjoyed using it) but some of the people believed that this list may have been later modified by the manager of the department and the supervisor responsible for coordinating the measurement effort. This was verified to be true.

Roadblocks in the path of successful implementation: Under this category, an attempt has been made to capture and summarize reasons that have contributed to the ineffective implementation of the ME department's measurement system. One of the points most often cited was that the measurement system once developed was "never maintained." Some of the reasons which can be attributed to this have been discussed under "data and information management." Also in this regard one of the top managers commented that "the trouble in identifying and going after data is usually the single source of failure."

Was measurement perceived as a threat? My conclusion is that those respondents who believed and understood the system did not consider it a threat. They understood that the system was designed not to show individual performance, but group

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7 This brings up an interesting point in that modifying the list was perhaps not entirely the wrong thing to do; because there is no proof that the group generating the measures was of the right composition. It is likely that the team who did the post-NGT review and modification had more insights into what the ME department, as a team needed to "see."
performance. However, those who were impatient with the system and did not reflect a belief in it considered it more of a threat. "Trust" was another related issue which was discussed. The interviewees admitted a lack of trust or confidence in the measures that were generated. According to one person, "the senior manager must want and understand the system; also his assistants must understand the system and make sure that all records are kept and turned in at the end of the week." In similar vein, the manager of the department spoke about "change" causing anxiety in people. In the ME department, the measurement system was viewed as an element of change. There was no initial resistance and the people worked through the first stages of anxiety in order to give the measurement system a chance. But the moment they noticed that it wasn't really helping them in any way they began reacting negatively to the "change" by not participating.
APPENDIX I

1. Management Practices in GSP&L (Source: GSP&L) p. 303

2. Consolidated Report from GSP&L p. 311
GSP&L's MANAGEMENT PRACTICES

I. Company Description

GSP&L is one of America's leading utility companies. In 1986 GSP&L won the electric industry's coveted Edison Award in recognition of its Quality Improvement Program. The Quality Improvement Program (QIP) originated in 1981. It grew out of GSP&L's problems experienced in the late 1970s. Fuel costs were rising, inflation was soaring, heavy capital expenditures seemed inevitable, and at the same time knowledgeable customers were demanding reliable service at low cost. The days of building bigger plants and selling cheaper power were gone. The situation was similar to that faced by many manufacturers.

II. Quality Improvement Program

QIP at GSP&L has three phases:


Quality Improvement Teams

Within GSP&L they have become known simply as "QI teams," or just "teams." Their function is similar to that of quality circles. The purposes of the teams are to develop the skills, abilities, and attitudes of the team members as well as to improve the quality of GSP&L's services. There are four kinds of teams:

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8 The sources of information contained in this section include interviews at GSP&L as well as documentation acquired during my field visit there. As with IPC and Acme all names have been changed to ensure confidentiality.
1. **Functional team:** Usually a natural work unit, and all volunteers.

2. **Cross-functional team:** Formed to address problems that cut across organizational boundaries.

3. **Task team:** Members are appointed from one or more organizational units to work on a specific problem. When the problem is solved, the team is disbanded.

4. **Lead team:** These teams are headed by a vice president, staff manager, plant manager, or other manager as appropriate. These teams serve as steering committees for the activities of the teams operating in their areas. They determine how team members are selected, and duration of team meetings. One hour per week is average.

    Facilitators coach team leaders. They communicate and coordinate the QIP efforts between teams and functional units; and handle all other duties generally associated with facilitators of quality circles. In addition, GSP&L has a quality information clearing-house known as Information Central. This clearing-house keeps the files on team membership and their Quality Improvement (QI) stories. It processes and communicates Improvement Action Memorandums resulting from team activities, and assists with team evaluation processes. Information Central coordinates lead team and corporate recognition activities. With 1500 teams, GSP&L is festooned with recognition materials, and the process of providing recognition materials and occasions is a management task in itself.

