

INFORMATION SYSTEMS CONTRIBUTION TO BUSINESS PERFORMANCE:

A STUDY OF INFORMATION SYSTEMS EXECUTIVES' ATTITUDES

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ABSTRACT

A shift is occurring in the Information Systems (IS) paradigm towards integrating IS activities with business activities. To investigate this development further, the study examined business performance measurement frameworks, and adopted these in compiling IS effectiveness measures relevant to the business environment. The IS executives of Australia's 200 largest companies were surveyed to establish how important these IS effectiveness measures and the traditional IS efficiency measures are in reflecting IS performance. It was found that IS executives continue to focus on IS efficiency and rate internal-oriented IS effectiveness significantly higher than business- and finance-oriented IS effectiveness. The findings appear to indicate that IS executives at least in Australia are technology-oriented rather than business-performance-oriented in their attitudes to IS performance. In contrast, the finding that qualitative IS measures were regarded significantly more important than quantitative IS measures may indicate that they believe that many benefits of IS are intangible and strategic.

INTRODUCTION

Little agreement exists on measures of Information Systems (IS) performance. The contribution of information systems has, in the past, been generally measured in terms of efficiency ("doing things right"). More recently, attention is being given to measuring information systems effectiveness ("doing the right things"). There is a growing expectation that information systems need to make a contribution to the overall performance of the business ("improving the bottom line").

A study was conducted with the aim of identifying the role of IS in today's business environment, in particular the contribution IS makes to overall business performance. Suitable IS performance measures were established, followed by the conduct of a survey to establish Australian IS executives' attitudes to the importance of such measures. The article discusses the research conduct and findings. It commences with a literature review of the topic.

INFORMATION SYSTEMS AND BUSINESS PERFORMANCE

Recently a shift in the IS paradigm has occurred with significant implications for the measurement of IS effectiveness. This is reflected in Farwell et al.'s (1992) description of two IS worlds: the new and the old. In the old IS world, it was assumed that information systems are developed and directly controlled by IS professionals; specialised technical knowledge was needed which only the IS professionals possess. In the new IS world, there are changes in the business computing environment with users having more direct control over IS applications, and demanding IS support and services as opposed to IS products. This paradigm shift implies that there is a need for the IS executive to have an "integrative perspective on corporate computing and the management of corporate information resources" (Farwell et al., 1992, p 9).

According to Symons (1991), the evaluation of IS effectiveness in today's business environment requires the consideration of two separate but related areas: the alignment of IS with business strategy, and the contribution of IS to organisational effectiveness. Various attempts have been made to provide frameworks to integrate IS with business (a good overview is provided by Baets, 1992). The key problem remains in that the success of the integration process is dependent on the IS analyst's experience and knowledge of the IT/IS and his/her ability to infer the IS objectives, characteristics, and design principles from the organisation's mission, objectives, strategies, and strategic attributes. In order to assess the contribution of IS to organisational effectiveness, it is necessary to conceptualise it in terms of implementation issues which include specifications of requirements, assessment of costs and benefits, managing processes of change, offering organisational support and conflict management. Both the linkage of IS to business goals and the consideration of the implementation process aim to integrate IT with the rest of the business.

Recent attempts to measure business performance provide potentially promising new frameworks to measuring IS effectiveness in business terms. The business value of IS may thus be derived, which according to Rouse (1991) is usually measured by the changes in indicators such as profitability, market share and market size. Four proposals have been identified for contemporary business performance measurement frameworks.

Kaplan and Norton's (1992) Balanced Scorecard approach offers a balance of financial and operating measures for establishing business performance. Financial measures reflect what has taken place. Non-financial measures are the drivers of future financial performance and include operational data on customer satisfaction, internal processes, and the organisation's innovation and improvement activities. Goals from each perspective are specified and appropriate measures are identified. It is claimed that this approach integrates diverse, complex information in an easy-to-read manner, presenting those measures in each category that management wants emphasised.

