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# ICT Investment Effectiveness in the South African Post Office: Reconsidering the Approaches of the Past 20 Years

Research Paper

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## ABSTRACT

Organizations have invested and continue to invest considerable resources in Information and Communication Technology (ICT). Much of this investment is made on the basis of guarantee than an expected return will occur. This study presents the results of an empirical study of the impact of ICT investment on performance at the South African Post office (SAPO). Six years of historical data, from 2005 to 2010, were obtained from the Chief Information Officer (CIO) of the SAPO and analyzed. This included appropriate IT data and financial data from the organization's financial statements and balance sheet. ICT investments were tested against financial performance indicators such as return on ICT investment, operating leverage, turnover growth, net profit, organizational risk, IT cost efficiency ratio and IT efficiency ratio. Within the period studied, it was observed that ICT investments at SAPO were negatively correlated with most of the financial indicators such as return on ICT investment, operating leverage, turn-over growth, net profit, organizational risk and IT efficiency ratio. This study therefore suggests that ICT investments at SAPO for the mentioned period did not have desirable impact on financial performance of the organization. In order to realize tangible financial benefits of the ICT investments at SAPO, the research results suggest that a longer period needs to be considered, and should also include like non-technological determinants such as competence and experience levels of IT personnel, alignment of IT strategy with business strategy and business process re-engineering to suit new systems needs to be considered too prior to making any investments in ICT.

## Keywords

ICT investment, Organizational Risk, ITEX, OPEX, operating leverage, turn-over growth

## INTRODUCTION

For most organizations ICT expenditure continues to be a major, if not the single largest component of capital investment. Tangible benefits have, however, remained elusive for many organizations. A number of pertinent issues and questions have been raised as to why organizations have failed to reap the benefits of huge ICT investments (Hamidi et al., 2011).

This study therefore conducts an empirical investigation into ICT investment effectiveness in the South African Post Office (SAPO). The main objectives of this study were to determine the impact of ICT investment on financial performance at the SAPO. This makes ICT investment a challenge within all sectors of the economy. However, more effort is needed to ensure that every cent spent on ICT is worth it.

## STATEMENT OF THE PROBLEM

Melville et al., (2007) note that current debate continues among managers and academics with regard to the measurable benefits of ICT investment. Existing research on return on investment (ROI) and other performance measures indicates conflicting empirical findings. The strategic importance of ICT investment and ICT investment decisions by business managers will be emphasized in this study.

The SAPO, like other organizations, also tracks the return on its investments. With its 2010 mission (SAPO, 2010), which seeks to enable the nation to connect effectively with the world by distributing information, goods, financial and government services, leveraging its broad reach and embracing change, technology and innovation, SAPO also needs to measure the value of its ICT expenditure.

SAPO has invested financial resources in ICT technologies. However, no tangible returns had been realized yet from these investments during the period from 2005 to 2010. According to Shu and Strassmann (2005), there is no evidence of a relationship between ICT expenditure and the financial performance of an organization. Melville et al., (2007) did find evidence of such relationships. Kim and Lim (2011) indicated that a lagged effect exists between ICT investment and the financial performance of an organization. The reasons for the mixed results were contributed to data reliability, methods of analysis and the lack of appropriate ways to measure the effects of ICT investment.

Originating from this problem statement are the following research questions which were explored in this study:

- What is the impact of ICT investment on IT cost-efficiency and IT efficiency ratios?
- Will the initial ICT investment target be changed if managers can identify changes in the organizational risk?
- What is the impact of ICT investment on organizational risk, cost-benefit analysis, operating leverage, and return on IT assets?
- What is the impact of ICT investment on the financial performance of SAPO, as measured by ROI, operational costs, profitability levels (operating income, operating leverage, net profit, and turnover growth) and operating expenses?

## BACKGROUND TO THE ORGANISATION

The Postal Services Act (Act 124 of 1998) designates SAPO as the universal postal services operator in the Republic of South Africa. The Act obliges SAPO to provide a defined range of postal services, namely delivering a basic letter of less than 1kg throughout the country and providing addresses to all citizens at an affordable price (SAPO, 2010).

A license agreement governs the performance required from SAPO in discharging its universal services obligations. The license agreement sets rules for a user-orientated, high-quality, country-wide universal postal service at an affordable cost. To this end, it establishes rules for access to universal postal services and the quality of these services (SAPO, 2010).

### Literature Review

The researchers used the following keywords to search for relevant literature in this study: ICT investment resources, application of ICT investment, strategy and ICT investment, ICT investment and productivity, definition of ICT, information and ICT investment, use of ICT, advantages and disadvantages of ICT, efficiency of ICT, ease of ICT, and role of ICT investment.

The following themes were discussed: impact of ICT on an organization, the effectiveness of ICT in terms of organizational performance, alignment with business strategy, business performance, proposed methods for measuring ICT value, models for ICT investment decision making and lastly conclusion.

ICT strategies, according to Huang et al., (2008), include the technology scope, system competencies and ICT governance. The technology scope focuses on important ICT technologies and applications, while system competencies deal with those capabilities that distinguish ICT services and are important to the achievement of a company's strategies. ICT governance, among other things, involves the areas of responsibility in a partnership between ICT and business. Yao et al., (2010) advocate for the establishment of an ICT dashboard which, according to the Gartner Group, is 'a multi-dimensional, linked set of metrics used to define measure and modify performance'. This is important in order for ICT to be able to demonstrate the value added to the organization.

According Porter (1985), ICT is only regarded as an activity that supports the primary activities, in order to create value within an organization. A company's margin or profit depends on its effectiveness in performing these activities efficiently. It is in these activities that a firm has the opportunity to generate superior value.

Morita and Nakahara (2004) argue that the success of a business depends on its ability to deliver more real value to consumers without using labor, capital or other inputs. This is achieved through productivity growth, which results from working smarter by adopting new technologies and new techniques for production. The introduction of ICT in organizations has had mixed results in terms of productivity output. Although there have been many success stories in this regard, there have also been stories of cost overruns, abandoned systems and other ICT failures.

Morita and Nakahara (2004) found that a positive consensus was beginning to emerge regarding the catalyst effect of ICT. An important finding was that while the average returns on ICT investment were solidly positive, there was a huge variation across organizations. Some have spent vast sums on ICT with little benefit, while others have spent similar amounts with success. The benefits of ICT appeared to be realized when ICT investment was coupled with other complementary investments: new strategies, new business processes and new organizations.

The above view is supported by Masli et al., (2010), who state that sustained competitive advantages can be achieved through building and leveraging key ICT assets such as human resources, reusable technology and partnerships between ICT and business management. ICT is often the product or service that contributes directly to revenue and profit. Gregor et al., (2006) also argue that although it is not reflected in macro-economic measures of productivity or financial measures of financial performance, there is doubt that ICT has improved performance.