    Teams normally focus on problems falling within their own work areas. An issue falling outside that scope should be "bubbled up" to lead teams, which often appoint a task team to look into it. Supervisors may be team leaders, but typically they are not. Supervisors are usually facilitators, and they are encouraged to support the teams. However, functional teams select their own topics (called themes) to study. (Task teams work on assigned topics.) A brainstorm list of topics may be narrowed to four or five themes by a process called "multivoting," a system of group voting which quickly
winnows out the preferred themes. Themes to study are selected based on 1) Whether it impacts the customer and 2) The team’s judgment on whether a condition needs improving. Teams present their proposals (QI Stories) to the level of management which can either authorize action or explain why the solution cannot be implemented.

The Quality Improvement Story

Every QI team functions by using the seven-step QI story approach shown in Figure I.1. It is similar to the storyboard approach used by many companies, but is unusually rigorous. This methodology is general, but useful for any scope problem—from hurricane contingency to ordering lunch. Training for participation in QI teams concentrates on the QI story and the analysis techniques that support it, and also emphasizes meeting skills and respect for people necessary to work as teams. The value of this training began by enhancing the capabilities of the employees even before QI improvement stories began rolling in.

Policy Deployment

Policy Deployment is GSP&L’s overall corporate improvement process. Many corporations have a strategic planning process. GSP&L does strategic planning through Policy Deployment so that quality goals and quality activities at all levels support the corporate vision. All the problem-solving effort by departments, individuals, and QI teams should head roughly in the same direction. The intent of Policy Deployment is to do more than plan strategy with a quality twist. By concentrating company resources on a few priority issues, GSP&L targets breakthrough objectives in performance.

Though GSP&L’s corporate vision is guided from the top, it is not passed down from the corporate office without input from around the company. Policy Deployment is a process involving everyone in management. The strategic planning and feedback process is
Figure I.1: The Quality Improvement Story; A Worksheet for Daily Problem-Solving
4 COUNTERMEASURES (What steps will correct the problem?)

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>ROOT CAUSE</th>
<th>COUNTER MEASURE</th>
<th>EFFECTIVE</th>
<th>FEASIBLE</th>
<th>OVERALL</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURRENT PROCESS IS INADEQUATE TO MEET 7 WORKDAY DEADLINE FOR RECEIPT OF THE 6175 FORM</td>
<td>UNFAMILIAR WITH FILLING OUT FORM</td>
<td>MANUALLY TRAINING</td>
<td>6.0</td>
<td>4.0</td>
<td>20.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BACKUP UNFAMILIAR WITH PROCESS</td>
<td>MANUALLY TRAINING</td>
<td>4.0</td>
<td>3.0</td>
<td>12.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAIL TO DIVISION BEFORE JAS</td>
<td>MAIL DIRECT</td>
<td>2.0</td>
<td>2.0</td>
<td>4.0</td>
<td></td>
</tr>
</tbody>
</table>

Recommended to Supervisor ______ Supervisor’s Initials ______

5 RESULTS (Is suggested solution working?)

6 STANDARDIZATION (Pass the word)

7 FUTURE PLANS (Is there any more to do?)

QUALITY TOOLS
- Checksheet
- Graphs
- Histogram
- Pareto Chart

CAUSE-AND-EFFECT DIAGRAM
- Scatter Diagram
- Control Chart

PRINCIPLES OF QUALITY
- Customer Satisfaction
- PDCA (Plan/Do/Check/Act)
- Speaking with Facts
- Respect for People

Figure 1.1 (Cont’d): The Quality Improvement Story;
A Worksheet for Daily Problem-Solving (Continued)
systematic and thorough. In addition to stimulating performance improvement, Policy Deployment has other benefits:

- Communication of company and departmental direction has become part of the normal routine.
- Horizontal Communication throughout GSP&L has improved.
- Perhaps best of all, there is broad participation in company planning. Note that in Figure 1.2 the development of policy spreads horizontal through GSP&L.

Quality in Daily Work (QIDW)

Quality in daily work is simply the application of PDCA (Plan-Do-Check-Act) to each individual's job, thus systematically improving the job, the product, and the services produced. This is probably the most difficult of the three components of GSP&L's Quality Improvement Program because it affects every employee within GSP&L and it calls on many of the same skills necessary for QI team work and for Policy Deployment. It also gets to the heart of quality improvement. The objectives of QIDW are to maintain gains made in improvement projects, to become more consistent in operating results, to clarify individual contributions to customer satisfaction, and to incrementally improve daily operations.

