Chapter 5

Enterprise Productivity Analysis due to ERP

5.1 Introduction

Information Technology (IT) has a central role in raising productivity because it is a source of leverage for information, communications, collaboration and management. In recent years, more and more enterprises use ERP system in their main business process. Successful ERP systems can greatly raise enterprise productivity (Sun, 2007).

The measures ordinarily used to measure productivity, such as labor productivity and even multifactor productivity, involve simply adding up all the known inputs and outputs and then perform empirical studies and doing the necessary calculations. But the arrival of the Digital Age has exponentially exacerbated the problem. By the late 1980s, with the advent of personal computers, networks and back-end systems that touched more parts of the business, measuring productivity became more difficult (Baker, 2007).

In the context of IT, there is no single measure for productivity. IT productivity is typically assessed in terms of economic efficiency (related to unit costs of key IT services) and support ratios (business or technology volumes in relation to IT services or staffing levels). In addition, IT productivity also is often measured in the context of the outcome of using automation to provide operating leverage. Therefore, ratios of operating expense to IT expense also play a role in gauging IT productivity, but more so in a time series model than as a single snapshot. From yet another vantage point, the productivity of IT often is viewed in the context of the growth rate of key business transactions, volumes or activities versus the change in IT expense. Overall, it is the pattern of change in all of these dimensions that is critical to an assessment of IT productivity (Rubin, 2012).

The ISO International Vocabulary of Metrology (VIM) defines a measurement method as a generic description of a logical organization of operations used in measurement, and an analysis model as an algorithm or calculation combining one or more measures obtained from a measurement method to produce evaluations or estimates relevant to the information needed for decision making.

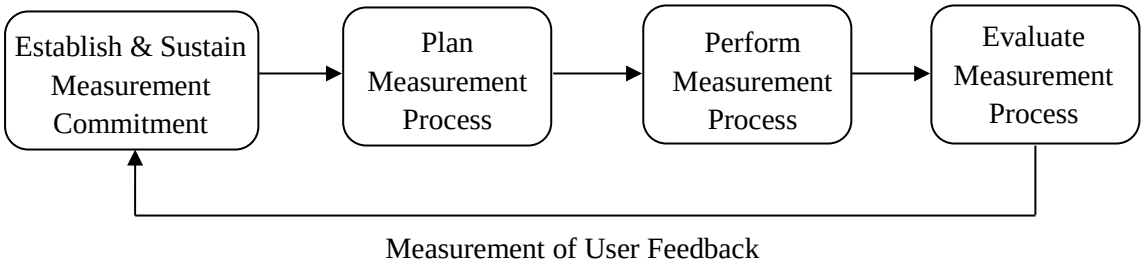
The purpose of a measurement process, as described in ISO (International Organization for Standardization) 15939, is to collect, analyze, and report data relating to the products developed and processes implemented within the organizational unit, to support effective management of the process, and to objectively demonstrate the quality of the products.

ISO 15939 defines four sequential activities:

- Establish and sustain measurement commitment
- Plan the measurement process
- Perform the measurement process
- Evaluate the measurement process

These activities are performed in an iterative cycle that allows for continuous feedback and improvement of the measurement process, as shown below.

Illustration 5.1: Sequence of Activities in a Measurement Process [Adapted from ISO/IEC 15939, Systems and Software Engineering— Measurement Process (2007), Second Edition, International Organization for Standardization, Geneva]



According to the Performance Measurement Framework for the Canadian Transport Agency, the following five criteria should be utilized in determining the most appropriate indicators to measure performance:

1. Validity – Does the indicator allow the precise measurement of the results?

2. Relevance – Is the indicator relevant to the activity, product or process being measured?
3. Reliability – Is the indicator a consistent measure over time?
4. Simplicity – Is the information available and will it be feasible to collect and analyze it?
5. Affordability – Is it affordable to collect the information and analyze it?

Although performance is a concept that is different from productivity, performance incorporates productivity. Whereas productivity is a fairly specific concept related to the ratio between output and input, performance is a broader concept that covers both the economic and operational aspects of an organisation. Performance refers to excellence, and includes profitability and productivity among other non-cost factors, such as quality, speed, delivery and flexibility (Pekuri, Haapasalo, and Herrala, 2011). The five criteria that have been specified above to be used for determining the most appropriate indicators to measure performance may thus also be used to determine the most appropriate indicators to measure productivity.

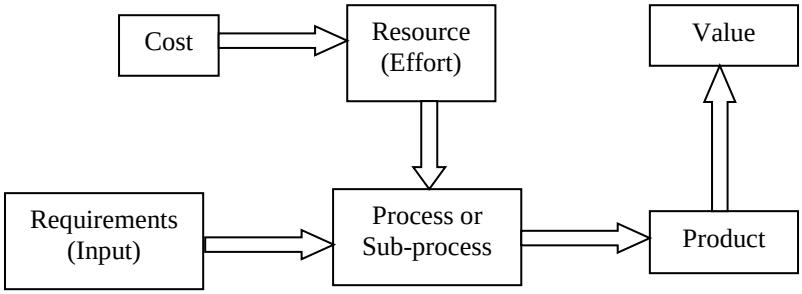
5.2 Purpose of the Enterprise Productivity Measurement Framework

SAP users in the refineries of Assam are not too clear either about Enterprise Productivity or the ways of measuring it. An important reason is that a variety of technical issues are intimately built into the definition and measurement of productivity (Li, 2013). The productivity study undertaken is in the context of the

use of SAP in the refineries of Assam. The key input in this study is technology. The results of the measured performance indicators may be used not only for improving processes, product manufacturing, application programming, employee activities, etc., but they can be used for preparing decisions in enterprise management as well (Selmeci, Orosz, Györök, and Orosz, 2012).

