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Measuring the impact of information systems

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ABSTRACT

For the last 35 years, the business strategy of corporate America has been to equate information services (IS) spending with business growth, increased revenue, and overall business success. This logic was based on the premise that productivity gains can be realized through efficient and effective delivery of business transactions and decision support. Yet, after significant financial resources have been invested in IS technology, the relationship between IS investments and business outcomes is still supported largely with anecdotal evidence and productivity measurements that mainly emphasize technical benchmarks. Such productivity criteria as volume throughput, shorter response time, and decreased processing costs, while useful measurements, do not capture or assess the newer value-added services that drive business in the 1990s.

In a downturned economy, financial investments at all levels are questioned and there is a need to demonstrate a payback in terms of quality management, reduced risk and the ability to respond to rapidly changing customer needs. This paper analyzes both traditional benchmarks and new methodologies of IS productivity and investment payback.

INTRODUCTION

Throughout the last decade, the expanding economy encouraged corporations to invest heavily in information services (IS) as a competitive tool for seeking larger market share and increased revenue. The logic behind these investments in IS technology focused primarily on having a larger engine to drive new business. Every generation of hardware and software purchased increased the number of transactions per worker, and provided greater business throughput. As the economic trend has altered over the last decade, corporations are forced to cut back on those IS operations that do not contribute directly to corporate profitability. The previous strategic use of IS systems to provide economies of scale for back office main-frame functions are no longer as relevant in a customer driven environment that mandates on-line support and information sharing across a full range of corporate data bases.

Now chief financial officers have begun to evaluate IS not only as a productivity tool, but as an expensive cost center. Their management options are straightforward - to downsize to smaller, less expensive and more easily managed computer platforms, and to outsource back office intensive applications such as claims processing, mortgage origination and insurance premiums. This resulting momentum towards cost containment is particularly true in the financial service industry where information is the chief product and service.

Whether a corporation is focusing on economies of scale issues or the newer value-added strategies (Keen, 1988), there are productivity issues that must be resolved. In simplest terms the pivotal issue is managerial effectiveness over the long and short term. In defining managerial effectiveness, the authors of this paper expand on the fundamental business premise that a well managed enterprise exercises a rigorous control over the return of each of its profit centers. For this to take place, managers must access each corporate asset for its value in producing revenue, and for supporting managerial control, information sharing, and decision making for the corporate stakeholders.

Problems with Performance Measurement

Traditional indicators of management effectiveness provide only indirect and lagging indicators of performance. The broad and varied nature of middle management tasks makes them difficult to quantify in terms of assigning IS costs, and equally difficult in designing profits generated from specific IS systems. Even after the implementation of specific IS systems, business inertia can prevent a rapid change from occurring in office procedures and work habits. Consequently, it may take several years before such IS investments contribute to the bottom line (Nolan, 1988). And as the potential return on an investment stretches over an increasing timeframe, changing business conditions as well as advances in technology now become risk factors which could make the investment obsolete before the anticipated payback.

Any performance methodology must weigh the up-front investment costs, plus extended maintenance and support costs, against the risk of achieving long-term benefits in a changing business climate.

To further complicate any interpretations of IS productivity, some researchers maintain a working hypothesis that IS tends to reinforce existing management practices, helping well-run organizations while placing additional burdens on poorly structured ones. This hypothesis was recently restated by Strassman after analyzing 38 Fortune 500 Corporations where IS investment produced mixed performance results (Strassman, 1990). Clearly, corporations cannot randomly substitute information workers and IS systems for unskilled workers and manual processes and assume that productivity and profits will automatically increase. Organizational inertia works against any straightforward cause and effect relationship. And in certain instances, the substitution of expensive fixed cost IS systems for simpler manual services can be counter-productive (Roach, 1991). To further amplify this point, both the research of Vincent (1990) and that of Steiner and Teixeira (1990) argue that it does not make sense to automate all lines of business, rather only those lines in which an IS investment can be directly linked to superior profitability. Much the same arguments that Steiner and Teixeira (1990) made in the banking industry have also been made for the insurance sector (Harris & Katz, 1988, 1989). One of the conclusions drawn after reviewing this literature is that a more interactive model of management is called for (Parker & Benson, 1988), and consequently performance measures that are interactive and focus on activities within corporate lines of business.