A simple way to describe QIDW is to first stabilize a work process so the quality of the output is in control. Then apply the Plan-Do-Check-Act cycle to improve the work. The next step is standardization. The improved, standardized work process is reviewed for application in other work units when possible. (GSP&L calls this replication). QIDW with replication deploys quality improvements throughout FPL. The purpose of QIDW daily application of the Plan-Do-Check-Act cycle is meeting customers needs and reasonable expectations. Customers are not only ratepayers, but fellow GSP&L employees in other departments. A customer orientation is necessary to practice QIDW. Each individual and each group must identify customer, both internal and external, determine customers' real
Figure I.2: GSP&L’s Policy Deployment Process
needs, and improve customer service. The basic concept is simple. Learning how to actually do it is not quite as simple. QIDW is a process that is never "completely implemented." One QIDW result comes from the Montgomery District meter readers. They knew of many practical ways to cut meter readings errors, but had to implement their solutions. Through QIDW their reading errors dropped by 50 percent in a year.

III. Description of the Management Indicators Process

*The Management Indicators Process (1978-84)*

Between 1978-84 GSP&L used the "Management Indicators Process" shown in Figure I.3. Initially this process was almost entirely concerned with measuring financial indicators. There was no defined roadmap or basis to select these indicators; in most cases an idea for an indicator came in to DPA from an employee of GSP&L. DPA would then "review" the idea to determine if it was "consistent with management emphasis." While interviewing Tom and his colleague in DPA, I requested them to explode the two boxes in Figure I.3 which indicated "review" and "consistent with management emphasis." They pointed out that if they were to do that there wouldn't be too many activities involved in these boxes. Ideas for indicators were rejected since it was top management who made most of the requests. However, they did mention that occasionally requests for indicators from the line organization and lower levels were rejected. The reason was either that the requested indicators were not suitable for the line organization or that data collection procedures for those particular indicators would be too long and tedious. The actual
Figure 1.3: GSP&L's Management Indicators Process; 1978-84
reasons would however be different; "additional workload or it was not something we were hearing from top management."

Today, DPA recognizes that this attitude toward disseminating information was not the right thing to do. They also look back and find the 1978-84 process very "simplistic." The "top portion" of Figure 1.3 was criticized. Notice that the 1978-84 process has the involvement of only the "creative employee" and DPA. Also notice that there are three distinct steps in the process; development, production and delivery. The "development" step, as explained above, was not clearly thought through. "Production" was manual. Once DPA had determined that the suggested idea for indicator was consistent with management emphasis, a data search was initiated. If the required data was available on-line (and according to Tom, this was not often), a lot of the work had been made easier. Manual data collection was difficult and time-consuming; so were some of the calculations using the data which was acquired. Manual spreadsheets were used for the purpose. Tables and graphs were also prepared manually. Finally, in the "delivery" stage these tables and graphs were "published" in indicator books which were separated by function. There was one book for Transmission and Distribution (T&D), one for Commercial, another one for Administrative and so on. These books would be published monthly. Hence data had to be acquired every month and the graphs and tables had also to be updated in the same period. According to information from the interview, updating was extremely time consuming. Each chart would consume about 2-3 hours of a person's time. But then, according to Tom, "we had nothing else to do at that time."

Other major problems arose from the cross-functional nature of the indicator books. One of them was that with separate publications one division did not know how the other was doing. Of course, this information was not always a necessity, but divisions definitely needed to share information about each other's operation. To compound this particular
problem, a force supporting it suddenly emerged in the early 80s. A few executives felt comfortable with this type of separate information reporting to ensure confidentiality of data. Since most data were cost-related, these executives believed that it would be better if one division was not able to access another's information. They were of the opinion that a "common indicator book" would support unhealthy comparison of cost information between divisions and/or districts. Another problem was that some indicators appeared to belong in more than one book. The indicator, "Accurate bills to the customer" was quoted as an example to demonstrate this during the interview. Many people were involved in getting accurate bills to the customers; meter-readers, bill processing departments, people who mail the bills out and so forth. Therefore, what justification could there be for the indicator "accurate bills to the customer" appearing in only the indicator book developed for the meter-readers? Another example is the case of "reliability." The current quality improvement program regards this indicator as one of GSP&L's key improvement areas.