### **Attempts to Measure the Effectiveness of the Usage of ICT and Its Benefits**

Various approaches were used by researchers such as Kwong and Mohammed (1985) and Ward (1987) to measure the benefits of ICT for an organization. Ward (1987) claims that contrary to common policy, expenses such as research should be included as part of the total ICT investment cost. Kwong and Mohammed (1985) suggest the use of a computerization index (CI) in their empirical study on the evaluation of the impact of computerization on profitability. CI measures the extent and sophistication of computerization. It incorporates factors such as the number of computers, application software, staff, and number of shifts and years of computer usage.

Kwong and Mohammed (1985) compare the methods of Product Portfolio and Profit Impact of Marketing Strategy (PIMS) and the Boston Consulting Group Method as measurements of financial performance. Kwong and Mohammed (1985) observe that the organization in question showed an increasing degree of computerization. Their conclusion was that computerization is positively associated with improved performance for both the short- and long- term.

King (1988) provides, in a study on the effectiveness of IS planning; a comprehensive evaluation of an organization's IS strategic planning process. He notes that resource inputs have to be used to describe and evaluate the overall impact of IS strategic planning on an organization. He uses this term to describe a set of measures that can be applied to address the issue of how well the IS planning system has achieved its goals. Hence, he claims, it is possible to determine the relative worth of the IS planning system.

### **Alignment with Business Strategy**

ICT strategies are intended to indicate new opportunities which may positively impact on the overall business strategy. ICT strategies that support an existing business strategy result directly in business alignment. The ICT strategy, in a business alignment situation, is generated from the business strategy through such techniques as critical success factor (CSF) analysis. CSFs measure the performance or efficiency of the different parts of the organization, and exist in every functional area of the business. For instance, the accurate and speedy recording and updating of sales data is very critical in a sales environment (Lee and Lee, 2010).

Business governance describes the roles and relationships between the organization and all its stakeholders. The main driving force of business strategy is how to build and sustain a competitive edge over the long-term (Dehning et al., 2004).

Weill and Olson (1989) indicate that the link between ICT and corporate strategy varies a lot. Claims which emerge from their study include the suggestion that managers need to adopt a broad definition of ICT so that they know what that investment is, and that ICT expenditure should be measured and tracked over time against a convenient base. This base can include revenues, total

expenses or management-controlled costs. This suggests that every ICT investment could be treated as a portfolio investment, with aims and associated levels of risk.

## Business Performance

Relationships between investment in ICT and business performance, as well as productivity, have reported the positive effects of such investment. Lin (2009) questions these results on the grounds that the studies involved an examination of primarily cross-sectional data. This criticism stems at least in part from the premise that the benefits of ICT investment can only be realized over longer periods of time. It is possible that in some instances, ICT has the potential to provide benefits within the same year that the investment is made.

According to Shu and Strassmann (2005), another explanation for the paradox is that the benefits from ICT can take several years to appear on the bottom line. The idea that new technologies may have a delayed impact is a common one in business. A survey of executives suggested that many expected it to take as long as five years for IT investments to pay off (Yang and Olfman, 2006). This agrees with an econometric study conducted by Radhakrishnan et al., (2008), which found lags of two to four years before the strongest business impacts of IT were felt. Fernández-Menéndez et al., (2009) also found slightly higher, albeit still very low, productivity when small lags were introduced.

Michael (2007) notes that the existence of lags is based on theory. He states that returns on ICT investments are not instantaneous and therefore cannot be measured based on a direct relationship. He also confirms that the unusual complexity and novelty of ICT may result in firms and individual users requiring some experience before becoming proficient. According to dynamic models of learning-by-using, the optimal investment strategy sets short-term marginal costs greater than short-term marginal benefits.

Bojane and Jerman-Blažič (2008) state that investments in ICT might take years to add value to a firm and are more likely to be reflected in the future profit streams of a business. They argue that returns on ICT investment occur in three key phases for value: dormancy, triggering and transformation. Phase 1, value dormancy, occurs after an ICT investment has been made by the firm, and the associated value flows take time to appear. For value flows to occur within the firm in Phase 2, a primary set of value triggers needs to be in place. This involves the triggering of value flows that result in changes in business routines and structures, which permit the flow of ICT value. In this phase, firms have to focus on setting off a series of timely value triggers.

The effects of ICT investment in the high information-intensive industry are larger than in the low information-intensive industry (Shao and Lin, 2002). Furthermore, a lagged effect of ICT investment is larger than an immediate effect, regardless of the information intensity of the industry. Before a new tool can be fully integrated and used, the users need to be given the appropriate training in order to accept the new technology. As the users gain adequate experience, investors will be able to draw conclusions regarding whether or not the investment has had the desired effect (Anyangah, 2010).

A business can use ROI, market share, customer satisfaction levels, operational efficiency and revenue, amongst other measures, to determine whether or not its business objectives are being met (Joshi and Pant, 2008). Lee and Lee (2010) note that business executives must no longer use financial benefits alone to measure the value added by ICT investments. Instead, they should now consider non-financial benefits such as improved customer satisfaction, greater information availability and shorter

production cycle times. The greater the benefits of the investment in relation to the cost, the more value will be added to the business by the ICT project.

### **Measuring the Value of ICT and ROI**

Understanding, measuring and monitoring the benefits delivered by ICT is becoming vital to the successful exploitation of business technology. Measuring the value of an investment is an inextricable part of business planning. Dehning et al., (2006) note that because of increasing competition and limited capital budgets, organizations need to carefully assess every information technology opportunity to ensure that their resources are spent judiciously. Conventional wisdom holds that ICT has enormous potential. Despite the potential benefits derived from ICT investment, traditional capital budgeting models have failed to estimate true ICT values due to their inability to measure complex interactions between ICT and organizational performance.

This lack of understanding suggests that ICT organizations and the business units that act as their customers should be able to confidently and continuously demonstrate the value of their investments over time. The uncomfortable fact remains that most companies have done an abysmal job of accurately determining the economic, strategic and operational returns on their ICT investment (Love et al., 2005). Antonopoulos and Sakellaris (2009) note that although they observed a general optimism in society as a whole with regard to ICT's potential for creating sustainable competitive advantages, they had some concern about the lack of empirical support for the positive economic impact of ICT on businesses.

According to Weill and Olson (1989), ICT investment and the return on ICT investment are issues that need to be considered. They propose that ICT investment does not lend itself to ROI approaches because it is difficult to determine the income stream and the calculation of a meaningful ROI is therefore not possible. In addition, investment in ICT tends to be spread throughout the organization. The outcomes of these investments, they continue, are likely to be the result of interactions among a number of different project investments in ICT (namely database, hardware, etc.).