Activity Based Costs (ABC) of IS

Corporate planners and researchers are seeking interactive tools which assess and quantify those value-added services that directly impact the internal staff and business customer. Activity Based Costing (ABC) seeks to quantify the actual IS cost of supporting specific

products and services within a corporation's line of business (Kaplan, 1989). Asset management is a fundamental component of an ABC methodology. One of the most straightforward approaches for measuring IS performance is through quantifying IS returns on assets, gauging thereby how efficiently and effectively those resources are managed. IS effectiveness then becomes directly proportional to its contribution to overall corporate returns on IS expenditure. If long-run profitability of an enterprise is damaged by keeping funds invested in IS systems that have minimal returns, then it is incumbent on Activity Based Costing to reflect this fact. It does so by moving IS costs from corporate overhead and assigning costs to activities within each line of business. As a starting point for this discussion of ABC, we must first examine the profitability ratio of IS services, that is, the ratio of enterprise profit divided by IS budget. We refer to this cost/benefit ratio as IS Payoff, that every dollar invested in IS resources pays back at a given level of corporate profitability. Information Services is no longer just overhead, the cost of doing business, but rather a resource to be used effectively to generate corporate profits.

$$\text{IS Payoff} = \frac{\text{Profitability}}{\text{IS Budget}}$$

But for Activity Based Costing to have greater relevance, it is important to define in greater detail the components of the IS payoff (Bernstein, 1990). Since sales are a critically important yardstick affecting profitability and a major indicator of IS activity we can recast the formula:

$$\text{IS Payoff} = \frac{\text{Net Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{IS Budget}}$$

This recast formula highlights two important relationships. The first, Net Income to Sales, indicates how effective the organization is in turning business into profits, and begins to capture the intangible functions of IS decision-making and information sharing. The second relationship, Sales to IS Budget, is a measure of budget utilization (IS Turnover), and therefore a measure of IS efficiency in handling a given level of business. Both components of this new formula provide insight into the role IS plays within an organization. Profitability as well as budget utilization determine the return realized on a given investment in IS technology and systems.

Table 1 further amplifies these relationships by analyzing the financial performance of 17 leading financial corporations in the insurance sector of the economy using 1990 *Computerworld* data (Sullivan-Trainor, 1990). When the IS Budget (column A) is tabulated against 1989 corporate profitability (column C), it becomes clear that there is no automatic payoff (column D) for increased expenditures in computers for the 17 firms chosen as *Computerworld* IS leaders. In fact the range of Payoffs (Column D) for the 17 firms shows significantly different returns for IS investments, ranging from a high end of 9.3 : 1 for New York Life to a negative return of -0.3 : 1 for Merrill-Lynch. In these times of limited resources, the fundamental issue for corporate planners is to closely track the financial return for every dollar invested in IS. Table 2 presents a brief abstract of this tracking process for three of the financial firms, Paine Webber (ranked number 1), General Re Corporation (ranked number 5), and Northwest Mutual (ranked number 16). This table reviews the original formula for Payoff and then recasts the data to show the two components, Net Income to Sales, and Sales to IS Budget (IS Turnover). High Payoffs are achieved in the case of General Re by having highly profitable lines of

business, with a profitability ratio of .22. In the case of Northwest Mutual, the driving force for their high Payoff is through significant IS Turnover, with a Sales to IS Budget ratio of 122. Finally Paine Webber's lukewarm Payoff is the result of neither high IS Turnover nor an exceptional Profit to Sales ratio.