In the early 80s it was not; or at least it was not recognized as being one. The "reliability" belonged solely to the T&D function. So, in order to develop "reliability" indicators the data came from T&D but the indicator had an impact on several functions.

*The Management Indicators Process (1985)*

Figure 1.4 shows the next stage of evolution of GSP&L's "management indicators process." Notice that the new process shows the involvement of the "creative employee," DPA-GO, as well as "computer systems" and "division staff groups." One of the important innovations incorporated in 1985 was in the "production" of the indicators. By 1985, requests for indicators were so overwhelming that automation was seen as a necessity. Up to now, most data for these indicators were available in a computer somewhere; "it was a matter of extracting that data and putting it on spreadsheets or whatever and publishing it." GSP&L decided to invest in computer technology that would tap directly into data, compute the required indicator using the inputted formula and display
Figure 1.4: GSP&L's Management Indicators Process; 1985
information on-line. If necessary it was also possible to automatically print the graphs or charts or whatever the information portrayal may have been.

The appropriate computer systems were installed and in 1985 GSP&L significantly improved the process of production of the indicators. Also, at this time it recognized the fallacy of not sharing information and designed the system in such a way that a person in any division or district could access information on his or her own division/district or on any other. GSP&L recognized that the whole point in performance improvement was to expose one's problems, to bring them to the surface and not to be ashamed of them. While sharing information had its plus points, it also brought with it unanticipated problems. There were two major ones. One had to with the slowing down of the computer system considerably because so many people accessed it at the same time; some for inputting new data and others for accessing data and looking at information. To combat this problem, "shadow files" were created (see Figure I.4). Every night a "shadow" of the day's computer transactions would be copied over to another file. With this new innovation, people could go into the shadow file and get all kinds of historical information up through the previous day without burdening the main system.

Perhaps the more important problem was that "duplication of information" which involved people accessing data from different points and using their own formulas to calculate the indicator. Figure I.4 shows this clearly; observe separate indicator "production" processes under DPA and "Division Staff Groups." Opportunities to generate indicators using on-line data were available throughout the organization. The people made decisions about what should be included in or excluded from the computations. This obviously caused the problem of "inconsistent standards" between divisions. When one division was asked how it was doing in restoring electric service, they'd say that it was being done after an interruption of 30 minutes. Another division would estimate it at 25
minutes. A comparison of the calculation procedure for the two divisions would possibly reveal a difference. In response to this problem, GSP&L developed the Division's Information Management System (DMIS). Essentially this consisted of the DPA generating a standard set of programs to generate information for all divisions. This was of course, done by working closely with each division and coming up with a common (consensus) list of information needs of all divisions. So, in 1985, the duplication of information was minimized. Information from the interview reveals that this was one of the major success stories in 1985. The success, however did not come free and had a drawback. In addition to publishing indicator books, DPA also began doing some analysis and documenting a summary of findings and distributing it to the divisions along with the books. Doing this "favor" for the divisions sometimes put DPA in a "tight spot;" DPA would get a call from an area in which the indicator was supposed to be headed in the wrong direction. The call would challenge DPA's analysis strategy and findings. Soon they learned that analysis of data and generation of performance information should be done at the site of performance and not else where. They do, however, continue to assist the divisions in the analysis of performance information if and when the need arises.

What seems to be interesting from the perspective of Tom and his colleague was that the year 1985 emphasized "automation" so much that once again, the "top part" of the process was still underdeveloped. A comparison of Figure I.3 and Figure I.4 will show identical processes occurring in the "development" step. Even in 1985 there was absolutely no change in the way indicators were developed, reviewed and/or approved. In Tom's words, ".....we really didn't do a whole lot of work up top. What are we developing indicators for? Why are we doing this? That piece was not a big concern; I guess it was kind of assumed that top management knew and that they would provide us with the direction we needed we really never even questioned if there were the right indicators. Somebody just told us that they needed these indicators and we felt like our role was to
provide it." This clearly brings out the fact that top management continued to be DPA's primary and most important customer.

