

**Exploiting the Power of Productivity Accounting for Power/Energy
Utilities**

Business School: School of Business and Administration

University: University of Stellenbosch

**Address: 7 Milford Road, 11 St Andrews, Douglasdale. Johannesburg. South
Africa**

Telephone: +27 82 552 1612 or +27 11 800 2988

Fax: +27 86 665 0384

Email: letsoalnj@eskom.co.za

Supervisor: Prof Andre Roux

Supervisor, Email: andre@ifr.sun.ac.za

19th EDAMBA Summer Academy

Sorèze, France

July 2010

Exploiting the Power of Productivity Accounting for Power/Energy Utilities

Abstract/Summary of paper

Productivity Accounting stems from the growth measurement studies or class of learning. It is also related to what is known as Total Factor Productivity (TFP) or Multi Factor Productivity (MFP). The distinction of Productivity Accounting from either TFP or MFP comes from the flexibility with which Productivity Accounting can deal with both the historical and future assessment of productivity improvement. The methodology blends neatly with financial accounting presentation of profit changes.

The research problem can be described as follows:

- Improper measurement of productivity improvement - e.g., the use of single productivity indices
- Proper measurement would yield a better approach to business management - instead of using cost cutting as a tool for all financial problems of productivity.
- Proper measurement will highlight price and quantity changes separately – The source of profit improvement can be attributed to the right cause.
- Profit alone is insufficient for productivity improvement – better sales through pricing may increase profits without productivity growth
- Price increments cut is no proxy for productivity improvement – price increase moderation does not boost productivity

The intended end is to show or prove that proper productivity measurement through productivity accounting directs productivity improvement in a fully integrated manner for a business.

Research Objective

- To show that it is the sustainability of profits based on productivity that counts more than price recovery.

- To show that it is by an affordable price of electricity, as an energy resource, and related services that economic growth (societal productivity) is supported. At the same time comments will be made on the price regulation that makes price requests reductions as proxy for organizational productivity.
- The research intends to show that productivity accounting might resolve some of the productivity measurement issues. In addition, it will show a comparative view of productivity from various power utilities that can be seen against their own recorded historical performance.

The methodology, productivity accounting, used is explained in terms of its aspects that make it unique in measuring productivity improvement and being suitable for businesses.

Exploiting the Power of Productivity Accounting for Power/Energy Utilities

Introduction and Research Problem

1.1. Introduction

Productivity Accounting stems from the growth measurement studies or class of learning. It is also related to what is known as Total Factor Productivity (TFP) or Multi Factor Productivity (MFP). It can be applied to companies and specific profit centres within companies and blends neatly with financial accounting presentation of profit changes unlike the other two.

Energy utilities produce power as an input to the various industries of societies. Moreover, these utilities have to make a profit, while at the same time selling the energy at a reasonable price to its customers. Regulators often have to curb excessive energy prices to force the electricity utilities to be productive or obtain the required profit levels through productivity rather than price gains. Very often some resources are dispensed with, including employees in order to achieve increased or desired profits and thereby claim productivity improvement.

All over the world the measurement of productivity improvement is often used as a single index, which has little bearing on the drive to improve it. When some world utilities talk of productivity, they are actually referring to efficiency in the sense reduced cost or simply output per person. In some cases this efficiency is related to the thriftier use of electricity by consumers through the use of energy efficient gadgets; this does not necessarily imply productivity for the electricity supplier.

Productivity Accounting can consistently address the issue of productivity of all resources and thus assist in optimizing the mix of resources and costs in delivering the output of the organization. Productivity translates into the creation of true wealth, not simply the accumulation of money by pricing goods or services far above their costs. In Africa the use of energy still needs to grow significantly and it is therefore imperative that the supply of energy be at affordable low prices.

The research problem can be described as follows:

- Improper measurement of productivity improvement - e.g., the use of single productivity indices
- Proper measurement would yield a better approach to business management - instead of using cost cutting as a tool for all financial problems of productivity.
- Proper measurement will highlight price and quantity changes separately – The source of profit improvement can be attributed to the right cause.
- Profit alone is insufficient for productivity improvement – better sales through pricing may increase profits without productivity growth
- Price increments cut is no proxy for productivity improvement – price increase moderation does not boost productivity

The intended end is to show or prove that proper productivity measurement through productivity accounting directs productivity improvement in a fully integrated manner for a business.