Rubin (1991a, 1991b) introduced the Business Value framework where IS performance, in terms of its business contribution, is arrived at in three stages. In the first stage, key measures for evaluating technical and software processes are defined in terms of quality, productivity and impact on customer satisfaction. In the second stage, the key technical indicators are linked to business performance. For example, the IS organisation should be able to make the following assertion about its performance in business terms: "If we show a productivity increase of N% this year, the business will be able to lower product costs by Y% or produce Z new products". In the third stage, IS can directly express changes in its performance in terms of such key measures as cycle time, quality, profitability, shareholder value, process improvement and yield.

In the Enterprise-Level measurement by Berger (1988) (also cited in Belitsos, 1988), IT is not the sole responsibility of one department (the IS department). Other departments, such as engineering, sales and customer service, should be able to buy and operate their own IT/IS. The approach firstly requires the determination of the enterprise's business objectives and goals. Secondly, the decision is made whether or not IT is needed to accomplish these objectives and goals and, if so, what strategy is needed. The effectiveness of IT is measured through business actions that will result in increased market share, new market penetration, and lower product costs.

According to Strassmann (1990), understanding how successfully an organisation uses its resources and measures its success are prerequisites for analysing the effectiveness of IT. Specifically, his concept of Return on Management (ROM) measures performance based on the value provided by management to an organisation. The approach assumes that in the modern organisation, the cost of managing the enterprise is the cost of providing information. Improvements in the management value-added (or ROM) can be realised by investing in appropriate IT which enables management, inter alia, to evaluate effectively the competitive environment, to develop business strategies, and to motivate staff.

RESEARCH DESIGN

As seen above, business-performance models provide a wide range of IS measurement criteria to select from. To assist in the compilation of the research material, the expert opinions of four IS professionals were solicited through discussion and involvement in the pilot testing of the material. The Appendix shows the IS performance measurement items that were compiled and their categorisation under fourteen headings whilst Table 1 provides an overview of this breakdown.

Table 1
Categorisation of IS Performance Measures

Measure	Efficiency	Effectiveness	Internal	Business	Finance	Quantitative	Qualitative
Throughput by IS	x						
Utilisation of IS	x						
Cost of IS	x						
Programming by IS	x						
Availability of IS		x	x			x	
Timeliness of IS		x	x			x	
Accuracy of information		x	x			x	
Quality provided by IS		x		x		x	x
Return on IS		x		x	x	x	
Increase attributed to IS		x		x	x	x	
Comparisons		x		x	x	x	
Time to develop IS		x		x		x	
IS personnel		x		x		x	x
IS enables		x		x			x

The measures will be discussed below together with the research hypotheses.

Research Hypotheses

As stated in the introductory section, IS have in the past been measured in terms of efficiency which focuses on IS performance along the lines of throughput, utilisation, costs, and programming. However, since attention is increasingly being given to effectiveness, it was hypothesised that Australian IS executives rate the importance of IS higher in terms of effectiveness than in terms of efficiency. Accordingly, hypothesis 1 was formulated.

Hypothesis 1: IS executives place a greater importance on IS effectiveness than on IS efficiency.

To gain further insight into the importance of IS effectiveness measures, we categorised them according to the organisational activities they support. First, we distinguished between internal- and business-oriented items. Second, the items were also classified as being either quantitative- or qualitative-oriented. Third, within business-oriented items, those measuring financial performance were identified as being finance-oriented. These groupings reflect the broad approaches to measuring business performance discussed in the earlier section and are briefly defined below.

- Internal- and business-oriented measures: the former measure the contribution that IS makes within the organisation and include the availability, timeliness and accuracy of information produced. The latter measure the business contribution of IS, for example the quality provided to products and services, financial returns and IS enabling characteristics.
- Quantitative- and qualitative-oriented measures: a distinction was made according to whether or not the measure could be quantified. Examples of quantifiable measures are the time availability and financial returns of IS, whilst qualitatively-oriented measures include improved communications and better decision-making.
- Finance-oriented measures: they comprise measures that can be expressed in financial terms, namely the returns on, and increases attributable to, IS.

