

# Applying Importance-Performance Analysis to Information Systems: An Exploratory Case Study

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## Abstract

Using an end-user satisfaction survey, the perception of the importance of attributes of information systems was investigated and whether the performance of information systems met the users' expectations in a company in Malaysia. It was discovered that the end-users were moderately satisfied with the company's IS performance and that there were gaps between importance and performance on all the systems-related attributes studied. The largest gap pertained to the attributes Understanding Systems, Documentation, and High Availability of Systems. The contribution of the study is in advancing Importance-Performance Analysis applicable to IS research.

**Keywords:** information systems performance, information systems importance, end-user satisfaction

## Introduction

Information technology (IT) and information systems (IS) continue to be highly or significantly debated in today's corporate environments. As IT spending grows and becomes commoditized and as essential as electricity and running water, many organizations continue to wonder if their IT spending is justified (Farbey, Land, & Targett, 1992) and whether their IS functions are effective (Delone & McLean, 1992). IT and IS have evolved drastically from the heyday of mainframe computing to the environment that has reached out to the end-users. In the past, end-users interacted with systems via the system analyst or programmer who translated the user requirements into system input in order to generate the output required for the end-users' analysis and decision-making process. However, now end-users are more directly involved with the systems as they navigate themselves typically via an interactive user interface, thus assuming more responsibility for their own applications. Therefore, the ability to capture and measure end-user satisfaction serves as a tangible surrogate measure in determining the performance of the IS function and services, and of IS themselves (Ives, Olson, & Baroudi, 1983). Besides evaluating IS performance, it is also important to evaluate whether IS in an organization meet users' expectations. This paper

aims to demonstrate the use of Importance-Performance Analysis (IPA) in evaluating IS.

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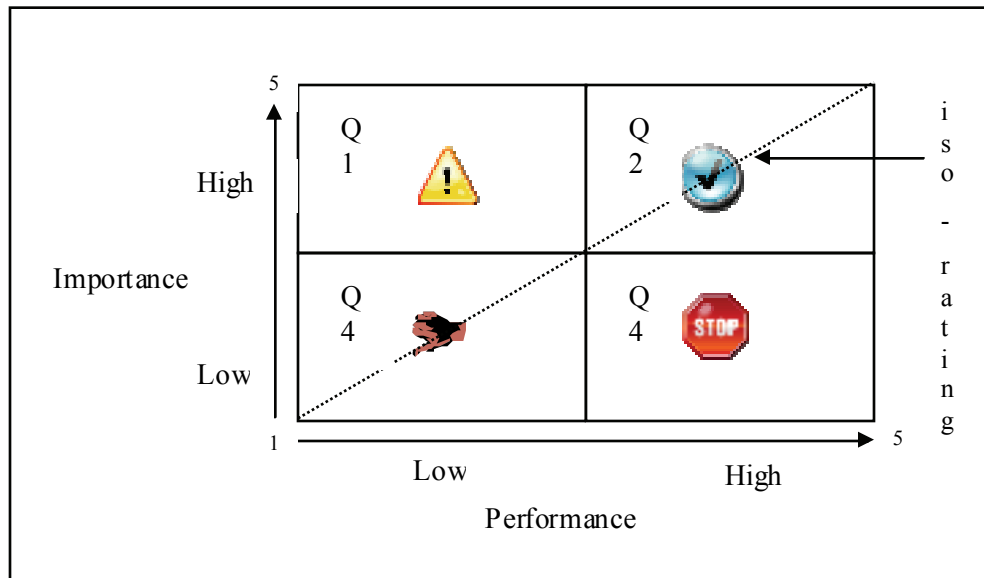
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## Research Framework

### Importance-Performance Analysis

The Importance-Performance Analysis (IPA) framework was introduced by Martilla and James (1977) in marketing research in order to assist in understanding customer satisfaction as a function of both expectations concerning the significant attributes and judgments about their performance. Analyzed individually, importance and performance data may not be as meaningful as when both data sets are studied simultaneously (Graf, Hemmasi, & Nielsen, 1992). Hence, importance and performance data are plotted on a two dimensional grid with importance on the y-axis and performance on the x-axis. The data are then mapped into four quadrants (Bacon, 2003; Martilla & James, 1977) as depicted in Figure 1. In quadrant 1, importance is high but performance is low. This quadrant is labeled as “Concentrate Here”, indicating the existing systems require urgent corrective action and thus should be given top priority. Items in quadrant 2 indicate high importance and high performance, which indicates that existing systems have strengths and should continue being maintained. This category is labeled as “Keep up good work.” In contrast, the category of low importance and low performance items makes the third quadrant labeled as “Low Priority”. While the systems with such a rating of the attributes do not pose a threat they may be candidates for discontinuation. Finally, quadrant 4 represents low importance and high performance, which suggests insignificant strengths and a possibility that the resources invested may better be diverted elsewhere.