*The Management Indicators Process (1986-87)*

In 1986 management policy began to change and it is reported that the Quality Improvement Program (QIP) began to "sink deeper" in the organization. The existing Management by Objectives began gradually getting replaced by Policy Deployment, Short-term Plans, and Quality-in-Daily-Work. A cross-functional policy deployment committee was formed in 1986 and this was comprised of coordinating executives from all parts of GSP&L. For the first time, the management indicators process moved away from being totally dependent on the "creative employee" for ideas for indicators. Indicators which measures the "short-term plans" formulated by the policy deployment committee were also included in the "development" step (see Figure I.5). According to Tom, "short-term plans are basically things that are important and need to be fixed. They are important at the time and need to be fixed in the short-term; like service and reliability." "...the direction no longer directly came from management. It came from the collective bargaining of several managers, directors and divisions." In 1986-87, for the first time, the process of developing indicators began to include a bottom-up orientation, in addition to top management requests for information. As Figure I.5 shows, another improvement in the 1986-87 process was the dissemination of more timely information. Compare production and delivery times in Figure I.5 with that of the same in the previous two figures. The maximum production delay has reduced from 35 days to 25 days. The maximum delivery delay has reduced from 15 days to 5 days.
Figure 1.5: GSP&L's Management Indicators Process; 1986-87
The Management Indicators Process (1988)

In 1988 the management indicators process (Figure I.6) improved even further. Notice the increased involvement of different groups. Notice also that the "light-bulb" approach taken by the "creative employee" has been redefined. The 1988 process begins with the generation of short-term plans at different locations within GSP&L. As mentioned earlier, short-term plans are simply objectives for company-wide performance improvement. Indicators that are developed are based on these short-term plans. Recommendations for short-term plans along with data supporting the need for these plans are "bubbled" up to the policy deployment committee (PDC).

Recommendations for short-term plans are in the form of the "The One-Minute QI Story." These QI stories are then "bubbled" up to the PDC by managers in various locations. Some of these go all the way up to the PDC and some remain within departments or divisions. This selection is based on decisions regarding whether or not a short-plan needs to be deployed throughout the organization or simply within a department or a division. Once the PDC had gathered all the QI stories, the final list of short-term plans for the year is generated. A group of people called "Master QI Story Keepers" are assigned the task of coordinating the implementation of the final list of short-term plans. Part of their responsibility is developing indicators for the short-term plans. This again would be cross-functional responsibility and would require working with the various locations to determine appropriate indicators. So now the company began to separate publication of indicators by its short-term plans. Another important innovation in the 1988 process was that GSP&L surveyed external customers to determine factors which satisfied the with the Company's products and service. An attempt was made to incorporate these factors into the process of developing indicators. However, this effort did not crystallize until 1989.
Figure I.6: GSF&L's Management Indicators Process; 1988
The Management Indicators Process (1989)

Figure I.7 shows the "management indicators process" as it currently exists. Notice the change in name; it's now called the 1989 Quality Management System. The most important addition to the current process is it's reinforced and enhanced customer orientation. The basic input into the 1989 process is what GSP&L calls the "Customer Needs Table of Tables." (Due to GSP&L imposed restrictions on its distribution, the Table of Tables had to be included in the Detached Appendix.) The Table of Tables is an attempt to capture what's most important to GSP&L's customers and design a measurement system to satisfy those needs. Viewed another way it was also an attempt to define a measurement hierarchy. Based on customer surveys, GSP&L identified the following at the highest level of measurement: (1) Sales and service quality (2) Delivery (3) Safety (4) Cost and (5) Corporate Responsibility. Following this, elements of each of the above areas are identified. These elements are called "Corporate Quality Elements." In all 19 quality elements have been identified. For example, "Cost" has three quality elements associated with it. These are Price, Rate Options and Financial Integrity. Similarly, "Sales and Service Quality" has six quality elements; "Delivery" has two; "Safety" also two; and "Corporate Responsibility" has six quality elements. All these can be seen in the Table of Tables. Once again, based on customer input, each of these quality elements are weighted on a scale 1-10. Some quality elements impact certain divisions; a few others impact still other divisions. Whatever the case, each indicator is based on a particular quality element just as a particular short-term plan is based on any one quality elements. The Table of Tables has become a powerful document at GSP&L in that every improvement activity has this basic roadmap to follow.
Figure I.7: GSP&L's Management Indicators Process; 1989
APPENDIX J