### **ICT Contribution Model**

Epstein and Rejc (2005) developed a model for evaluating performance in IT, in order for management to better justify and evaluate ICT initiatives. The ICT contribution model for evaluating performance in ICT is a general model of key factors that help organizations identify and measure the costs and benefits of ICT, and properly assess the payoffs of investments in ICT. They suggest that the identification and measurement of the impacts of ICT investments should start with a careful examination of the critical factors for corporate success in ICT integration. ICT success must ultimately be measured by its contribution to overall organizational success. The ICT contribution model can be applied with equal effect to both for-profit and non-profit organizations. The following model illustrates the inputs, processes, outputs and outcomes of ICT contributions within an organization.

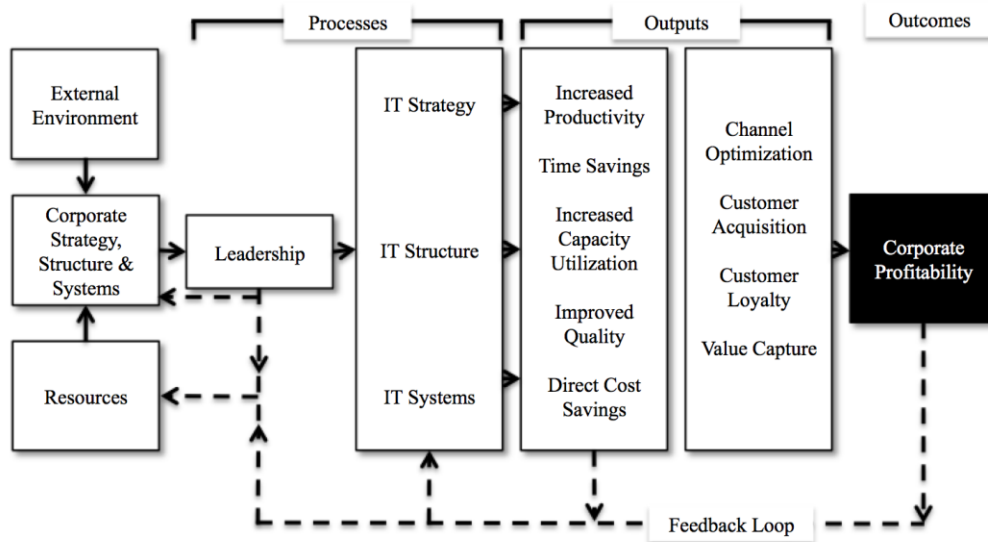


Figure 1: The ICT contribution model (Epstein and Rejc, 2005)

The guideline includes a detailed plan of how to calculate ROI. An organization’s ICT success is dependent on various inputs, which include its existing corporate strategy, structure and systems that present both opportunities and constraints for ICT initiatives. These, along with available resources and the external environment, are critical inputs that affect choices regarding the formulation and implementation of ICT strategies. Other factors, such as leadership and ICT strategy, ICT structure and ICT systems or processes, also significantly impact the performance and success of ICT initiatives (Epstein and Rejc, 2005).

### Beyond Budgeting

Fox (2008) argues that working with budgets, as practiced in most corporations, should be abolished. This is a radical proposition, but it is merely a step in the long-running battle to change organizations from centralized hierarchies to devolved networks. Organizations have invested huge sums in quality programs, ICT networks, process reengineering, and a range of management tools, including value analysis, balanced scorecards and activity accounting. Beyond budgeting replaces the budgeting model with a more adaptive and devolved alternative, and defines a set of principles that guides leaders towards a new management model which is lean, adaptive and ethical. Beyond budgeting is not a process, but is rather a management model based on two sets of principles, namely the six principles of managing with adaptive management processes, and the six devolution-based principles.

Tanaka et al., (2005) note that in the private sector, managers are forced to consider current and future opportunities and threats, particularly where rolling monthly forecasts of financial performance operate together with a focus on other non-financial value drivers. In essence, the 'beyond budgeting' model entails devolved managerial responsibility, whereby power and responsibility go hand-in-hand.

However, these drivers will be ineffective unless front-line staff have the scope, knowledge and power to deliver. The result is an organization that is lean, adaptive and ethical, and that has the potential to remain at the top of its peer group league table. There are many possibilities, ranging from traditional budgeting to beyond budgeting, to modernize the budgeting process. However, the beyond



budgeting model deserves serious consideration because it enables an organization to look with a fresh view at its budgeting process, other planning processes and organizational structure (Tanaka et al., 2005).

Tanaka et al., (2005) argue that the more beyond-budgeting principles an organization implements, the better it performs. The Chartered Institute of Management Accountants (CIMA, 2006) notes that during the late 1980s and 1990s, numerous concerns were raised about traditional accounting measures. These criticisms were primarily concerned with the scope for subjectivity that even the most comprehensive accounting standards allow. As a result, they turned to the concept of shareholder value and how this can be created and sustained.

### **Models for ICT investment decision making**

In order to test the validity of statements made by authors such as Weill and Olson (1989) and Harris and Katz (1991) in the literature, as well as to justify decision making with regard to ICT investments, suitable models were required for this study. Eleven such models for ICT investment decision-making were found in the literature. These models are: computerization index (CI), operating leverage (OPEL), return on ICT assets (R) organizational factor, revenue stability, stochastic process simulation (SPS), IT expense ratio (ITEX), operating cost efficiency ratio (OPEX), IT cost efficiency ratio (ITCE), the probability of making an ICT investment when organizational risk is affected positively/negatively when making an ICT investment, and cost-benefit analysis ratio (CBA). A brief description of each of these models is provided below.

### **Computerization Index (Ci)**

The aim of Kwong and Mohamed's (1985) study was to quantitatively measure the impact of computerization on profitability and, in the process, develop an indicator of the extent and sophistication of computerization. They proposed a Computerization Index (CI) for this purpose, which is constructed according to the following formula:

$$CI = V1 (W1) + V2 (W2) + V3 (W3)$$

Ten variables (V1 to V10) were chosen to collectively represent the computerization process, and their importance was indicated by awarding weights to each variable. These variables are as follows: Management activity level, Years of computer usage, Number of computers, Application software, Size of CPU, Hardware costs, Staff, Number of shifts, Organizational location, and Investment analysis

### **Presentation of Formulae Used To Do the Calculations for CI**

Kwong and Mohamed's (1985), CI was constructed as follows:

$$CI = V1 (W1) + V2 (W2) + V3 (W3)$$

where CI = Computerization

V1 = Variable affecting the degree of computerization

W1 = Weight applied to Variable V1

The same ten variables (V1 up to V10) were selected by Kwong and Mohamed (1985) to collectively represent the computerization index.