The four quadrants matrix helps organizations to identify the areas for improvement and actions for minimizing the gap between importance and performance. Extensions of the importance-performance mapping include adding an upward sloping – a 45-degree line to highlight regions of differing priorities. This is also known as the iso-rating or iso-priority line, where importance equals performance. Any attribute below the line must be given priority, whereas an attribute above the line indicates otherwise (Bacon, 2003).



**Figure 1. Importance-Performance Map**

(Source: adapted from Bacon, 2003; Martilla & James, 1977)

IPA has been used in different research and practical domains (Eskildsen & Kristensen, 2006). Slack (1994) used it to study operations strategy while Sampson and Showalter (1999) evaluated customers. Ford, Joseph, and Joseph (1999) used IPA in the area of marketing strategy. IPA is also used in various industries, such as health (Dolinsky & Caputo, 1991; Skok, Kophamel, & Richardson, 2001), banking (Joseph, Allbrigh, Stone, Sekhon, & Tinson 2005; Yeo, 2003), hotel (Weber, 2000), and tourism (Duke & Mont 1996). The IPA has also been applied in IS research. Magal and Levenburg (2005) employed IPA to study the motivations behind e-business strategies among small businesses while Shaw, Delone, and Niederman (2002) used it to analyze end-user support. Skok and colleagues (2001) mapped out the IPA using the Delone and McLean IS success model. Delone and McLean (1992) used the construct of end-user satisfaction as a proxy measure of systems performance. Firstly, End-User Satisfaction has a high face validity since it is hard to deny that an information system is successful when it is favored by the users. Secondly, the development of the Bailey and Pearson instrument (1983) and its derivatives provided a reliable tool for measuring user satisfaction, which also facilitates comparison among studies. Thirdly, the measurement of end-user satisfaction is relatively more popular since other measures have performed poorly.

## Methodology

Based on the reasons mentioned above, this study adapted the measurement tool developed by Bailey and Pearson (1983) to evaluate end-user satisfaction. The measures used are: System Quality, Information Quality, Service Quality, and System Use. System Quality typically focuses on the processing system itself, measuring its performance in terms of productivity, throughput, and resource utilization. On the other hand, Information Quality focuses on measures involving the output from an IS, typically the reports produced. If the users perceive the information generated to be inaccurate, outdated, or irrelevant, their dissatisfaction will eventually force them to seek alternatives and avoid using the information system altogether. System Use reflects the level of recipient consumption of the information system output. It is hard to deny the success of a system that is used heavily, which explains its popularity as the IS measure of choice. Although certain researchers strived to differentiate between voluntary and mandatory use, Delone and McLean (1992) noted that “no system use is totally mandatory”. If the system is proven to perform poorly in all aspects, management can always opt to discontinue the system and seek other alternatives. The inclusion of the Service Quality dimension recognizes the service element in the information systems function. Pitt, Watson, and Kavan (1995) proposed that Service Quality is an antecedent of System Use and User Satisfaction. Because IS now has an important service component, IS researchers may be interested in identifying the exact service components that can help boost User Satisfaction.

New and modified measurement items were added to suit the current issues which are pertinent to the IS development and performance evaluation, specific to the Malaysian IT firm. The newly added factors include High Availability of Systems that directly affects the employees' ability to be productive. Frequent downtimes mean idle time since employees are not able to access the required data or email for their communication needs. Senior management has raised concerns on this issue since it affects business continuity and can potentially compromise its competitive position. Thus, the IS department under study is exploring measures to provide continuous access to the company's IS including clustering technology that provides real-time replication onto a backup system.