There are, however, issues associated with the productivity concept and its measurement that need to be highlighted first in the following subsections.

1.1.1 Types of measures of productivity

The partial measures single out one input resource as the basis of determining the organizational productivity. The more comprehensive approaches try to include more than one input resource in the measurement.

An academic view of productivity measurement techniques splits them into normative or non-normative; or into parametric or non-parametric; even differentiating into frontier and non-frontier approaches. Despite the views describing the taxonomy of the discipline, the measures of productivity have to be made practical for use in an organization focusing on sustainable increased profitability.

Thomas and Baron, 1994, indicate that there is a lack of a unifying concept on the diverse views of productivity. They note that used in conjunction with productivity,

the words, 'performance', 'evaluation', 'measurement' and 'improvement' are used in different ways. On 'productivity measurement', their views are that it refers to the way in which productivity is indexed. They further write that 'productivity improvement' refers to the change sought, noted or measured in productivity. In quoting Bridges (1992), they write, "The keystone to implementing productivity improvements is putting everything in measurable terms." Further from Frazelle (1992), they add that productivity must first be understood before it is effectively measured.

1.1.2 Booms and busts based on costs and prices allowed by regulators

Andrew Ford, in the Journal of Industry, Competition and Trade explains the booms and busts in the California electricity industry that depended on expected price spikes to start construction of new power generation infrastructure. It can be concluded that ignoring productivity from the equation of constructing for increased capacity has created the booms and bust experienced in California during the first decade of the 21st century. The capacity construction industry was driven more by expected electricity price spikes than by an attempt to embody an organizational productivity culture in the thinking. At low prices, which fell below the cost of the added constructed capacity, the industry players were reluctant to start the construction work, but with expected high prices all constructors created excess capacity (competition) and by the time of completion of construction the prices were forced to low levels, again resulting in some suppliers going bust.

The total reliance on price recovery highlighted the fact that something else needed to be considered. For the customers, when electricity supply was low as safety capacity margins were eroded, it often meant mass rolling blackouts but also increased prices to signal efficient use of the scarce supply created by the previous delays to construct. There was no indication of productivity based profitability being applied by the industry players as the focus was simply price recovery only. Profitability based on price recovery invariably attracts all competitors, hence the business failure of many suppliers when the expected prices did not actually materialize. The remaining suppliers were helped by the reduced supplier base to again raise the prices after the weaker participants were ousted. This was clearly an unhealthy situation for all, both suppliers and customers.

The paper argued that electricity markets are prone to the same cycles of boom and bust that appear in commodity markets or even the real estate industry. The electricity industry faces the "... challenge of recovering high fixed costs through high utilization", but single-mindedly focused on price recovery.

It can be argued that, unlike commodities, electricity is not a choice product, it is a necessity and consumers do not have to decide whether to have it or not. It therefore has to be provided with productivity in mind in the process.

1.1.3 The Accounting Profession ignores productivity

Accounting reports provide an indication of the financial outcomes of a business. Banker *et al* (1989), indicate that productivity measurement has gone largely unnoticed by the accounting professionals. Accounting textbooks virtually ignore issues of productivity measurement, while accounting journals contain few articles on the subject. It is rather economists who write about productivity in the aggregate sense. Other professionals, such as industrial engineers, production professionals do not necessarily link it to the accounting system.

They further argue that the accounting profession believes that variances computed from the standard costing system are sufficient to measure the efficiency of the enterprise. The result is that it is believed that productivity improvement could be signaled by the tightening of these standards. The drive to develop productivity statistics independent of the accounting system or information is an indication of a need that is not well articulated. Accounting researchers have not investigated productivity measurement in depth with the result that the standard costing system knowledge has not been applied to productivity measurement techniques.

On the other hand it can be argued that the productivity discipline does not necessarily fall only into the accounting fraternity scope, since it has a wider use than mere accounting for variances. It is therefore for the productivity professionals to raise the level of the discipline, even acknowledging where it borrows from other disciplines at highlighting resource use and linkages to productivity at company level.

A Fortune magazine survey of 500 of the largest corporations (*Fortune 30 July 2006*) in 1986, found that 78% of responding chief executives officers cited productivity improvement and cost control as the most important elements of their corporate strategy for the 1980s. Whether they thought of true productivity improvement is another question if one uses partial indices for measurement.