	Variable	Weight
V <sub>1</sub>	Management activity level	0.40
V <sub>2</sub>	Years of computer usage	0.10
V <sub>3</sub>	Number of computers	0.10
V <sub>4</sub>	Application software	0.06
V <sub>5</sub>	Size of CPU	0.06
V <sub>6</sub>	Hardware costs	0.06
V <sub>7</sub>	Staff	0.06
V <sub>8</sub>	Number of shifts	0.06
V <sub>9</sub>	Organizational location	0.05
V <sub>10</sub>	Project investment analysis	0.05
		1.00

**Table 1: Variables (Kwong and Mohamed, 1985)**

## ICT-Related Ratios

Harris and Katz (1991) note that technology is altering the way in which companies compete. Evaluating whether or not an organization's level of investment in information technology is sufficient represents a competitive edge, and has been a historical challenge for top management. These complications, used by Harris and Katz (1991), were formulated by an industry panel of senior information system executives. In this table, which is presented below, the columns correspond to systems technology sophistication.

<b>Hardware</b>	Multiple processors/ Multiple locations directly connected or via switched networks
<b>Operational</b>	Database management system, TSO, CICS, remote and local batch
<b>Systems Software</b>	Multiple CPUs/multiple program execution, multiple operational environments
<b>Application Software</b>	Modular programs/structured techniques, high-level language
<b>Management</b>	Multiple locations/dissimilar operations, remote control

**Table 2: Levels of systems technology sophistications (Harris and Katz, 1991)**

Harris and Katz (1991) plotted income versus operating expenses over a couple of years. The sample was then ranked by income and then divided into quantities. The result of this is represented in a tabular form, comparing the premium income, average non-interest operating expense and average amount spent on ICT. Another plotted graph shows income growth versus non-interest operating expense for the sample used by them. The authors calculated some ratios, one of which is called the operating cost efficiency ratio (OPEX), which is the ratio of total operating expense to income (turnover). The organization with the largest OPEX ratio represents the least profitable organization, and the organization with the smallest is the most profitable.

The organization with the largest CI was assumed to be the most computerized. According to Harris and Katz (1991), this enables the comparison of a business with similar lines of business. The conclusion they drew is that any organization with expenses per monetary income that are higher than the competition is at a competitive disadvantage.

Another ratio, known as the IT expense ratio (ITEX), is the ratio of IT expenses to non-interest operating expenses. The last ratio is the IT cost efficiency ratio (ITCE), which is the ratio of the cost of information processing to sales revenue. Harris and Katz (1991) report that 75% of their sample improved their profitability position, while the operating expense ratio decreased. Their findings do suggest empirical relationships, namely that the most profitable organization or top performers are more likely to spend a significantly higher proportion of their non-interest operating expense on IT. They note that every situation should be evaluated on its own merits.

### **IT Efficiency Ratio (Itex)**

This is the ratio of IT expense to total operating expense as one measure of the degree of operational dependence on IT.

(Harris and Katz, 1991). It can be expressed as follows:

$$\text{IT Efficiency Ratio} = \frac{\text{Information Technology Expenses}}{\text{Total Operating Expenses}}$$

### **IT Cost Efficiency Ratio (Itce)**

The IT cost efficiency ratio is a single-factor expense measure of the cost of IT. In this study, three sources of IT-based cost economies are relevant. These are scale economies, scope economies and economies due to learning effects. The cost of information processing as a proportion of sales revenue (turnover) was investigated, and the original formulae used premium income as a basis. This study, however, because of the spread of the organization, substituted premium income with turnover (sales revenue) (Harris and Katz, 1991). This can be expressed as follows:

$$\text{IT Cost Efficiency Ratio} = \frac{\text{Information Technology Expense}}{\text{Total Turnover}}$$

### **Operating Cost Efficiency Ratio (Opex)**

This is the ratio of non-interest operating expense to income (Harris and Katz, 1991). It can be expressed as follows:

$$\text{Operating Cost Expense Ratio} = \frac{\text{Non-interest Operating Expenses}}{\text{Income}}$$

## Research Methodology

This study was predominantly quantitative in nature, and was conducted by means of a survey that made use of a semi-structured questionnaire (see appendix A), which was completed by a knowledgeable individual within SAPO.

This study attempted to gauge the effectiveness of SAPO's Information and Communications Technology (ICT). Users of SAPO's ICT who might have an interest in the performance of the system included all stakeholders, such as management, clients, government and employees.

The information for the study was only gathered from SAPO's CIO. Given the topic and nature of the research the CIO would be the only individual with access to and knowledge of all aspects of the ICT investment effectiveness as he is the central coordinating body. All other users or potential subjects would be using the same datasets (thus resulting in 100% corroboration). It may therefore be assumed that the CIO is the most knowledgeable, objective and experienced with regard to the subject matter being explored. The researchers felt that increasing the sample would not add value to this study, since the study deals with quantitative or financial performance attributes, which do not depend on people's perceptions. This study therefore focused on collecting objective information that could be used.

## Data Collection

The financial data for this study was obtained from the SAPO 2005 – 2010 financial statements, which was the period under investigation. The questionnaire used was one developed by one of the researchers in a previous study. The questionnaire was sent via e-mail to the CIO at SAPO after the necessary approvals had been obtained. The questionnaire was tested for consistency, free of any errors, using simple language with no ambiguities.

In order to obtain a better understanding of the dataset, the data was summarized in the form of appropriate figures and tables. One of the main aims of this chapter is to present the data in an understandable and interpretable way, in order to be able to formulate working strategies to improve ICT investment effectiveness at SAPO.

## Computerization Index

SAPO's computerization index, calculated as the weighted average of variables such as management activity level, years of computer usage, number of computers, application software, size of CPU, hardware costs, staff, number of shifts, organizational location and project investment analysis, is shown below. This index is a measure of ICT resources that have been invested in an organization over a given period of time.

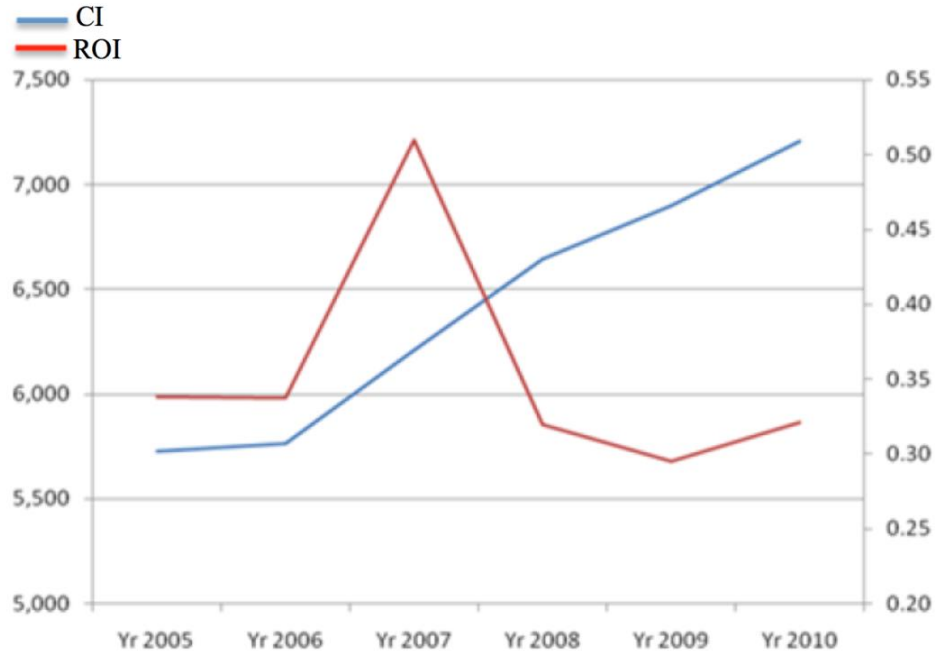
It can be observed in the above table that SAPO increased its computerization level by 25.9% to 7208 between 2005 and 2010. This means that SAPO has been consistently investing more ICT resources in order to improve the general level of computerization sophistication. The improvements in the number of computers bought, size of CPU's for users, application software in use at SAPO, and management activity level contributed significantly to the increased computerization level. This improvement could have been driven by dynamic and advanced market expectations, as well as the intense competition faced by SAPO during the period under review (Kwong and Mohamed, 1985).