In line with our expectation that businesses, and therefore IS executives, increasingly adopt a business, financial and qualitative focus towards IS we framed the following hypotheses:

Hypothesis 2: IS executives place a greater importance on business-oriented than on internal-oriented IS effectiveness.

Hypothesis 3: IS executives place a greater importance on finance-oriented than on internal-oriented IS effectiveness.

Hypothesis 4: IS executives place a greater importance on qualitative measures than on quantitative measures of IS effectiveness.

As discussed earlier, a shift in the IS paradigm is occurring in which IS is managed in a decentralised way and is integrated with business activities. We expected therefore that IS effectiveness would be more important to decentralised IS organisations than to centralised ones. This led to the following hypothesis.

Hypothesis 5: IS executives in decentralised IS management structures place a greater importance on IS effectiveness than IS executives in centralised IS management structures.

Task

Data was collected through questionnaires. The three sections of the questionnaire captured information on the organisations' information systems, the responses to the importance of IS performance measures, and demographic data of respondents. Participants were asked to consider the various measures and indicate how important they regarded each was in reflecting IT/IS performance. A 7-point category-numerical scale was used because the sensitivity of a scale is important when changes in attitudes or other hypothetical constructs are under investigation (Zikmund, 1988). This was the need in this study since the views of IS executives in considering the relative importance of newer forms of IS effectiveness were determined.

Subjects

The sample included Australia's top 200 companies by turnover. It was argued that such organisations would likely be large enough to be concerned whether or not their IT/IS products and services are regarded as satisfactory by the rest of the organisation. The sample was selected from the listing of companies in the database available from the Australian Stock Exchange (1993). The subjects of the study were the IS executives in these organisations. The sample reduced from 200 to 194 because six organisations either declined to participate or the parent company was based overseas. Forty-three useable responses were eventually received after one reminder letter was mailed. This gave a response rate of 22%.

Validity and Reliability

Content validity of the questionnaire was assumed on the bases that an exhaustive search of the literature for items to be included in the questionnaire had been conducted. Construct validity¹ was achieved by soliciting the expert opinions of four IS professionals through discussion and involvement in the pilot testing of the questionnaire. Reliability was examined in terms of internal consistency of the questionnaire responses, i.e. the extent to which all of the subparts of an instrument or scale measure the same characteristics. This was established through the Cronbach-Alpha technique; a technique where the mean reliability coefficient estimates for all possible ways of splitting a set of items in half are computed. Table 2 shows the Cronbach's alpha value for each group of IS performance measurement in the questionnaire.

The largest number of responses were from manufacturing companies (27.9%), followed by mining with 20.9% of responses. To test the representativeness of the sample, the industry profile of the respondents was compared with the same profile of Australia's top 200 organisations. A chi-squared goodness of fit test ($X^2 = 6.572$, $p = 0.765$) showed that there was no significant difference in the frequency distribution of industries represented in the sample and the underlying population.

Table 2
Cronbach's Alpha value for each Group of IS Performance

Measure	Alpha
Throughput by IS	0.632
Utilisation of IS	0.568
Cost of IS	0.822
Programming by IS	0.655
Availability of IS	0.704
Timeliness of IS	0.503
Accuracy of information	0.857
Quality provided by IS	0.944
Return on IS	0.840
Increase attributed to IS	0.874
Comparisons	0.738
Time to develop IS	0.830
IS personnel	0.916
IS enables	0.901

¹ Construct validity can also be established through factor analysis (Davis and Consenza, 1988). In our study, at a cut-off level of 0.30, the fourteen categories (factors) that were used to divide the measures in the questionnaire accounted for 75.3% of the total variance of the original measure as explained by each factor. The low number of responses, however, raises concern over the use of this statistic.

DATA ANALYSIS

Demographics

The industry distribution of the sample and population organisations is shown in Table 3.