**Table 1. The 17 Most Effective Users of IS in the Financial Sector
Computerworld Premier 100 Survey - 1990**

Rank	COMPANY	A IS Budget \$ M	B IS % Revenue	C 89 Profit \$ M	D IS Payoff (C : A)	E Revenue \$ M	F Profit Revenue (C : E)	G IS Turnover (E : A)
1.	Paine Webber, Inc.	200	6.8	139	0.7	2,924	0.05	15
2.	American Express Co.	874	3.5	1157	1.3	25,043	0.05	29
3.	Pacific Mutual Life	57	2.9	28	0.5	1,979	0.01	35
4.	Salomon, Inc.	335	3.7	470	1.4	9,005	0.05	27
5.	General Re Corp.	87	3.1	599	6.9	2,771	0.22	32
6.	Massachusetts Mutual	75	1.5	124	1.7	5,000	0.02	67
7.	New York Life	156	1.0	1452	9.3	15,294	0.09	98
8.	The Prudential	818	1.9	743	0.9	43,053	0.02	53
9.	Primerica Corp.	183	3.2	289	1.6	5,683	0.05	31
10.	Metropolitan Life	433	1.9	300	0.7	22,552	0.01	52
11.	The Travelers Corp.	342	1.8	455	1.3	19,000	0.02	56
12.	Ambase Corp.	94	2.7	96	1.0	3,521	0.03	37
13.	Mutual Benefit Life	48	1.3	44	0.9	3,840	0.01	80
14.	Merrill Lynch & Co.	800	7.1	-213	-0.3	11,331	-0.02	14
15.	Mutual Life of NY	100	2.6	12	0.1	3,831	0.00	38
16.	Northwestern Mutual	52	0.8	372	7.2	6,341	0.06	122
17.	Aetna Life & Casualty	500	2.5	300	0.6	19,685	0.02	39
	Median for all Financial Services	303	2.8	375	2.1	11,815	0.04	48

It is clear from the data in Table 1 and Table 2 that if IS is a factor in corporate productivity, and therefore in corporate profitability, then certain corporations are getting better payoffs than other corporations for every dollar invested in IS.

Figure 1 further explores these relationships by graphing the components of IS Payoff. Ratio of IS Turnover (column G) is plotted on the X axis, and corporate profitability ratio (column F) is plotted on the Y axis for the 17 Fortune 500 firms in the insurance sector. Many of the firms are labeled, using their *Computerworld* ranking, including Paine Webber - No. 1, General Re - No. 5, and Northwestern Mutual - No. 16.

The graph visually demonstrates the return on IS budgets, with those firms in the lower left hand corner of the chart having both a low profitability ratio and poor IS turnover. Those firms in the lower right portion of the graph show high IS turnover, particularly Northwestern Mutual, while General Re, in the top left portion of the graph, shows a high profitability ratio.

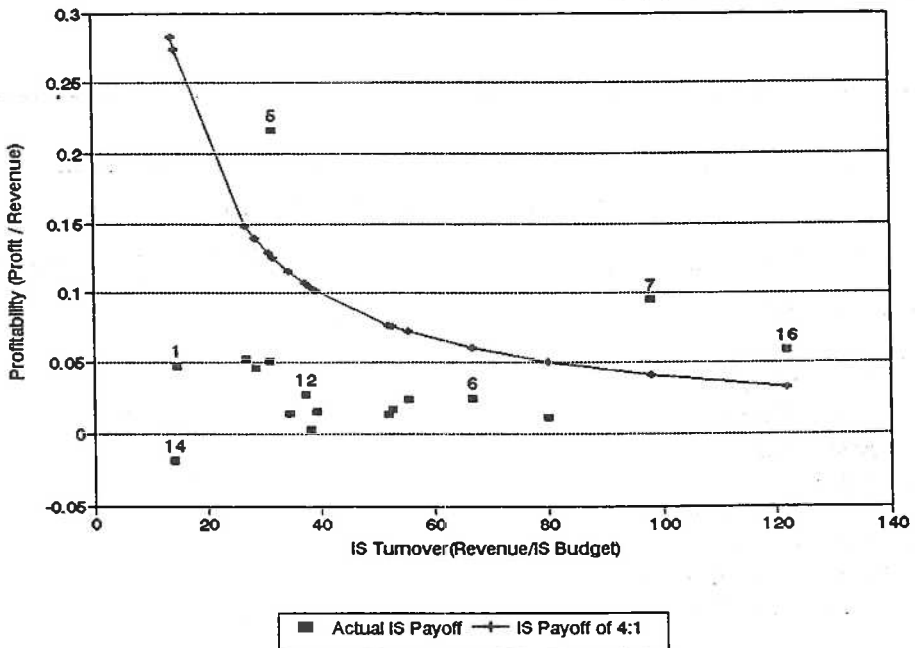
Table 2. Tracking IS Payoff

	Paine Webber	Northwest Mutual	General Re
1. IS Budget	\$ 200 M	\$ 52 M	\$ 87 M
2. Sales	\$ 2924 M	\$ 6341 M	\$ 2771 M
3. Profit	\$ 139 M	\$ 373 M	\$ 599 M
4. Profit as % Sales (3/2)	.05	.06	.22
5. IS Turnover (2/1)	15	122	32
6. Return on IS Services (4 x 5) Payoff	.7	7.2	6.9