Variable	Weight	Year 2005	Year 2006	Year 2007	Year 2008	Year 2009	Year 2010
Management activity level	0.4	35	37	40	42	45	48
Years of computer usage	0.1	32	33	34	35	36	37
Number of computers	0.1	45 429	48 370	51 501	54 834	58 384	62 163
Application software	0.06	153	163	173	184	196	209
Size of CPU	0.06	3	3	3	4	4	5
Hardware costs	0.06	3	3	3	3	3	3
Staff	0.06	19 268	15 005	17 138	18 870	17 117	15 918
Number of shifts	0.06	2	2	2	2	2	2
Organizational location	0.05	5	5	5	5	5	5
Project investment analysis	0.05	1	1	1	1	1	1
<b>Computerization Index (CI)</b>		<b>5 726</b>	<b>5 766</b>	<b>6 209</b>	<b>6 648</b>	<b>6 900</b>	<b>7 208</b>

**Table 3 SAPO computerization index trend for the period 2005 to 2010**

### **Relationship between the Computerization Index and Return on IT Assets (ROI)**

Figure 4 below illustrates the relationship between ICT investment (CI) and return on IT assets. It shows that for the first two years, return on IT assets was increasing, with a corresponding increase in ICT investment. However, the remainder of the 5 year period indicates a different trend, whereby an increase in ICT investment was followed by a decrease in return on IT assets. SAPO's ICT investment (CI) and return on IT assets between 2005 and 2010 were negatively correlated, with a correlation coefficient of minus 0.3. This might indicate that SAPO has an inefficient operational environment that does not improve company returns when the computerization levels are increased (Hu and Quan, 2005).

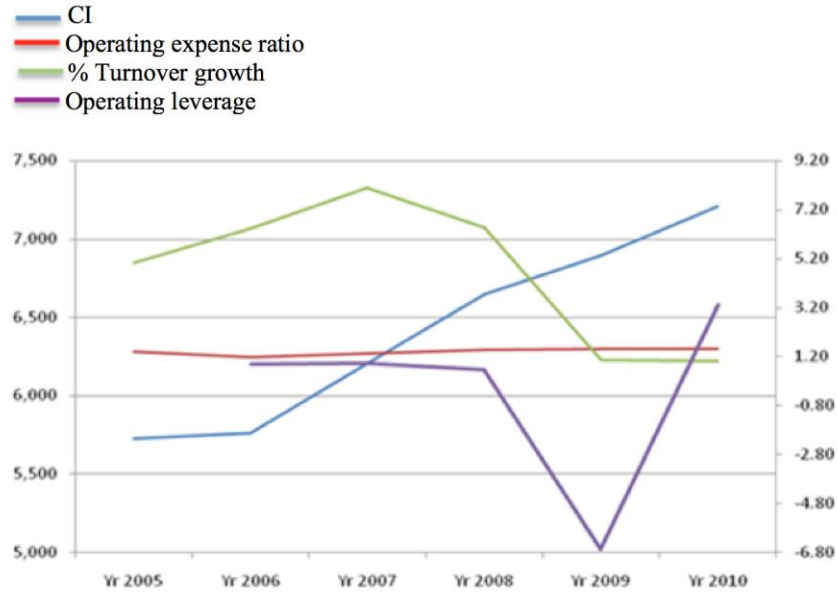


**Figure 2: Relationship between the computerization index and return on IT assets (ROI)**

In other words, investing in more ICT resources at SAPO during the period 2005 to 2010 did not have any impact on returns on ICT assets. The results obtained in this study contradict Hu and Quan's (2005) theory, which states that ICT provides competitive advantages to firms by adding value across all aspects of the value chain, including improving operational performance, reducing costs and improving returns. However, it is important to note that the driver of ICTs impact on return on ICT assets is not only investment in technology, as technology usage also plays a critical role in this regard. In order to obtain more credible results for the effect of ICT investment on return on ICT assets in this study, a longer period of review should perhaps have been considered. Nevertheless, it must be noted that the return on ICT assets recorded by SAPO during the period under review was relatively high, with an average of 35.3%.

### Relationship between ICT Investment and Business Performance Indicators

Figure 3 below compares CI, operating expense ratio and % turnover growth. It shows that as the level of computerization for SAPO during the period 2005- 2010 increased, the operating expense ratio also increased. These two indicators (level of computerization and operating expense ratio) exhibited a high positive correlation, with a correlation coefficient of 0.81. This suggests that increasing ICT investments at SAPO during the period under review did not have any impact in terms of the lowering of operational costs within the organization. However, this contradicts Hu and Quan's (2005) theory, which states that ICT provides competitive advantages to firms by improving operational performance, thereby reducing costs.



**Figure 3: Relationship between ICT investment and business performance indicators**

At SAPO, the increase in operational cost after investing in ICT could be attributed to an inefficient operational environment and poor cost control management techniques. SAPO’s turnover growth rate (refer to Figure 3 above) showed an increase in the first two years and then consistently and dramatically decreased up to the end of the five-year period. Consequently, the level of ICT investment and turnover growth rate were negatively correlated, with a correlation coefficient of minus 0.7. Operating leverage showed an initial decrease in the first three years, before increasing during the remaining two years. The level of ICT investment also correlated negatively (with a weak correlation coefficient of minus 0.13) with operating leverage (Radhakrishnan et al., 2008).

According to Shu and Strassmann (2005), another explanation for this paradox is that the benefits from ICT can take several years to appear on the bottom line. A survey of executives suggested that ICT investments might take as long as five years to pay off (Yang et al., 2006). This is supported by an econometric study conducted by Radhakrishnan et al., (2008), which found lags of two to four years before the strongest business impacts of information technology were felt. The failure to see improvement in turnover at SAPO after ICT investment can be attributed to the short period of review in this study. A failure to effectively utilize the available technology could have compounded the problem at SAPO.