Table 3
Distribution of the Population and Sample by Industry

Industry	Population		Sample	
	N	%	N	%
Manufacturers	66	33.0	12	27.9
Mining	41	20.5	9	20.9
Wholesale/Retail Trade	36	18.0	6	14.0
Finance, Insurance and Business Services	21	10.5	6	14.0
Construction	10	5.0	5	11.9
Entertainment and Personal Service	6	3.0	2	4.7
Electricity, Gas and Water	1	0.5	1	2.3
Transport, Storage and Communication	9	4.5	1	2.3
Publishing	6	3.0	1	2.3
Agriculture, Forestry, Fishing and Hunting	3	1.5	0	0
Total	200	100.0	43	100.0

The questionnaires were mailed to the information systems executives of Australia's largest companies. Of the respondents, 88% were above 30 years old, and 46% were older than 40 years. However, most (67%) had been in their position for 5 years or less and only 5% for more than 10 years. Their IS experience was mostly above 10 years (67%), while 28% had more than 20 years experience. With respect to the IS management structure, 58% of organisations used a centralised structure, 37% a decentralised one, and the remaining 5% indicated that they were employing outside contractors and consultants.

Hypotheses Testing

Histograms produced showed that research variables followed a normal probability distribution. Since the sample is also representative of the population (see Table 2), the parametric t-test and analysis of variance were used to test the hypotheses. The outcomes of the statistical analysis are provided in Tables 4 and 5 below.

Table 4
t-tests of Efficiency and Effectiveness measures

Measure	Mean	St. Dev.	p-value	t-value
<i>Efficiency - Effectiveness</i>				
Efficiency measures	4.72	0.82	0.211	1.269
Effectiveness measures	4.86	0.77		
<i>Effectiveness: Internal - Business</i>				
Internal-oriented measures	5.46	0.82	0.000	6.145
Business-oriented measures	4.65	0.87		
<i>Effectiveness: Internal - Finance</i>				
Internal-oriented measures	5.46	0.82	0.000	8.083
Finance-oriented measures	4.25	0.97		
<i>Effectiveness: Quantitative - Qualitative</i>				
Quantitative-oriented measures	4.78	0.78	0.004	3.090
Qualitative-oriented measures	5.06	0.93		

Table 4 shows that whilst there was no significant difference in the importance attributed by IS executives to the overall measures of IS efficiency and IS effectiveness, difference existed when effectiveness measures were further categorised. Internal-oriented effectiveness measures were considered more important than both business-oriented and

finance-oriented effectiveness measures, and IS qualitative-oriented measures were considered more important than IS quantitative-oriented measures. As a result hypothesis 1, 2, and 3 have to be rejected and only hypotheses 4 can be accepted.

The IS management structure did not affect the overall IS effectiveness measure, according to the analysis of variance contained in Table 5 below.

When t-tests were carried out on the various IS effectiveness measures (for example internal-oriented versus business-oriented) by IS management structure, there was a significant difference between qualitative-oriented and quantitative-oriented measures in centralised IS structures ($t = 3.222, p = 0.004$) but not in decentralised ones ($t = 0.989, p = 0.338$). Hypothesis 5, therefore, can only partially be accepted. The findings are discussed below.

Table 5
ANOVA of IS Effectiveness measures by IS Management Structure

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-value	p-value
IS management structure	2.707	2	1.353	2.375	0.106
Error	22.798	40	0.570		
Total	25.505	42			

DISCUSSION

Our study attempted to establish the attitudes of IS managers to measuring the contribution of information systems by using business performance measurement frameworks. Below follow a discussion of the findings, the study's limitations and further research required.

Findings

IS executives in Australia's largest organisations still focus heavily on IS efficiency and on internal measures of IS effectiveness. According to our sample, nearly half the IS managers are older than 40 years and 28% have IS experience in excess of 20 years. Their backgrounds may therefore have had an influence on their attitudes to IS business performance. They could be following the behaviour of their colleagues in Northern America reported in a recent study by Bryce (1992). The comparison of American with Japanese companies found that American managers placed importance on programming technology and tools whereas their Japanese counterparts addressed management issues. It was reported that most IS managers in the USA graduated from the ranks of programming and do not entirely understand or appreciate management issues, hence their continuing focus on efficiency. Australian IS managers may be similar in career backgrounds and appear to possess the same technical inclination. This requires further study (see next section).