Members of the Expert Panel

Dr. George Smith (Ohio State University)
Dr. Thomas Tuttle (University of Maryland)
Dr. Dave Sumanth (University of Miami)
Dr. Joe Mize (Oklahoma State University)
Mr. Carl Thor (American Productivity and Quality Center)
  Capt. Phil Monroe (USN Retired)
  Mr. Jerry Gass (USAA)
  Mr. William Compton (NAVSES)
  Dr. Patrick Koelling (Virginia Tech)
  Mr. Gari Medford (Northrop Corporation)
Dr. Edward Lawler (University of Southern California)
  Mr. Dick Engwall (Westinghouse)
  Mr. Glen Peters (Lynn & Peters Inc.)
  Mr. Ken Harmon (VPC)
I. PERSONAL INFORMATION

Current Position: Quality Improvement Coordinator
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II. EDUCATION


1985 - B.S. Industrial and Production Engineering, Bangalore University, India.

III. MAJOR AREAS OF INTEREST

Quality and Productivity Management: Implementation and maintenance of Quality and Productivity Improvement Processes in white-collar and manufacturing environments, Measurement and Evaluation of project performance particularly in white-collar areas, Strategic and Operational Planning.


Other Industrial Engineering interests: Inventory Control Systems (MRP), Value Analysis.

IV. PROFESSIONAL EXPERIENCE

A. Positions Held/Consulting/Research

Feb. 1987 to Present - Research Associate, VPC, An International Center for the Management of Quality and Productivity, Virginia Polytechnic Institute and State University, Blacksburg, VA.

Project and Program Manager for a variety of research, development, education, and consulting projects ranging from $800 to $100,000. Clients include Ingersoll-Rand, United Illuminating, U.S. Navy and Rhodia S.A. (Brazil). Designed, developed, and prepared quality/productivity/management presentations and educational materials. Facilitated/trained/coordinated measurement and evaluation workshops, planning sessions, Industrial Engineering conferences, and short courses. Worked closely with clients to implement quality and productivity improvements in operations. Established and improved internal management processes. Performed action research in the areas of performance management, planning methodologies, performance measurement and evaluation, gainsharing and white-collar productivity.
July 1985 to Sept. 1986 - Project Manager/Management Trainee, Om Consultants (India) Private Limited, Bangalore, India.

Responsible for project management and supervision of Industrial Engineering, Environmental Engineering and Market Research projects ranging from Rs.5,000 to Rs.200,000. Worked with clients and senior consultants starting from the initial design session of a project to the delivery of the final report. Designed, developed and coordinated Value Engineering workshops. Traveled within the sub-continent in connection with market feasibility and Environmental Engineering projects for clients such as Smith, Kline, & French, Beckman Instruments, and the Swedish International Development Authority (SIDA).

Jan 1985 to July 1985-Engineering Trainee, Bharat Electronics Limited, Bangalore, India.

Studied the Material Control Department of the Low Power Equipment Division of the Defense Equipment Manufacturer; designed, developed, and implemented an automated material requirements planning (MRP) system. In the process worked closely with internal and external customers of the department, understanding sociological and psychological implications of automation in a traditionally labor intensive organizational unit.

B. Extension (Design/develop/coordinate/present management briefings)

Feb-May 1987 Taught senior Industrial Engineering class Compensation Management at Virginia Tech (26 students)

March 1988 Prepared a reference manual on gainsharing for Rhodia S.A. (Brazil)

May 1988 Briefed managers from San Miguel Corporation (Philippines) on gainsharing. VPC, Blacksburg. (3 attendees)

June 1988 Briefed managers from Alcoa (Brazil) on productivity and quality improvement interventions and gainsharing. VPC, Blacksburg. (3 attendees)

April 1989 Briefed consultants from National Productivity Institute (South Africa) on performance measurement and evaluation. VPC, Blacksburg. (3 attendees)

V. PUBLICATIONS


VI. HONORS AND AWARDS

1984 Outstanding Speaker Award, Bangalore University.

Creative Writing Award, Bangalore University.

1983 Outstanding Speaker Award, Bangalore University.