A Productivity Measurement Framework (PMF) for Enterprise Productivity due to ERP should propose a means to identify and quantify "normal productivity", which can serve as a baseline for detecting possible anomalies in the ERP that may impact Enterprise Productivity. To achieve this goal, methods are needed to collect the necessary base measures specific to Enterprise Productivity due to ERP, and analysis models must be designed to determine the relationships that exist among these measures.

Illustration 5.2: Simple Model of Productivity (Card, 2006)



The (product) output here is an indent or a pay slip or a report which is a result of the business process executed by the ERP. Resources typically have a cost associated with them. Usually, effort is the primary resource of concern for the

generation of output. The output has a value associated with it (typically the price to the customer).The value is a function of capability, timeliness and price.

Ruivo, Johanssonb, Oliveiraa, and Netoa (2013) have identified six productivity factors with respect to ERP:

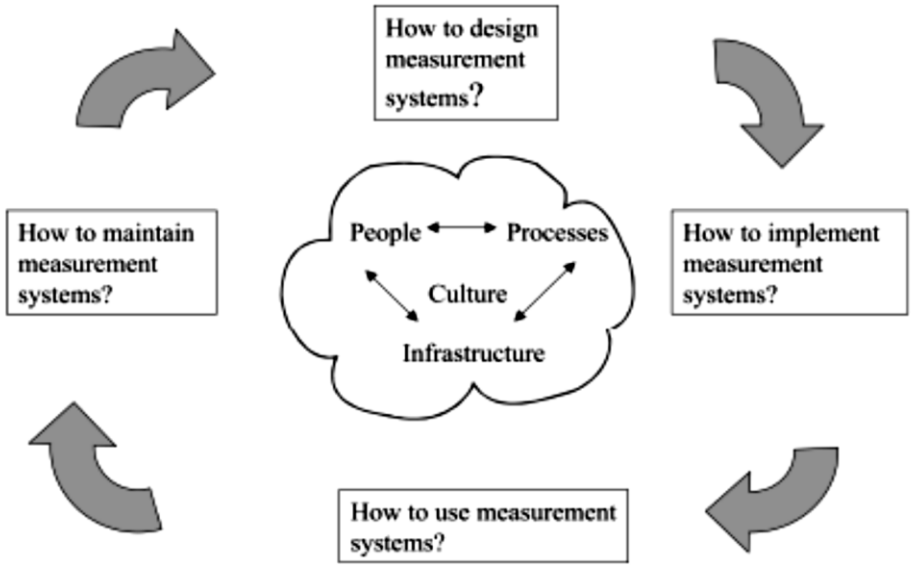
- **Compatibility**: System compatibility is measured by the degree to which the ERP system matches IT features, such as compatibility with hardware and other software.
- **Complexity**: System complexity is measured by reversing the item-questions scale of how intuitive the application is, how quickly users can become proficient with application; and how comfortable they are using it.
- **Efficiency**: Transactional efficiency is measured by how easy it is for users to execute common and repetitive tasks, the effectiveness of the user interface, and the speed and reliability of the software.
- **Best-practices**: Best-practices is measured by how easy it is for users to set up the application and map workflows based on local requirements, and the system's adaptability to business needs.
- **Training**: The online training factor is a measure of how easy it is for users to be trained on the system, to understand the content material, and to navigate through topics applied to daily tasks.

- **Empowerment**: Employee empowerment factor is measured by how well the software enables collaboration, role tailored reporting, and access to real-time information.

The Enterprise Productivity Measurement Framework must answer the following questions in sequence keeping in mind the people, processes, culture and infrastructure of the organization (Neely et al., 2000):

- How to design measurement systems?
- How to implement measurement systems?
- How to use measurement systems?
- How to maintain measurement systems?

Illustration 5.3: Design Answers for an Enterprise Productivity Measurement Framework



5.3 Design of the Enterprise Productivity Measurement Framework

Productivity measurement is used on the macroscopic level such as for benchmarking organizations or projects. And it is applied to the microscopic level, such as for estimating work packages, identifying overheads or analyzing what product components are overly expensive. Productivity improvement needs precisely defined productivity measurements – which are based on SMART improvement goals, that is specific, measurable, attainable, relevant and timely goals (Ebert, 2013).