Banker et al (1989), write that from an empirical observation, companies with extensive cost accounting systems have established productivity measurement systems independent of the accounting systems and have even established separate departments to develop productivity statistics.

It is thus necessary that the productivity measurement be made practical by a new breed of professionals, with broad skills in economics, mathematics, statistics, operations research and business management.

1.1.4 Casual comments on quality as productivity

It is generally accepted that in comparative terms, given similar prices and opportunities, consumers will choose a competing product that gives superior quality by whatever criteria they judge the distinction by. Where productivity is defined as a consequence of this it is often deemed that quality leads to productivity (as in increased output and sales), although money from highly priced high quality items is not made from volumes sold.

1.1.5 Focus on production efficiency

Fortunately for power utilities there is a natural confluence of production and delivery to customers, resulting in power sold instantly it is produced. Other industries may have to store physical items and thus would measure productivity at production completion instead of at point of sale to customers. Production efficiency does not therefore stand as proxy for the organizational productivity improvement. The productivity improvement of the whole value chain needs to be considered, while it may be supported by internal efficiency drives.

1.1.6 Once off studies make it a passing fad – econometrics approach

In econometrics (Mawson et al, 2003) productivity may be seen as an observable phenomenon, and not as something that is driven independently. As a result of growth in GDP it is derived and not targeted for achievement. Economists may therefore engage in time series studies that measure productivity on a once-off basis. The results may not have the regularity required to give meaningful information as they may span different time periods, or be across different industries that are not readily comparable.

1.1.7 Year by year focus of financial reporting

Regular financial reporting is largely driving the present and this is reflected in the financial reports that focus more on current performance than anything else. Interim financial reporting is also focusing on actual versus current budgets or plans. Any reference to any other period is often of not much significance in such reports. Banker et al (1989) reflect on this in noting that accounting professionals and accounting textbooks ignore topics on productivity measurement. There is therefore a need to deal with productivity measurement separately from financial reporting.

1.1.8. Measurements highlight the contribution of productivity

Pacific Studies

Pacific Power has made a typical study over time of productivity growth of the company using Total Factor Productivity (TFP) analysis. Though this method is not perfect it provided some indication of productivity changes. However the simplistic assumption in TFP that resources are simply labour and capital may be a cause for its unreliable outcome of any measurement. The results reflect though the trend of productivity improvement by the company during the period.

Eskom case

Eskom has been measuring productivity improvement for over twenty years. The audited analysis is reported on annually and is even used extensively in modifying budgets and plans for driving productivity permanently. Eskom needless to say is the lowest priced for industrial customers in the whole world and still managed to be

profitable at the same time. The future is likely to remain the same provided it can keep on increasing output in line with the increase in inputs. Should it not be in a position to increase output, the increasing costs will force a price adjustment for the organization to be profitable, while not improving productivity.

Research Objective

1.2. The Purpose of the research

- To provide a well reasoned and working approach to the measurement of productivity improvement for commercial enterprises as opposed to an aggregate economic view.
- It is intended also to influence that productivity is measured from this methodology, first for power utilities and also for other businesses.
- The study intends to show that it is the sustainability of profits based on productivity that counts more than price recovery.
- It intends further to show that affordable price of electricity, as an energy resource, supports economic growth (societal productivity). At the same time comment on the price regulation that make price requests to be cut as proxy for organizational productivity.
- In addition, to have a comparative view of productivity from various power utilities that can be seen against their own recorded historical performance.

The methodology is best described by what is the framework of a nine-block diagram. It is a change based presentation of the productivity and price recovery frame of the Productivity Accounting methodology. The methodology matches the revenue changes to the cost changes by splitting each into quantity and price changes. The quantity relationships are used to define productivity changes, while the price relationships are for determining price based recoveries. The impact of changing profit is used to establish contribution from either productivity or price recovery. The methodology thus provides a basis of detecting change in the direction a business is taking in its results.