The correlation coefficients for profitability indicators, as discussed above, are illustrated in Table 4 below. This table indicates a strong positive correlation between ICT investment (CI) and operation expense ratio, which is in line with Shu and Strassmann’s (2005) theory. The rest of the indicators, such as return on IT assets, operating leverage and turnover growth, exhibited a negative correlation with ICT investment. This could be in line with Shu and Strassmann’s (2005) explanation that the benefits from ICT can take several years to appear on the bottom-line. Positive results could have been obtained in this study if a lengthy time period was considered. Failure of ICT investment at SAPO to boost its financial performance can further be attributed to the lack of capacity to exploit ICT capabilities.

	<i>CI</i>	<i>Return on IT assets</i>	<i>Operating leverage</i>	<i>Operating expense ratio</i>	<i>% Turnover growth</i>
CI	1				
Return on IT assets	-0.31	1			
Operating leverage	-0.13	0.30	1		
Operating expense ratio	0.81	-0.41	-0.35	1	
% Turnover growth	-0.70	0.66	0.36	-0.68	1
Operating leverage	-0.13	0.30	1	-0.35	0.36

**Table 4: Correlation analysis among profitability indicators**

In this regard, the lack of capacity could refer to the low levels of ICT literacy and lack of ICT experience and expertise. It is also essential to invest in technologies that are relevant or appropriate to the organization's core business, in order to achieve positive financial benefits. In addition, the likely failure of SAPO to adapt to new operational models offered by new technology projects could have hindered achievement of results for the financial indicators.

### Relationship between CI and Profitability Performance Indicators

Figure 5 below illustrates the relationship between the computerization Index (CI) and profitability indicators such as operating income, operating expenses and net profit. It can be observed from this figure that operating income increased during the 5 year period under review. This increase in operating income could have been mostly due to other factors, such as the price adjustments that SAPO makes to most of its products every year. Nevertheless, the CI was positively correlated with operating income, with a correlation coefficient of +0.88. Kwong and Mohammed (1985) observe that the organization's performance showed an improvement here, with an increase in the level of computerization.

Kwong and Mohammed (1985) conclusion was that computerization is positively associated with improved performance, in both the short- and long-term. Operating expenses showed a similar increase during the 5 year period under review. Consequently, the CI was also positively correlated with operating expenses (+0.93), and costs also increased in tandem. On the contrary, SAPO's net profit decreased significantly during the 5 year review period, and was negatively correlated with the CI, with a correlation coefficient of minus 0.67.



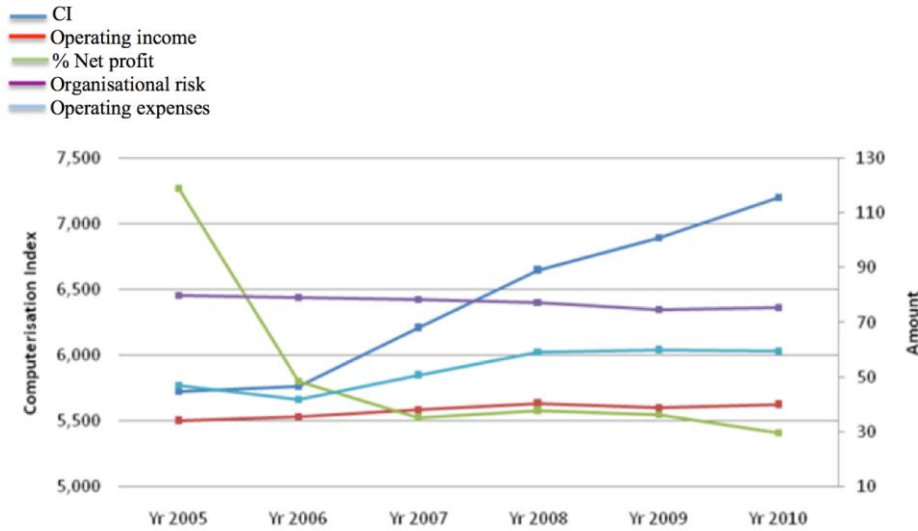


Figure 4: Relationship between CI and profitability performance indicators

The results obtained in this study also contradict Hu and Quan’s (2005) theory, which states that ICT provides competitive advantages to firms by adding value across all aspects of the value chain, including improving operational performance, reducing costs and improving returns. Investing more ICT resources at SAPO did not improve the operating expenses or net profit of the organization, possibly due to the failure of the organization to complement ICT usage intensity with organizational change, among others. The organizational risk for SAPO declined steadily during the 5 year period under review. This could be attributed to the fact that as more ICT resources are invested in any organization, it is more likely to improve its service delivery and hence attract more clients. As expected, the computerization index was negatively correlated with organizational risk, with a correlation coefficient of minus 0.94.

	CI	Operating income	Net profit	Organisational risk
CI	1			
Operating income	0.88	1		
Net profit	-0.67	-0.85	1	
Organisational risk	-0.94	-0.79	0.68	1
Operating expenses	0.93	0.86	-0.51	-0.85

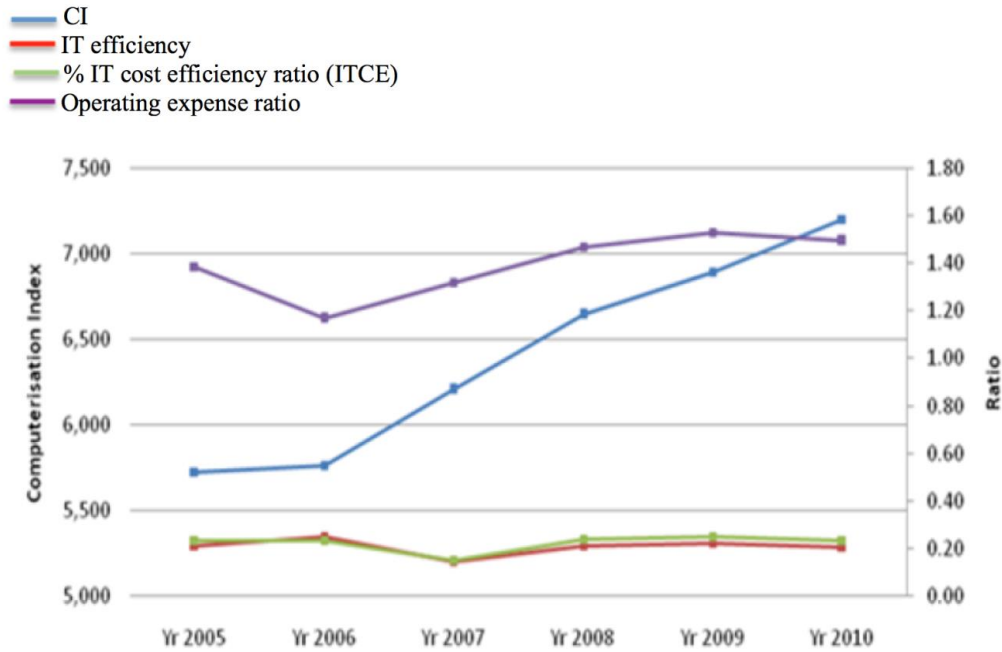
Table 5: Correlation analysis for CI and profitability performance indicators

Despite all the profitability negatives observed above, the profitability index, calculated as the sum of the present value of cash flow after tax divided by the initial investment, was +4.2. This indicates that SAPO’s investment in ICT assets over the 5 year period has been a worthwhile venture (Hu and Quan, 2005).