Our study showed that IS internal-oriented measures play a significantly more important part in reflecting IS performance than business- and finance-oriented measures. The latter may present unfamiliar concepts to many Australian IS executives as it appears to be the case in Northern America. According to a study of Chief Information Officers (CIOs) and Chief Executive Officers (CEOs) in the USA and Canada by Plewa and Lyman (1992), the CEO was found to consistently focus on such outside factors as market share and customer satisfaction, whereas the CIO measured the success of IS performance by internal measures. When asked to report their department's progress, the CIO usually discussed the following: systems and network uptime, reports delivered on time, number of errors, number of aborts, and control over expenses. It appears that the CIO is still focussing on his/her department's performance rather than on the performance of the organisation.

Concerns about the business proficiency of Australian IS managers have been raised in previous research. Broadbent et al. (1992) found that Australian organisations had difficulty in lining up business and IS strategies because of the skills gap on the part of the IS managers. More specifically, Hunt and Dampney (1990) found that Australian IS managers have to possess a general business background, and that in the 1990s IS were too important to be managed by "EDP" experts, a term used for the older, more technology-oriented generation of managers.

Qualitative measures were regarded as more important than quantitative measures, particularly in centrally IS managed organisations. Possible reasons can be found in other studies. According to Katz (1993), whilst most senior executives believe that the benefits of IS expenditures are quantifiable and measurable in some way, they tend to offer only vague and general guidelines when asked what quantifiable measures are being used. Kaplan (1986) and Willcocks (1992) argue that many of the benefits of IS (such as quality, flexibility, responsiveness, and functional integration) are intangible and, therefore, the measures for these benefits cannot be quantified and have to be

qualitative. Willcocks (1992) goes further in that he believes that many IS/IT investments are justified by faith alone and notional figures are used instead of rigorous methods to calculate the benefits of IT/IS investments. More positive views are held by Singleton et al. (1988). They suggest that measures of IS effectiveness tend to become more qualitative and less quantitative as the focus moves from operational to managerial to strategic concerns. Hence, this could indicate that Australian IS executives, despite their internal focus, may be adopting, or be involved in, strategic approaches to the use of IT/IS. This presents an opportunity for further research as outlined below.

Study Limitations and Further Research

Our study was subject to limitations because of the new-ground-breaking nature of the research. First, it was innovative in adopting elements from different business performance measurement frameworks to construct indicators of IS effectiveness. The questionnaire design and responses, therefore, need to be examined rigorously in terms of validity and reliability. Whilst procedural design requirements were met through a thorough literature review and the involvement of IS professionals in constructing and pilot testing the questionnaire, some concern is reflected in the internal groupings with Cronbach's alpha values below 0.80, the generally regarded satisfactory level (Sekaran, 1984) (see Table 2). However, it was reasoned that these values were acceptable in view of the newness of the research topic.

The relatively low response rate of 22% may be a concern but was very similar to the response rate in the well-know Australian IS key issues study by Watson (1989). The population, being Australia's top 200 companies, are frequently approached by researchers and they may have become selective by way of response. Furthermore, it was learned during the study that some companies have a policy of not responding to surveys. General weaknesses of a survey design approach obviously exist, such that it only collects self reports, recall may be selective, and respondent may not be willing to express attitudes or beliefs on sensitive topics.

The study acknowledges that "IT value research is still in its adolescence" (Kauffman & Weill, 1989, cited in Sethi et al., 1993) and considerable additional research is required. As a first step, the study explored the attitudes of IS executives to a range of business performance measures. As the next step, it recommends that case studies/action research be carried out to capture the complexities and richness of organisational behaviour towards measuring IS contribution to business performance.