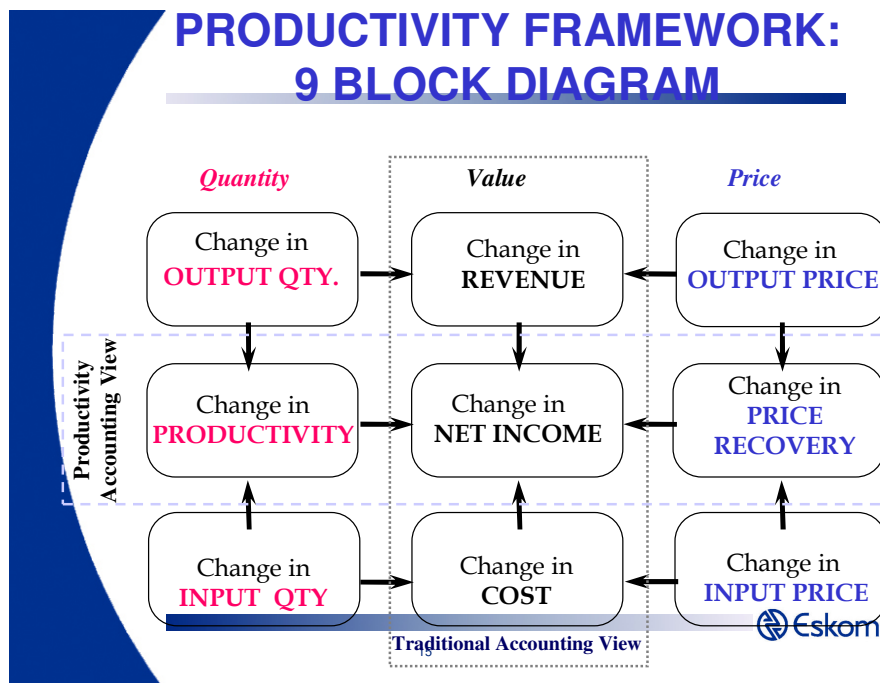


Figure 3.1. The Nine Block Diagram

Source: Eskom, 2006

The productivity change can be split into its components of capacity utilization change, efficiency of resources and sustained business growth as can be shown in Figure 3.2

CAPACITY UTILISATION & EFFICIENCY

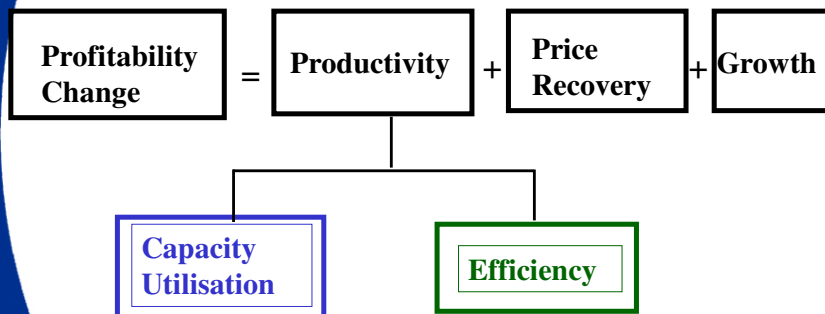


Figure 3.2. Productivity, Price Recovery and Growth changes

Source: Eskom 2006

Why the methodology?

The process of collecting and processing data is the best suited to this study as it relies on already available information which needs to be subjected to productivity analysis through the empirical productivity accounting model. The data is the available and generally audited business results from a financial perspective and is as such verifiable to a large extent.

The research would provide a reference for productivity improvement and measurement to Eskom. In addition it would highlight that total capacity growth as the driver of productivity and not simply the cutting of costs. It will highlight the transformative power of all resources driven by people to achieve productivity (Skills and use of other equipment than just mere numbers of people). It should expose that electricity pricing is more than a reduction of price applied for as a means of fostering productivity change in a utility.

There is no doubt that the research should reflect whether the utilities, for the period in question, balanced the making of profit with the care of consumers in pricing terms, regulated or not.

The Analytic Induction method is used to do the research work. A comparison of the productivity improvement results of the selected utilities is tested against the reported performance to establish the value productivity accounting is deemed to provide in business performance management. At the same time it provides a benchmark on the same basis of measurement for all the utilities. It is the methodology which is subjected to the information from the various utilities that helps define how best it describes the changing productivities of the business. Each of the individual analysis per utility provides a basis for inducing a conclusion on the applicability of the methodology in measuring productivity for the utilities.

Data and its Collection

The data to be collected will be from the audited annual financial reports. The Income statement and balance sheet will form the core data source. Additional information on any semblance of productivity will also be perused from the annual reports. It will be the data over a period of ten years from each of the utilities that will be researched on. In addition any other additional pertinent required information will be obtained by direct telephonic contact to supplement the base information. It is believed the published financial results are the most reliable source. There is no limitation to data availability in this instance, except in the form of presentation that may require recasting.