The second new variable is Implementation of Latest Technology that has a direct bearing on the company's productivity. Being a leading IT solutions provider, the company needs to keep itself abreast of the recent technologies and solutions available in the market. This is aided by strategic partnerships with various partners who provide the thought leadership, access to their latest de-

velopments and skill transfer in order to equip the employees with the relevant expertise. Additionally, in order to formulate better solutions for its customers, the company needs to have first-hand experience in using the proposed technologies. To realize this strategy, the company has embarked on a restructuring exercise that sees the formalization of a R&D think-tank and a deployment unit to facilitate rapid roll-out of the latest technologies for internal use.

The third new factor included in this study is Ubiquitous Access to IT Applications to enable productivity anytime and anywhere. The primary aim is to provide constant connectivity for the employees who are often out of the office, enabling them to stay in touch with email and critical applications hosted within the organization's network.

A convenience sampling method was used for data gathering. The targeted respondents were the organization's end-users of various IS (email, Internet browsing, and a host of office automation systems developed in-house). In order to expedite the data collection process, the survey was converted into an online format and deposited in the organization's Lotus Notes database. An email broadcast was sent out to explain the research objectives and a brief instruction on how to complete the survey was also included. 680 users accessed the survey and 163 questionnaires were filled, which is equivalent to a response rate of 24%. All completed questionnaires were automatically deposited into a Lotus Notes database. The security settings on this database were modified to allow anonymous responses to ensure complete anonymity.

The questionnaire contained 20 attributes that were selected out of the 39 items proposed by Bailey and Pearson (1983). The rationale for this was to reduce the complexity of the survey questionnaire. Also, the survey questionnaire did not include any negative questions for verification purposes again for the sake of simplification and to reduce the total time taken to provide a complete response. It is foreseeable that including other factors may provide a different insight or improve the internal reliability of the variables studied. However, to perform a vigorous test to qualify the best set of variables would be time consuming and could possibly shorten the duration required for data collection.

The questionnaire was comprised of two sections, each containing the select 20 attributes (see Table 1). The first section asked respondents to evaluate the degree of importance placed upon each attribute. The second section required an evaluation of the actual performance of the same attributes. The respondents were prompted to use a five-point Likert Scale (1=low, 5-high).

## Findings

It was found that the respondents were moderately satisfied with the IS performance as indicated by the mean scores (see Table 1). The mean scores in Table 1 indicated that the respondents were the least satisfied with the Degree of Training (the mean score of 2.95) that was provided to them. In contrast, the respondents expressed the greatest satisfaction with the following attributes: Relationship with the Electronic Data Processing (EDP) staff (the mean score of 3.82), Response/Turnaround Time (the mean score of 3.76) and Technical Competence of EDP Staff (the mean score of 3.65). A detailed discussion on user satisfaction is presented in Hisham's (2006) paper.

Table 1 indicates the respondents' perception that all attributes were below their expectations or level of importance (note the negative values for differences in mean scores). The degree of difference, however, varies. From the gap between means, it is easy to see that the IS department needs to work harder to achieve better results on Understanding of the Systems, Documentation, System Availability, Ubiquitous Access, and Training. These five items have the highest gap scores indicating the biggest discrepancy between importance and performance. On the other hand, the items with the lowest gap scores suggest that the current performance levels are manageable, even if they are still below end-users' expectations. These include Relationship with the

EDP Staff, Relevancy, Time Required for New Development, Feeling of Control, and Feeling of Participation.

**Table 1. IS Attributes, Means, and Gap Scores**

IS Attributes	Performance Mean (X)	Importance Mean (Y)	Means' Difference (X-Y)
Understanding of Systems	3.27	4.36	-1.09
Documentation	3.06	4.14	-1.08
High Availability of Systems	3.1	4.16	-1.06
Ubiquitous Access to Applications	3.05	4.07	-1.02
Degree of Training	2.95	3.95	-1.00
Security of Data	3.53	4.49	-0.96
Integration of Systems	3.09	3.99	-0.90
Top Management Involvement	3.35	4.19	-0.84
Flexibility of Systems	3.28	4.07	-0.79
Implementation of Latest Technology	3.03	3.81	-0.78
Confidence in the Systems	3.44	4.22	-0.78
Attitude of the EDP Staff	3.55	4.31	-0.76
Job Effects	3.51	4.24	-0.73
Response/Turnaround Time	3.76	4.46	-0.70
Technical Competence of the EDP Staff	3.65	4.23	-0.58
Feeling of Participation	3.25	3.79	-0.54
Feeling of Control	3.27	3.74	-0.47
Time Required for New Development	3.36	3.8	-0.44
Relevancy	3.54	3.97	-0.43
Relationship with the EDP Staff	3.82	4.05	-0.23

Mean scores for both importance and performance data were plotted as coordinates on the Importance-Performance Map as depicted in Figure 1. All the means were above 2.5 thus falling in the second quadrant of the IPA map (refer to Figure 1). To show the resulting positions on the map more clearly, only the plotted scores are shown (Figure 2). These indicate that both performance and importance of the systems are satisfactory. Therefore, the systems are qualified for further maintenance (cf. Bacon, 2003; Martilla & James, 1977).

