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# MASTER'S THESIS

## Impact of Information Technology on Productivity

A case study in Telecommunication industry of Iran

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## **Abstract**

Productivity is an important economic factor which has a key role in evaluating the economic growth. It is identified as the foundation for economic prosperity, a prerequisite for national development and also an important indicator of organizational competitiveness (Dedrick et al., 2003).

Information Technology (IT) is one of the important resources for increasing the economic growth. It causes companies to use their input resources as much as possible in an effective way. As investment in IT capital accounts for an ever-increasing share of capital investment, it is important to understand how these investments might pay off (Gilchrist et al., 2001). There has been much debate on whether or not the investment in IT provides improvements in productivity and business efficiencies.

IT investment may make little direct contribution to overall performance of companies until they are combined with complementary investments in business activities, human capital, and company restructuring. Therefore, according to role of IT in Business Process Reengineering, as a facilitator and enabler, BPR is valuable for companies to increase the impact of IT on overall performance of companies. On the other word, both IT and BPR investments, together, are able to improve productivity drastically.

In this research Cobb-Douglas model was used to examine the impact of Information Technology investment on productivity at Telecommunication Company of Tehran (TCT). 44 financial and economic data were collected since 1997 up to 2007 for driving the corresponding model. Weighted Least Square (WLS) was run by SPSS 15 to test hypotheses. The results have indicated that IT investment not only makes the positive contribution to output of Telecommunication Company of Tehran but also this contribution is positive after deductions for depreciation and labor expenses. Further productivity analysis exposed the positive correlations between IT, Total Factor Productivity and Labor Productivity.

In order to reveal the importance of BPR approach as a complementary investment for improving IT influences, the appropriate questionnaires distributed through Employees and Experts of TCT in the second phase of this study. Evaluation of BPR factors proved the necessity of employing this complementary investment at Telecommunication Company of Tehran.

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# Chapter One

## Introduction and Problem Statement

*This chapter begins with background in productivity as an economic factor and Information technology. This will be followed by problem area discussion, the purpose of the research and the main objectives and importance of the study. The main questions which are investigated within scope of research will be introduced. Finally, our contribution and overview of entire thesis are presented.*

### 1-1. Background

Strong Competition causes the new technologies to be employed for improving productivity level of companies' resources. Productivity is one of the important factors to evaluate the economic growth both at the industry and firm level. Its growth directs companies to increase their market share (Tabatabae, 2000).

At the most basic level, productivity is based on the economics of the firms. It is measured as the ratio of output to input. Historically, productivity is often defined as the ratio of output to the most limited or critical input, with all the other inputs held constant.

Based on Neo-classical economic model, productivity is one of the important factors that impact on economic growth. It causes Companies to produce more products through specified production's factors, and to optimize the employment of the production's requirements (Solow, 1956).

Improving the productivity is fundamental to survival companies in a very competitive market. The purpose of all productivity-related attempts is to make lasting improvements in performance. Productivity is also the best methods we have to fight inflation, reduce unemployment, enhance profits, reduce costs, create capital and wealth and improve the quality of working life. (Drucker, 2001) clearly, indicated the importance of productivity as an economic indicator when he stated "Without productivity objectives, a business does not have direction.

Investigation of the productivity achieves the following results:

- The resources efficiency will be judged.
- Evaluation of resources management will be facilitated (Kazemi, 2003).

Measuring the productivity growth causes companies to evaluate the factors that affect on value added such as IT, Innovation ant etc (NPC productivity report, 2003).

Current business activity is characterized by intense international, rapid product innovation, increased use of automation, and significant organizational changes in response to new manufacturing and information technologies (Dirks, 2005).

Information technology (IT) is one of the valuable resources to increase the economic growth and customer satisfaction. It has a potential to impact on the structure of organizations and improve the quality of organizational performance significantly.

In the 1980s, IT was heralded as a key to competitive advantage (Porter and Millar, 1985). Porter and Millar (1985) concluded that IT has influenced competition in three ways: it has led to changes in industry structure and competition, it was used to support the creation of new businesses, and companies using IT outperformed their competition. Although IT as a critical factor to competitive advantage became less certain in the recent years, the high percentage of top executives considered IT as a key to a company's profitability and survival. This issue causes IT to pose a serious

dilemma for top management. On one hand, continuing IT innovations have the potential of changing the competitive game for many organizations. On the other hand, the size of the IT investment puts increasing pressure on managers to assess its business value (Mukhopadhyay, et al., 1997).