CONCLUDING COMMENT

Is too much expected of IS executives? Can they be talented business people working as equal partners with other executives and managers of business units to design systems that will benefit the organisation? According to the findings of Waldman (1992), this is an unrealistic expectation in the real world where generally 80% of IS staff are technology-oriented and only 20% are business-oriented. It could be argued, therefore, that IS should be judged by how effectively it builds the system that the business side has decided on and not on the benefits that its systems return to the organisation.

On the other hand, in today's economic climate, it is reasonable to expect that IS executives investigate and consider adopting business-performance-oriented IS approaches. Their focus should be on the organisation as a whole, and not simply on the IS department. To achieve this, they need to increase their knowledge of business management. With the changing structures of IS management from centralised to decentralised and dispersed, and the growth in importance of aligning IS with business activities, the IS executive should become a contributor to the organisation's "bottom line".

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APPENDIX

Mean Importance Ratings for IS Efficiency Measures

Measure	Mean
<i>Throughput</i>	
Hardware	4.41
Software	4.44
IS Personnel	5.16
<i>Utilisation</i>	
Hardware	4.72
Software	4.79
IS Personnel	5.16
<i>Cost</i>	
Hardware	5.00
Software	5.27
IS Personnel	5.11
<i>Programming</i>	
Lines of code delivered	4.16
Function points	3.76
Overall mean	4.72

Mean Importance Ratings for IS Effectiveness Measures

Measure	Mean	Int.	Bus.	Fin.	Q'nt.	Q'lt.
<i>Availability</i>						
Hardware	5.79	5.79			5.79	
Software	5.67	5.67			5.67	
IS Personnel	4.90	4.90			4.90	
<i>Timeliness</i>						
Hardware	5.51	5.51			5.51	
Software	6.00	6.00			6.00	
IS Personnel	5.30	5.30			5.30	
<i>Accuracy of Information produced</i>						
by hardware	5.37	5.37			5.37	
by software	5.65	5.65			5.65	
by IS personnel	5.00	5.00			5.00	
<i>Quality provided by IS</i>						
Functional requirements met	5.30		5.30		5.30	
User/customer complaints	5.07		5.07		5.07	
Improved service level	5.20		5.20		5.20	
Overall user/customer satisfaction	5.48		5.48			5.48
User/customer perception of ease of use	5.20		5.20			5.20
Meeting critical success factors	5.16		5.16			5.16
<i>Returns</i>						
on IS investment	4.93		4.93	4.93	4.93	
on equity attributable to IS	4.32		4.32	4.32	4.32	
on assets attributable to IS	4.11		4.11	4.11	4.11	
on management (value-added)	4.72		4.72	4.72	4.72	
IS yield	4.48		4.48	4.48	4.48	
Overall cost reduction attributable to IS	5.20		5.20	5.20	5.20	
<i>Increase attributable to IS</i>						
in net earnings per share	3.83		3.83	3.83	3.83	
in net income	2.74		2.74	2.74	2.74	
in profit margin	4.11		4.11	4.11	4.11	
in market share	4.25		4.25	4.25	4.25	
in sales	4.20		4.20	4.20	4.20	
<i>Comparisons</i>						
Industry: IS budget as % of revenue	4.09		4.09	4.09	4.09	
% of IS resources applied to strategic business	4.14		4.14		4.14	
<i>Time</i>						
to develop new IS applications	5.04		5.04		5.04	
adopt new IS methodologies	4.25		4.25		4.25	
<i>IS Personnel</i>						
Education/training	4.69		4.69		4.69	
Morale level	4.90		4.90			4.90
Agreement with IS strategic directions	4.76		4.76			4.76
<i>IS enables</i>						
improved communications	4.81		4.81			4.81
better decision-making	5.18		5.18			5.18
expanded access to information	5.00		5.00			5.00
enhanced reporting capabilities	5.04		5.04			5.04
Overall mean	4.86	5.46	4.65	4.25	4.78	5.06