### Relationship between ICT Investment and IT-Related Ratios

Figure 5 below illustrates the performance of IT-related ratios over the 5 year period under review. The operating expense ratio showed an increase, together with the CI, but decreased slightly in the final year. As a result, the CI correlated positively with the operating expense ratio, with a correlation coefficient of +0.81, as shown in Table 5. This means that by increasing ICT investment assets between 2005 and

2010, SAPO did not produce the desired positive result of reducing its total operational costs. Harris and Katz (1991) report that the most profitable organizations or top performers are more likely to spend a significantly higher proportion of their operating expense on IT.



**Figure 5: Relationship between ICT investment and IT-related ratios**

In this regard, the operating expense ratio averaged 1.4 for the 5 year period. This means that the total operational costs for SAPO between 2005 and 2010 were outstripping its operational income. This is not good for business, as the organization might then have to rely on other sources of income to close the gap and remain viable. In the first two years, IT cost-efficiency and IT efficiency ratios dropped slightly before showing an increase for the remaining period. Despite being positively correlated (IT cost efficiency and IT efficiency), with a high positive correlation of +0.84, the IT efficiency ratio correlated negatively with CI, while the IT cost efficiency ratio was positively correlated with CI. This is supported by Harris and Katz (1991), who report that top performers are more likely to spend a higher proportion of their operating expense on IT, thereby resulting in a positive relationship between CI and operational expenses.

Furthermore, for the 5 year period under review, IT cost-efficiency and IT efficiency ratios averaged 22.6% and 21% respectively (refer to Table 6). The correlation analysis for CI and IT-related ratios, such as IT cost-efficiency and IT efficiency ratios and the operating expense ratio, as discussed above, is shown in Table 6 below (Harris and Katz, 1991).

	CI	IT efficiency ratio	IT cost-efficiency ratio
CI	1		
IT efficiency ratio (ITEX)	-0.13	1	
IT cost-efficiency ratio (ITCE)	0.24	0.84	1
Operating expense ratio	0.81	-0.17	0.37

**Table 6: Correlation analysis for CI and IT-related ratios**

Table 7 below indicates the profitability performance indicators and IT- related performance ratios for the 5 year period under review.

	Year 2005	Year 2006	Year 2007	Year 2008	Year 2009	Year 2010	AVG
Computerization Index (CI)	5,724	5,764	6,207	6,646	6,898	7,206	6,408
Operating leverage		0.902	0.934	0.669	-6.674	3.308	-0.172
Return on IT assets	0.338	0.337	0.510	0.319	0.295	0.321	0.353
Organizational risk factor	80.06%	79.24%	78.38%	77.53%	74.82%	75.66%	0.776
IT efficiency ratio (ITEX)	0.21	0.25	0.15	0.21	0.22	0.21	0.210
IT cost efficiency ratio (ITCE)	0.24	0.24	0.15	0.24	0.25	0.24	0.226
Operating expense ratio	1.39	1.17	1.32	1.47	1.53	1.50	1.396
Profitability index							4.192

**Table 7: Profitability performance indicators and IT-related performance ratio trend for the 5 year period under review**

### Investment Decision and Cost-Benefit Analysis

It was observed in this study that there was no scientific methodology in place at SAPO to decide on whether or not to make an IT investment if the organization is affected. The decision, in this case, was entirely dependent on the discretion of the CFO, as well as the CIO. This contradicts Shoval and Lugasi's (1988) theory, which suggests that decision-making within an organization must rely on scientific models. Cost-benefit models must be used to consider the relative importance of the benefit and cost factors in a given situation.

SAPO indicated that it would invest in ICT if the probability that their organization would be negatively affected did not exceed 60%. This means that the perceived risk plays a part in ICT investment and that managers at SAPO are not risk-takers (refer to Table 8 below). However, in this part of the questionnaire, the respondents used subjective answers and there was no basis to provide support. SAPO indicated that it would only invest in ICT if the probability that the organization would be positively affected exceeded 60%.

Probability of making an IT investment if the organization is affected	100%	80%	60%	40%	20%	0%
<b>Negatively</b> to a large extent	X					
to a greater extent			X			
to some extent			X			
<b>Positively</b> to a large extent						X
to a greater extent			X			
to some extent	X					

**Table 8: Probability of making an IT investment, as evaluated by SAPO managers**

Table 9 below indicates the benefits that SAPO received during the period under review from its ICT investments. In addition, the benefits that SAPO received from its total ICT investments, including previous years, are also indicated. It should be noted that these suggestions are based on individual perceptions, as opposed to scientific models, which are more objective, as emphasized by Shoval and Lugasi (1988). SAPO management believes that they received less than 10% benefits from their ICT investments for each year. They also believe that they received about 60% benefits from their ICT investments for all the years combined.

	10	20	30	40	50	60	70	80	90	100
% Benefit received of total ICT investments in 2005	X									
% Benefit received of ICT investments in 2005	X									
% Benefit received of total ICT investments in 2006		X								
% Benefit received of ICT investments in 2006	X									
% Benefit received of total ICT investments in 2007			X							
% Benefit received of ICT investments in 2007	X									
% Benefit received of total ICT investments in 2008				X						
% Benefit received of ICT investments in 2008	X									
% Benefit received of total ICT investments in 2009					X					
% Benefit received of ICT investments in 2009	X									
% Benefit received of total ICT investments in 2010						X				
% Benefit received of ICT investments in 2010	X									

**Table 9: Cost-benefit analysis, as perceived by SAPO**

Table 10 below indicates the number of software applications that SAPO used during the period under review. From this table, it can be observed that the number of applications in each category increased during the period from 2005 to 2010. This indicates an increased investment in software applications at SAPO and is in line with the theory of Kwong and Mohammed (1985), it needs to invest in technologies that include applications. This enables organizations to grow in tandem. SAPO also indicated that it has a separate IT department, and that it normally uses project investment analysis for making ICT investment decisions.