For many years, there has been much discussion about whether the IT revolution was paying off in higher productivity. Studies in the 1980s found no positive relationship between IT investment and productivity, a situation referred to as the *productivity paradox* (Dedrick et al., 2003). Since then, decades of studies at the firm and country level has consistently shown that the impact of IT investment on productivity and economic growth is significant and positive.

Albadvi and Keramati (2006) also provided the satisfactory evidences to show that IT implementation increase productivity when supported by rational complementary investment.

In the face of extreme competition and economic pressures, firms are changing their fundamental unit of analysis from the business function to the business process. IT investments may make little direct impact on the overall performance of the firms or the economy until they are combined with complementary investments in business activities, human capital, and companies redesigning. Therefore, according to the role of IT in Business Process Reengineering (BPR), as an enabler, BPR is essential for corporations to enhance the potential impacts of IT on their performances. On the other word, both IT and BPR investments, together, are able to improve productivity drastically.

Despite the fact that little more than 10 years ago Iran was backward technologically among the Middle East countries, it has been considered as a successful example of fast introduction of information technologies, recently.

The GDP growth of 6.9% in June 2005 places Iran among the fastest growing economies in the region. The economy has grown by an average 5% every year since 1999. The continued growth of exports to Middle East and western markets, integration with Asian countries, and institutional and regulatory reforms has thus laid a strong foundation for sustainable economic growth. The economy is likely to grow

by 5- 6 percent per year in near future (Central Bank of the Islamic Republic of Iran, 30<sup>th</sup> June 2006; cited Pourmirza, 2006).

The Average of the annual economic growth has been calculated 8 percent in fourth cultural, social and economic development plan of Iran (2005-09). 2.5% of the mentioned growth should be obtained by productivity. Besides, in order to achieve the above economic growth, all governmental sectors have to establish 31.3% of their GDP growth via Total Factor Productivity (TFP). And labor productivity, capital productivity and TFP would be at least 3.5%, 1% and 2.5% raised annually. Therefore, all activities and investments cause to achieve the above goals and extract the resources of organizations in the optimum ways are considered.

Telecommunication Company of Tehran (TCT) is one of the powerful companies which have continued business activities independently since 1995. TCT serves communication services and infrastructures. It is identified as a government company which has positive balance of finance. Therefore, TCT has a key role in the economic growth of Iran. The positive impact of IT investment on productivity causes TCT to increase its capacity for stay in competitive telecommunication market.

This research identifies and describes the impact of IT investment on productivity at Telecommunication Company of Tehran. Furthermore, the situation of BPR approach in TCT, as a method to improve the IT influences, is evaluated.

## **1-2. Problem Area Discussion**

More recently, the continuous movement towards globalization has made information technology one of the most important factors in achieving success as well as in seeking new markets, improving quality and providing better and faster customer service. Many of the recent studies have shed some light on the impact of IT on economic growth, productivity, employment, work organization and competitiveness (Satti, 2002).

Productivity at the organizational level is affected by the level of competition, which leads other organizations to step up the development of their productivity (Dedrick et al., 2003). Increased productivity, however, does not necessarily imply increased profitability. Competition may result in lower prices, thus eroding improvement in



margins. The beneficiaries will then be consumers, who get more value added for the price paid (Dedrick et al., 2003). This phenomenon is defined as consumer surplus.

IT has made rationalization possible in organizations by minimizing human involvement. These aspects of IT are labeled as *automational* (Zuboff, 1988). Increased access to information and enhanced means of accessing, analyzing, storing and communicating information can result in effects in addition to pure rationalization. These aspects are defined as *informational* (Zuboff, 1988) informational aspects empower employees and enrich quality of decisions and performances. *Transformational* is the third type of effects which encompasses the changes observed in process innovation and transformation. Another type of effects is identified by Hitt & Brynjolfsson (1996), who discuss the importance of the increased value perceived by consumers as a result of technological improvements. This phenomenon is defined as *consumer surplus* (Mooney et al., 1996).

IT is known as the productive resource to increase the economic growth, productivity and customer satisfaction. It has an effective role to enhance the quality of communication services. IT can be gainful in the communication services when appropriate successful BPR is implemented in the different parts of companies (Limayem, 2006). Moreover telecommunications service provider's survival depends on its ability to prepare for changes in customer needs, as well as changes in regulation and technology (Fornell and Wernerfelt, 1987; Reichheld and Sasser, 1990).

BPR begins with process redesigning which leads to fundamental changes in many aspects of an organization, including organizational structure, job characteristics, performance measures and the reward system. BPR relies heavily on the IT uses to create radically different working methods to achieve improvements of the order of magnitude required. Furthermore, BPR facilitates the change in corporate management's perception of technology. It also confirms an alternative channel through which IT solutions are being scrutinized and selected (Soliman, 1997).