The collection will be over the internet as well as from the hardcopies sourced directly from the selected power utilities. Some utilities do not have on internet data of the earlier years. All attempts have been made to secure this in hardcopy form, but where it is not available, in a few cases, it has been left out and research is based on the data available

Other pieces of data to be collected will be various inflation indices that prevailed during the periods of the analysis. These will be used together with the data from the company to do the analysis.

Data Analysis and interpretation

The analysis of the financial data obtained will be done using the productivity accounting methodology embodied in a productivity accounting model. The methodology splits all relevant values into quantity and prices and then determines the ratio of changes for computing productivity change from the quantities and price recovery from the ratio of price changes. This is completed with profit reconciliation between the periods in question.

The interpretation involves comparing any other description of productivity by the company in order to compare the benefits of the productivity accounting approach or methodology in terms of consistency and relevance to other measures. In addition any other comment on productivity, whichever way it is defined by the company, will be checked against these results

REFERENCES

Asian Productivity Organization (APO) Round Table Conference for the promotion of Productivity Movement in Africa; Aug 2006

Accel-Team, West Coast of Cumbria, UK, Productivity Improvement, XXXX

Banker, Rajiv D, Datar, Srikant M, Kaplan, Robert S, Productivity Measurement and Management Accounting, ex internet; 1989

Bridges, Bernisha M, "To Measure or not to Measure that is the Question", Productivity and Quality Improvement in Government, edited by John S W Fargher (Institute of Industrial Engineers, 01/1992)

Cowing Thomas F, Stevenson Rodney E, Productivity Measurement in Regulated Industries; Academic Press, 1981

Frazelle, Sandra J, "A Process for Improvement in White Collar Environment", Productivity and Quality Improvement in Government, edited by John S W Fargher (Institute of Industrial Engineers, 02/1992)

Kaci, Mustapha, Understanding Productivity: A Primer; the Canadian Productivity Review
2006.

Lillis, Kevin, RPI-X: Price Caps versus Rate of Return Regulation, Electricity Reform Abroad and US Investment, Chapter 2,1997

Loggerenberg, B.J. Productivity Decoding of Financial signals: A Primer for Managers on Deterministic Productivity Accounting; Productivity Measurement Associates, 1988

Mahadevan, Renuka. New currents in Productivity Analysis: Whereto Now? Gower

Press 2003

Mawson P, Carlaw K I, McLellan N, Productivity Measurement: Alternative Approaches and Estimate, New Zealand Treasury, June 2003

Mintzberg, Henry. Productivity is Killing American Enterprise; Harvard Business Review, July 2007,

Monga, RC, “Managing Productivity and Enterprise Competitiveness”, Action Programme on Productivity Improvement, Competitiveness and quality Jobs in Developing Countries- A working Paper – PMD3 1900

Owyong, David T, Productivity Growth: Theory and Measurement, National university of Singapore, 2003

Prokopenko, Joseph. Productivity Management: A Practical Handbook. International Labour Organization; 1992

Ramsay, dr., M. R Enterprise Productivity Measurement and International Labour Productivity Handbook

RSA President’s Council, A Strategy and action Plan to Improve Productivity in RSA; Government Printer, 1989

Thomas, Beverly E and Baron John P, Evaluating Knowledge Worker Productivity: Literature Review, June 1994

Sumanth, David. Total Productivity Management, 1997

Sayles, Leonard R. The Complete Book on Practical Productivity; Boardroom Books, 1993

Sibson, Robert E. Increasing Employee Productivity; American management Association, 1976

Tolentino, Arturo L. New Concepts in Productivity and its Measurement; Paper at a

European Productivity network 13-14 May 2004

Annual Reports Power Utilities:

China Light and Power Company, China, Annual Reports 1999 – 2006

Chubu, Japan, Annual Reports 1998 – 2006

Electrabel, Belgium, Annual Report 1996 – 2006

Endesa, Spain, Annual Reports 1996 – 2006

Enel, Italy, Annual Reports 1996 – 2006

Eskom, South Africa, Annual Reports 1996 – 2006

Nampower, Namibia, Annual Reports 1997 – 2006

Powergen, UK, Annual Reports 1999 – 2006

RWE, Germany, Annual Reports 1999 – 2006

Southern Company, USA, Annual Reports 1996 – 2006

Vattenfall, Sweden, Annual Reports 1996 – 2006