As discussed above, performance and importance scores provide more meaning when they are studied together. It is not enough to know which attribute was rated as the most important, or which one fared the best or worst. By mapping these scores against the iso-rating line one get an indication of whether the focus and resources are being deployed adequately, insufficiently or too

## Importance-Performance Analysis

lavishly. Figure 2 shows that all the scores were above the iso-rating, thus indicating that importance exceeds performance. This implies that there are opportunities for improvement in this company .

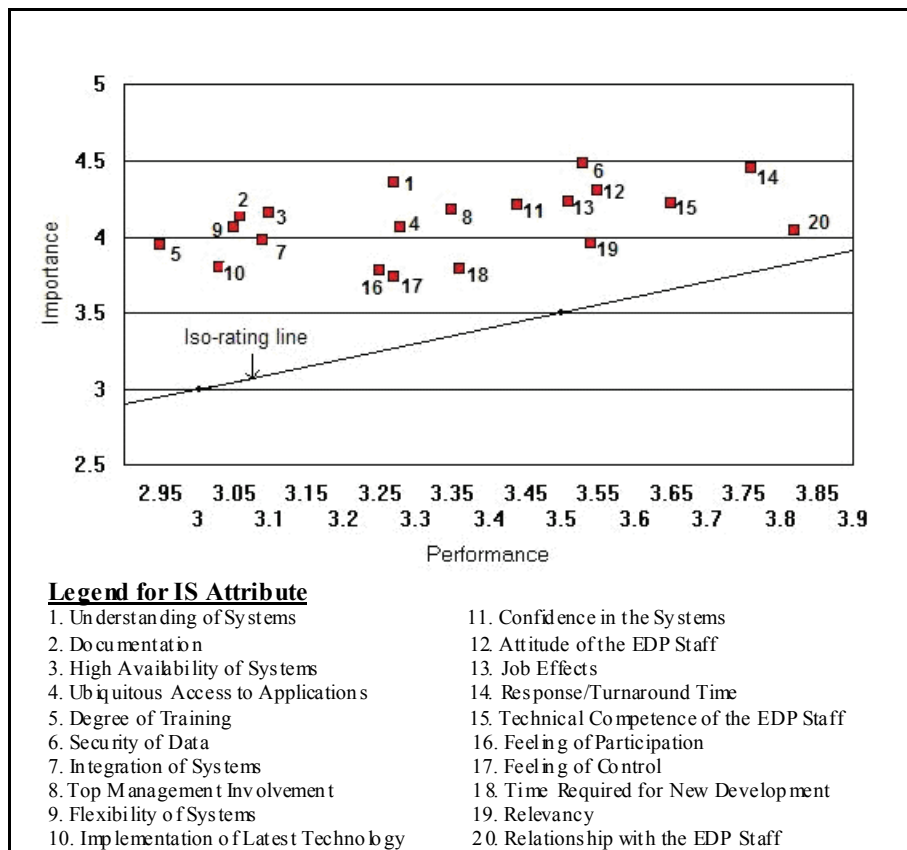


Figure 2. Map of IS Attributes

## Discussion and Conclusion

Organizations today are compelled to analyze the actual value (performance) of their IS. On the practical level, the implication of this is that IS departments should measure the satisfaction level amongst their end-users as part of evaluating the performance of IS. The same goes for managers in other areas who are responsible for the return on IS investments. End-users' input can reveal insights as to which areas deserve special attention and more resources. Using tested tools such as Bailey and Pearson's (1983) instrument helps ensure a highly consistent, reliable, and valid outcome that, when deployed over time, can help measure the performance of the IS department to ensure its continual alignment between its operational goals and the underlying business objectives.