Productivity growth arises from the development of new work methods based on new technology and production techniques. Consequently, when the new technology of IT was introduced in working life, productivity growth was expected. But, because computers were initially used in a situation where productivity growth had been low

and unemployment had been high since the mid-1970s, it was initially difficult to prove positive effects of investments in IT (Lundgren and Wiberg, 2001). Solow referred to this situation when he stated, "You can see the computer age everywhere but in the productivity statistics" (Solow, 1987). This phenomenon was later defined as the *productivity paradox* (Horzella, 2005). Of late, however, firm-level studies, in the manufacturing and service sectors, have shown that there are significant positive contributions from IT investments toward productivity (Harker, 2000).

### **1-3. Purpose of the research**

Nowadays, there are strong competitions among corporations which serve the communication services. Therefore, they not only employ information technologies through the organizational levels to improve the performance quality but also use the newest technologies to cover customers' needs.

There has been much discussion on whether or not the IT investment provides improvements in productivity and business efficiency. Several studies at the industry-level and at the firm-level have contributed differing understandings of this phenomenon.

Telecommunication Company of Tehran is one of the powerful companies that serve communication services and infrastructures. TCT has taken great steps in the development of telecommunication networks and for this purpose, as the main responsible organization in Iran, it has utilized the most advanced equipments and services such as digital switching centers, mobile phones, data networks, satellite services, Internet and special telephone services during the recent years. TCT has a key role in economic growth of Iran. Acceptance of Iran in WTO provides superior opportunities to penetrate in the Middle East and member's markets. In addition entrance the new competitors in communication market of Iran (Irancell and Taliya) causes TCT to increase its services quality, productivity and customer satisfaction.

The purpose of this research is to investigate the impact of IT investment on productivity at Telecommunication Company of Tehran. Besides, the status of BPR approach in TCT, as a complementary investment for improving the IT influences, will be evaluated.

In this research the production function model is used to assess impact of IT capital and labor in a government company and evaluate the BPR factors such as team working, paperwork and etc in order to obtain clear view about future investments and organizational change.

### **1-3-1. Objective of the research**

The main objectives of the research are introduced in below:

- Investigating the productivity measurement models.
- Calculating the productivity during the specific period of time at Telecommunication Company of Tehran.
- Calculating the variant subjects of Information Technology in Telecommunication Company of Tehran.
- Measuring and analyzing the impact of IT investment on productivity at TCT.
- Investigating BPR indicators at TCT to improve the productivity.

### **1-4. Importance of the research**

Rapid process of information, producing low price IT equipments and employing automation systems through the organizational levels in recent years cause corporations to access to the update information and knowledge easily and quickly.

Information Technologies are driving national development efforts worldwide. And a number of countries in both developing and the developed world are exploring ways of facilitating their development process through deployment and the exploitation of IT within their economies (Pourmirza, 2006).

More than 80% of the national GDP of Iran is created by governmental sectors. Although economic stagnation impact on all companies in 1990s, IT investments have been increased over the past years (Jahangard, 2004). Government companies, which have the positive financial levels, are pioneers in this area. Besides, the organizational levels of the most government companies in Iran are pyramidal. These kinds of levels make a lot of waiting and wasting times so, heavy IT investment in the current processes may fall down the positive IT influences.

Therefore, bright view of IT capital makes companies to better manage their recourses and future investments.

Rational complementary investments increase the positive impact of IT implantation (Albadvi and Keramati, 2006). Companies have implemented BPR approach to shift their fundamental unit of analysis from the business function to the business process, achieve remarkable improvements in critical, contemporary measures of performance and employ the real potential of IT investment through their organizations. BTN, British company in telecommunication area, is pioneer in implementing BPR. Thus, BPR approach can be an essential way for Telecommunication Company of Tehran to streamline its business activities.

In order to prove the importance of BPR in Telecommunication Company of Tehran, evaluation of its indicators is the first step.

Evaluating the impact of IT on productivity causes at least the following results:

- Telecommunication Company of Tehran evaluates the factors that affect on value added.
- Future planning for the value level of Telecommunication Company of Tehran can be facilitated.
- The resources management of Telecommunication Company of Tehran will be facilitated.
- Telecommunication Company of Tehran finds clear view about its future investments and organizational change.

### **1-5. Research Questions**

The critical questions within the scope of this research are:

**RQ1:** *What is the relationship between IT investment and productivity at Telecommunication Company of Tehran?*

**RQ2:** *Is there a meaningful difference between the present situation and the desired situation of Telecommunication Company of Tehran, with regard to BPR approach?*