To further demonstrate these relationships, hypothetical profitability data are plotted as a series of connected points on the diagram. The profitability for this second series is calculated using the formula:

$$\text{Profitability} = \frac{\text{IS Payoff}}{\text{IS Turnover}}$$

where the IS Payoff is hypothetically fixed at 4. This second series demonstrates what the profitability ratio should be, given each corporation's IS Turnover, and assuming that a reasonable IS Payoff is equal to 4:1. For instance, Paine Webber which has an IS Turnover of 15 would hypothetically need a profitability ratio of .266 to achieve a Payoff of 4. By contrast, General Re, with an IS Turnover of 32 and a profitability ratio of .22, clearly exceeds the Payoff of 4.

Figure 1. Return on IS Assets - *Computerworld* Financial Leaders

The actual performance level of many of the charted financial organizations form a cluster in the lower left hand corner of the graph, below the plotted Payoff markers of 4:1. Analyzing these corporations based on the assumptions spelled out earlier, it is easy to see that those in the lower left corner are under-performing, both in terms of overall profitability and in terms of IS turnover. Therefore their return or payoff is significantly below those corporations that have managed their IS resources more efficiently and effectively.

Additional ABC Indicators

The ABC methodology lends itself to incorporating multiple indicators of business performance. Figure 2 is a display of those ABC costs found in a particular line of business, while Figure 3 sets up performance ratios which link IS investments with indicators of management quality.

Figure 2. ABC Line of Business Costs

Line of Business	Year 0	Year 1	Year 2	Year 3	Year 4
IS Services					
Technology Investments (software/hardware)					
Systems Life Cycle (Development, Implementation)					
Ongoing System Maintenance and Enhancement					
Ongoing Operations					
Non-System Operational Charges (training, help desk)					
TOTAL					

Year 3. ABC Performance Ratios

Return on Investment	Year 1	Year 2	Year 3	Year 4
Payoff Factors Ratio				
Profit : Sale Ratio				
Sales : IS Budget Ratio				
Operating Costs Ratio				
Staffing Levels Ratio				
Inventory Ratio				
Complaints (Defects) Ratio				
On Time Service Ratio				
Stakeholder Satisfaction Ratio				
New Product/Services Ratio				

The ABC methodology is dependent on allocating costs figures to each profit center. Since IS technology and support costs directly impact the profitability of corporate lines of business, it makes sense to attribute the cost as well as the benefit to local profit centers. The advantage of this approach is that there are no IS costs hidden in overhead. Similarly, the return on investment with ABC methodology is a series of ratios which indicate performance both in terms of profitability as well as management quality. Therefore, the overall operating performance of an organization using ABC methodology now includes measures on actual versus budgeted operations for each product and service, and outcome measures that address financial and managerial performance.

CONCLUSIONS

Underlying the ABC analysis is the assumption that almost all indirect and support costs must be separated from corporate overhead. Once separated, these factors are viewed as variable rather than fixed. Even such indirect expenses as system hardware and total salaries paid to IS staff, which in conventional accounting do not vary much throughout a fiscal year and appear fixed, are now viewed as variable. In an economy that is downsizing computer platforms and staff as well as outsourcing IS service, a more flexible performance methodology is essential. The ABC methodology estimates future IS services based on previous performance, and readily compares downsizing and outsourcing alternatives for cost/benefit ratios as well as quality/benefit ratios. Although the ABC methodology may use historical data, its real strength is to predict the future consequences of managerial action. The objective is not only to get a more accurate allocation of costs, but to build a performance model of the organization, a model that enables managers to predict future costs in a changing mix of customer services, products, and IS technology. The performance of IS can provide visible markers for implementing improvements in stakeholder services, tracking profitability and IS asset utilization in each line of business. The ABC methodology is a predictive tool that estimates cost and quality ratios in a changing business environment for each line of business. It is also a diagnostic tool, pinpointing cost allocations that jeopardize corporate profitability.

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