As determined in this study, key IS attributes of IS performance pertain to Service Quality (Relationship with the EDP Staff) and System Quality (Response/Turnaround Time) are critical in delivering end-user satisfaction (i.e. system performance). On the other hand, data security is deemed to be the most important IS attribute, which echoes today's concern about rampant security threats. These include virus and worm attacks which could lead to data loss, identity theft, hacking by unscrupulous hackers, and unauthorized access to data. As such, an IS department

needs to be more proactive in handling these threats and continually demonstrate to the end-users its ability to secure the system and its information repositories. Confidence in the System is also partly related to data security. But even more, this attribute also has to do with the quality of information. The data presented to the user must be reliable, accurate, and timely; otherwise, data will be meaningless and will hinder the end-users from making sound decisions.

Principles of IPA can be expanded to other functional areas and there are particularly functional units that provide internal services, such as Human Resources. For example, a human resources department provides services to internal staff, such as the leave management system (a system for managing employees' leave applications). The staff can be asked to rate the system's performance as well as their expectation from the system. The findings then can be used to gauge whether their expectations are met, whether they are satisfied with the system, and most importantly as a guide for enhancements and improvements.

The Importance-Performance Map (Figure 2) revealed that all twenty IS attributes were performing below the end-users' expectations. The three variables with highest gap scores were, Understanding of Systems, Documentation, and High Availability of Systems. Mapping the mean scores for both data sets onto a scatter plot and analyzing the distance of the scores plotted against the iso-rating line gave much insight to help guide the prioritization of resources and management intervention. For example, to improve end-users' understanding of systems, the IS department could strive to improve its systems' documentation and training. This may include the use of computer-based training, applying multimedia and video to conduct online demonstrations, and organizing "IT open days" when end-users can approach the IS personnel and inquire about the systems deployed.

Based on the gap analysis, the IS department has already fostered good relationships with the end-users, encouraging a high user involvement in the development of new applications. This makes end-users feel that they are more in control and they are assured that the solutions developed are highly relevant to their tasks. The IS department would be wise to maintain their healthy relationship with the end-users, while pursuing the enhancement of the IS attributes identified with the highest gap scores.

Managers from the end-users' departments should work together with the IS department to reduce the Importance-Performance gaps. They should play a more active role in the development and implementation of new systems. For example, during the design stage, managers must write and request their specifications based on the functional and procedural requirements, while during the testing stage, managers must test the system thoroughly and extensively.

The limitation of this study is the use of a convenient rather than random sample. Additionally, end-user responses on the perceived importance might have suffered from their desire to rank everything as "very important" in order to suggest a highly concerned outlook on the overall state of the attributes presented. Nevertheless, the study accomplished its purpose of continuing IPA research within the field of IS, which was only recently imported from the field of marketing. This application of IPA contributes in several ways. For example, IPA has been used in IS research by Magal and Levenburg (2005) for evaluating e-strategies among small businesses in the United States. The respondents were business owners. In contrast, the present study differs as the respondents are users of systems within a company. Moreover, Skok and colleagues (2001) used IPA to study IS performance of a health club in the United Kingdom by deploying Delone and McLean's (1992) IS success typology. The model incorporates users' satisfaction as a variable to be studied. The present study differs in focusing on the end user satisfaction alone as it considers it a surrogate measure of IS success.

Finally, the present study has adapted Bailey and Pearson's (1983) instrument by adding three new dimensions – High Availability of Systems, Implementation of Latest Technology, and

Ubiquitous Access. These factors were included in response to the needs of the studied company. High Availability of Systems directly affects the employees' ability to be productive. Frequent downtimes mean idle time since employees are not able to access the data needed. The senior management has raised this issue since it affects business continuity and can potentially compromise its competitive position. Thus, the IS department is exploring measures to provide continuous access to the company's IS, including the technology clustering that provides real-time backups. Furthermore, the dimension Implementation of Latest Technology is added to the instrument because the company has to keep abreast of recent technologies and solutions available in the market. In order to formulate better solutions for its customers, the company must have first-hand experience in using the proposed technologies. The third new dimension is Ubiquitous Access that is supposed to enable the company to achieve productivity objectives anytime and anywhere. This means providing a constant connectivity for employees who are often out of office and enabling them to have continuous access to critical applications hosted within the company's network.

Lastly, it should be noted that most of the previous work on IPA was conducted in more developed countries, such as the United States and the United Kingdom. No research of this sort has ever been done in Malaysia, which belongs in the category of developing countries.

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