	2005	2006	2007	2008	2009	2010
Strategic planning	37	39	41	44	47	50
Management control	24	26	27	29	31	33
Operational control	40	43	46	49	52	55
Transaction processing	52	55	59	63	67	71

**Table 10: Classification of software applications used by SAPO during the period under review**

## Responses to the Research Questions

The main findings of this study in relation to each research question will be discussed in this section. Each question is followed by a discussion of the findings related to that question.

### What is the Impact of ICT Investment on IT Cost-Efficiency and IT Efficiency Ratios?

Kwong and Mohammed (1985) suggest the use of a CI in their empirical study on the quantitative evaluation of ICT investment in an organization. They state that the CI measures the extent and sophistication of computerization. In their evaluation model, CI incorporates factors such as the number of computers, application software, staff, number of shifts and years of computer usage. In addition, it looks at the size of the CPU, hardware costs, organizational location, level of management activity and project investment analysis. In line with Kwong and Mohammed's ICT investment evaluation model, this study also used CI as a measure of ICT investment at SAPO.

### Will The Initial ICT Investment Target Be Changed If Managers Can Identify Changes In The Organizational Risk?

Kwong and Mohammed (1985) conclude that increased computerization is positively associated with improved organizational performance, in both the short- and long-term. However, the results obtained in this study contradict Kwong and Mohammed's theory. Improved computerization at SAPO did not translate into improved organizational performance in terms of return on investments, turnover growth and net profit. In order to achieve positive results with improved ICT investment, SAPO management might need to consider investing in technologies or ICT systems that fit their business environment and hence support the broad strategic objectives of the organization. This will presumably assist in driving the organization's growth.

### What is the Impact of ICT Investment on Organizational Risk, Cost-Benefit Analysis, Operating Leverage, and Return on IT Assets?

Loukis et al., (2009) argue that the relationship between ICT and business should lead to ICT investments adding strategic value to the business. ICT effectiveness is thus measured in terms of the value that it adds to the business value proposition. The strategic value of ICT investment, among other things, includes the following: (Loukis et al., 2009)

- Cost reduction
- Improvement in product quality

- Improvement in the efficiency of production processes and the value chain.

Various researchers, such as Krell and Matook (2009), Hu and Quan (2005), and Badescu and Garcès-Ayerbe (2009), argue that ICT investment provides competitive advantages to organizations by adding value across all aspects of the value chain. This includes improving operational performance, reducing operating expenses, increasing decision quality, enhancing service innovation and differentiation, and improving financial performance (such as return on investment, operating income, net profit, operating leverage and other profitability indicators). The abovementioned researchers further emphasize that there is a strong positive relationship between ICT investment and the financial performance of an organization. This implies that the more money that is invested in ICT, the more likely it is that an organization will improve its financial performance.

However, contrary to Krell and Matook (2009), Masli et al., (2010) and Gregor et al., (2006), who all assert that ICT investment in an organization correlates positively with financial performance, the results in this study showed conflicting results. In this study, ICT investment correlated negatively with profitability performance indicators such as return on IT assets, operating leverage, turnover growth rate, net profit and organizational risk. ICT investment only correlated positively with operating income and operating expenses.

In support of the results that were obtained in this study, Morita and Nakahara (2004) note that investing more resources in ICT does not necessarily have a positive impact on the financial performance of an organization. They contend that there is a huge variation across organizations. Some can spend vast sums on ICT with little or no benefits, while others can spend similar amounts with great success. The benefits of ICT appear to be realized when ICT investment is coupled with other complementary investments such as new strategies, new business processes and a new organizational culture. These complementary investments all appeared to be important in realizing the benefits of ICT. However, these changes are not easy, since many organizations would require a time-consuming period of reengineering, restructuring and organizational redesign in order to best utilize their ICT investments.

### **What Is The Impact Of ICT Investment On The Financial Performance Of SAPO, As Measured By ROI, Operational Costs, Profitability Levels (Operating Income, Operating Leverage, Net Profit, And Turnover Growth) And Operating Expenses?**

Lee and Lee (2010) note that business executives must no longer use financial benefits alone to measure the value added by ICT investments. Instead, they now consider non-financial benefits such as the IT cost-efficiency ratio, IT efficiency ratio, improved customer satisfaction, better information availability and shorter production cycle times.

In support of Lee and Lee's (2010) theory, Martín-Oliver and Salas-Fumás (2008) contend that proper ICT investments results in operational efficiency, which in turn results in an improved IT cost-efficiency ratio and IT efficiency ratio, better information availability and shorter production cycles. This theory is also supported by Jorgenson and Motohashi (2005). However, in this study, ICT investments at SAPO correlated positively with the IT cost-efficiency ratio. On the other hand, ICT investments correlated negatively with the IT efficiency ratio, which contradicts the theory of Lee and Lee (2010) mentioned above.

### **MANAGERIAL GUIDELINES**

From the results of this study, the following guidelines are recommended for SAPO management:

- Consider the re-engineering of the organization's processes, in order to align them with the operation of new ICT technologies and achieve a return on investments.
- Contemplate the alignment of the IT strategy with the overall SAPO business strategy.
- Consider procuring ICT technologies that support the organization's strategic objectives, in order to drive the organization's growth.
- Ensure that available technologies are fully utilized, in order to realize their value and grow the business.
- Consider employing competent ICT personnel with experience.
- SAPO might be in need of competent managers who can convert original ideas into effective applications, so that ICT investment can have meaningful results that benefit the organization.
- SAPO also needs to do a value chain analysis to assist in ensuring that ICT initiatives are tightly coupled with the business activities, thereby resulting in good business performance.

## RECOMMENDATIONS

To keep the entire organization focused and on track, SAPO executives must establish clear objectives, initiatives and organizational linkages. A business strategy is the foundation for getting the most return on ICT investments. The concept of alignment therefore becomes meaningless if there is no articulated business strategy. In order to ensure that ICT investments at SAPO benefit the organization financially, it might need to boost its capacity to exploit ICT capabilities. In this regard, capacity could be high levels of ICT literacy, experience and expertise in ICT integration. It is also of paramount importance for SAPO to invest in technologies that are relevant or appropriate to the organization, in order to have positive financial benefits. SAPO needs to adapt to new operational models offered by new technology projects, so that it can provide positive results that benefit the organization.

## CONCLUSION

Based on the quantitative data obtained from SAPO for the period 2005 to 2010, it can be concluded that ICT investment during this period was negatively correlated with most of the financial indicators, such as return on ICT investment, operating leverage, turnover growth, net profit, organizational risk and IT efficiency ratio. However, ICT investment correlated positively with the IT cost-efficiency ratio and operating expense ratio.

In light of the insignificant impact of SAPO ICT investments during the period under review, the following issues might need to be fully explored, in order for the parastatal to improve and realize positive financial benefits:

SAPO also needs to be aware of the fact that it takes some time before it can achieve positive benefits for its investment in ICT. The five-year period that was considered in this study might be too short to realize such gains. What is critical at this stage, however, is to ensure that a suitable environment is created, as recommended above.

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