Measurement is ultimately a quest for certainty and control: certainty in understanding the nature of some phenomenon so as to control, influence, or evaluate that phenomenon. There needs to be an understanding of the relationship between measurement and instrumentation – the artifacts employed to collect/measure data on the phenomenon under study (Scacchi, 1995). The refineries of Assam use a state-of-art ERP system in SAP. The system is used for managing all the key functions if the refineries. Keeping in mind the Key Productivity Indicators (KPIs) along with the measurement objectives for each KPI and the data sources required for each KPI, a measurement framework is proposed as given below. The KPIs have been obtained from the ERP users of the refineries of Assam and have been elaborated in section 4.3.

Illustration 5.4: Proposed Measurement Framework for Measuring Enterprise Productivity

Measurement Objective	Maximize Output	Maximize Share Value	Optimize Inventory	Optimize Quality	Optimize Process	Increase Usage
Data Sources	Data Captured by ERP					User Feedback Data
Key Productivity Indicators	GRM	Market Capitalization	MOU Targets	MBN, F&L, Yield	Operating Cost / Unit Production	User Satisfaction

As is seen, most of the data will be captured by the ERP for the KPIs, GRM, Market Capitalization, MOU Targets, MBN, F&L, Yield and Operating Cost / Unit Production. Additionally, the measurement framework as proposed will rely on external data for the KPIs, Market Capitalization and MOU Targets. For the KPI, User Satisfaction, the data source will be User Feedback Data.

User satisfaction is driven by more than an appealing user interface and must be evaluated on multiple dimensions. The framework will assess user satisfaction along six major dimensions. These have been adopted from a study conducted in 2007 by market research firm, Keystone Strategy.

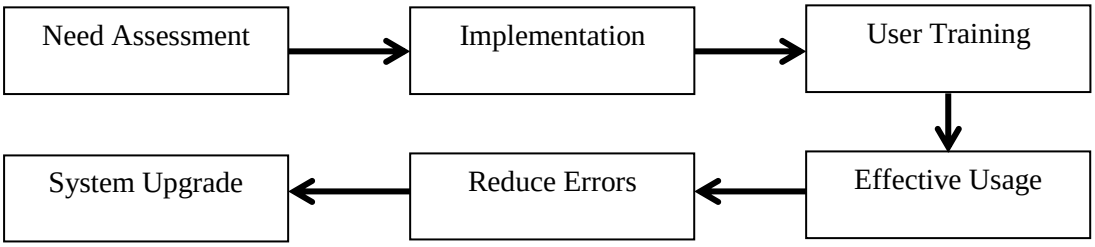
- Usability – It will measure the user's perception of how easy the ERP application is to use, how "in command" of the application a user feels, how easy it is to navigate in the ERP, and how much the user enjoys using the ERP.

- Familiarity – It will measure the user's perception of how intuitive the ERP application feels, how easy it is to learn, how quickly they can become proficient with the ERP application, and how comfortable they feel using it.
- Transactional Efficiency – It will measure the user's perception of how easy it is to execute common and repetitive tasks, the efficiency of the interface as it pertains to those common tasks, and the speed and reliability of the ERP.
- Flexibility – It will measure the user's perception of how easy it is to execute infrequent or unusual tasks in the ERP, how easily the ERP can be adapted to meet specific new business needs and processes, and how agile the ERP is in handling problems that arise unexpectedly.
- Business Insight – It will measure the user's perception of how well the ERP enables easy and comprehensive reporting, access to real-time information, visibility into cross-departmental information, and the ability to gauge the impact of business decisions.
- Collaboration – It will measure the user's perception of how the ERP helps them work and communicate with their colleagues; share and review work; and communicate with suppliers, partners, and customers.

For the measurement framework to be effective, a measurement strategy is proposed. The strategy shows the path that has to be followed. The need assessment gives us the measurement framework that has already been specified.

It has then to be implemented. The users of the measurement framework have to be trained in using the process. Its effective use has to be ensured and care taken to reduce the errors of measurement. Ultimately the system of measurement has to be upgraded.

Illustration 5.5: Strategy for Implementation of the Proposed Measurement Framework for Measuring Enterprise Productivity



5.4 Conclusion

This chapter looked at the third objective of the present study, "To develop a Measurement Framework for Enterprise Productivity analysis due to Enterprise Resource Planning (ERP) implementation from ERP user's perspective in the refineries of Assam".

Productivity is a key indicator in the assessment of performance of an enterprise. Measurement of productivity is crucial when significant investments are made with the purpose of increasing productivity. The effectiveness of ERP in Enterprise Productivity in the refineries of Assam can be understood only if there is a mechanism of measuring the Enterprise Productivity because of the use of ERP. Unfortunately, no such measurement mechanism exists. Through a

literature survey on measurement frameworks and data collected from the SAP users of the refineries of Assam, a measurement framework has been proposed. The intricacies of the proposed measurement framework have been explained. Also, a strategy for the effective implementation of the measurement framework has been given.

Measurement frameworks are a way of structuring KPIs around the strategy, goals, and objectives of the business. The key thing about a measurement framework is that it's coherent and helps the business to understand the relationship between the KPIs and the KPIs themselves. Data is generally not a problem but the trick is to get hold of the right data for the right measurement. A robust measurement framework is a key driver to analyze current Enterprise Productivity and improve upon it.