

Information Systems and Financial Performance*

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This study investigated the relationship between information systems and financial performance in small firms. Prior studies have reported mixed results, so this study adopted a critical, exploratory perspective which looked for evidence of both positive and negative relationships between the use of information systems and organisational performance. Positive and negative effects of information systems were identified. However, few had a substantial influence on performance, other than the process of information systems growth absorbing excessive managerial time. Two further factors were identified which could simultaneously promote information systems growth and influence performance: market conditions, and the owner's wish for firm growth.

1. Introduction

During the last ten years there has been a growing use of computers in small firms. The success of such systems has been studied [DeLone 1988, Raymond 1985 and 1987, Montazemi 1988, Lees 1987]. However, the emphasis of these studies has been on information system (IS) success, in terms of "system use" and "user satisfaction". Only the study by Cragg & King (1992) has considered organizational success in relation to information systems in small firms. They expected to find a positive correlation between information system sophistication and financial performance. Instead, they reported many negative correlations. This unexpected result suggested that firms with low IS sophistication performed better than those with high IS sophistication. A possible explanation of this

result is that IS has negative effects on performance, rather than positive effects. This paper explores this "negative effects" proposition, through studying six small engineering firms.

2. Information Systems and Financial Performance

Many authors have argued that information and information technology are important resources [Galbraith 1977, Lincoln 1986, Scott-Morton 1984, Zuboff 1985]. For example, many transaction processing systems were aimed at cutting operating costs, and it has been assumed that better information improves decision making. Furthermore, there has been much discussion of information systems creating competitive advantage (McFarlan 1984, Vitale 1986). However, relatively few studies of organisational performance have included computer related variables, and the evidence from these studies is very mixed. Turner (1982) and Yap & Walsham (1986) found no relationship between the use of computers and performance. Cron & Sobol (1983) reported mixed results as they found firms that made extensive use of the computer had a greater tendency to be either very low or very high performers. Three other studies have reported positive results (Kearney 1984, Kivijärvi & Saarinen 1988, Lincoln 1986). Using a case study approach, Kivijärvi & Saarinen (1988) found that the performance was greater in firms with more mature information systems. However, their longitudinal data over four years failed to reveal which was

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the cause and which was the effect. Furthermore, at the industry level, Morrison & Berndt (1991) found that the marginal benefits of information technology (IT) investments were less than their marginal costs. At the national economy level, Thachenkary (1991) reported that IT investments have not been translated into output gains.

The empirical studies have shown no clear picture about the relationship between information systems and organisational performance. As a result, Angell & Smithson (1990) have discussed the "misplaced belief that IS has solely beneficial effects" (p.27). Vitale (1986) and King et al (1991) have reported unintended, negative consequences of attempts to use IT. This paper explores this "negative effects" proposition further. Six small firms were examined to see if negative effects from IS could be identified, and if identified, whether they were likely to explain some of the negative results reported previously.

Study Design

The major aim of the study was to gain a better understanding of the relationship between information systems and organizational performance. Within this aim, the study set out to identify any positive and negative effects of IS on small firm performance. The study concentrated on financial measures of performance, based on the prior research. However, it was recognised that IS could have both direct and indirect effects on performance. For example, information systems could increase costs, and therefore directly impact on performance. However, if information systems decreased a manager's performance, then this could affect organisation performance, but indirectly.

There was little prior research on which to base a critical investigation of small firm computing. Earlier studies had discussed extra costs due to computerisation (Cragg 1984, Easton 1982). Furthermore, Stair et al (1989), based on Nolan's stages of growth model (Nolan, 1979), hypothesized that DP expenditure in small firms, would start off and remain high, as a percentage of sales. The early literature also provided evidence of problems associated with IS in small firms (Cheney 1983, Cragg 1984,

Easton 1982). Various stakeholders had been affected by these problems, including managers, employees and customers.

In addition to direct and indirect effects from IS, any reported negative correlation between IS and performance could be due to other factors, making the correlation spurious. For example, if a factor promoted both the growth of IS and poor performance simultaneously, the resultant correlation between IS and performance would be negative. The factor would be the causal variable, rather than IS growth. Potential factors included market conditions (Cron & Sobol, 1983), and the owners wish for firm growth (Cragg, 1984).

The study was therefore interested in three types of variables:

- direct impacts of IS on performance
- indirect effects of IS on performance
- factors which simultaneously influenced both IS and performance.

As there is poor theoretical understanding of any relationship between information systems and performance, the case study research method was selected. Firms that had been computerised for a few years were selected in order to consider short and long term effects. Following preliminary interviews with ten engineering firms, a sample of six was selected to reflect different levels of IS growth. All the firms had less than 50 employees, and were not subsidiaries of a larger firm. The smallest firm was a sole owner-operator; the largest had 40 employees.

Rather than one single data collection method, multiple methods were used. The firms had been part of a prior study, so earlier data was available (Cragg 1984, Cragg & King 1993). A preliminary interview was used to gather information on their systems and their use, typically from the person responsible for daily computer operations. A second round of interviews took place with the owner-manager, and where necessary, with the person responsible for IS. In addition, observations were made at the time of the interviews. Furthermore, an adapted version of the questionnaire used in the Cragg & King (1992) study was used to obtain complementary data, including financial performance.

The variables discussed earlier formed an initial set of questions for the interviews. In ad-

Table 1. The Six Case Study Firms: Descriptive Data

	The Six Firms					
	A	B	C	D	E	F
Type of engineering firm	Mechanical	Transport	Other	Electrical	Mechanical	Electrical
Main product	Cutting tools	Engine rebuilding	Doors& windows	Monitoring tols	Valves	POS terminals
Number of employees	15	8	40	1	40	35
Year established	1970	1975	1965	1984	1969	1966
Birth year of owner	1944	1949	1945	1939	1964	1946
Owner's education	University	Polytechnic	University	Polytechnic	Polytechnic	University
Owner	Founder	Founder	Founder's son	Acquired in 1984	Founder's son	Founder

dition, authors like Pettigrew (1985) and Yin (1984) suggested further topics which could help explore underlying forces or connections between variables. As a result, questions were asked concerning major events in company history, products, market factors, company performance, owner's background, computer use and impact. To retain actual responses, all interviews were tape-recorded. Transcripts were made of each interview and telephone calls made to clarify or add to this data. The sample covered a range of engineering firms, as shown in Table 1.

Case Study Results

The financial performance data for the six firms is summarised in Table 2. All the measures of financial performance present a similar picture;

Firms A and E were the best performing firms, and Firms B and D were the worst. The rank order, from best to worst, being: A, E, C, F, B, D.

Direct impacts between IS and Performance

Owners reported little direct impact of IS on financial performance. Questions on other factors like costs and debtor's control provided some evidence of a positive impact on financial performance. For example, firms A and B reported cost savings which were considered to have had a direct impact on profit. Firm A, was able to reduce their overdraft through earlier payment by customers. Furthermore, Firm A used their system to identify customers who had not ordered recently. Additional sales often resulted from a sales call to these firms. Firm

Table 2. Financial Performance data for the Six Firms

Measure of financial performance	A	B	C	D	E	F
One year sales growth (%)	+28	+2	+20	-25	+25	+20
Five year sales growth (%)	+94	+10	NA	NA	+75	+20
One year return on sales (%)	32	5	15	negative	20	8

Note: Firms C and D underwent considerable restructuring during the period, so their five year sales comparisons were not analyzed.

B had used expenditure records to help identify areas for cost reduction. The subsequent savings were a substantial percentage of the total system cost.

While firms A and B provided some evidence of reduced costs from IS, there was little evidence to support the hypothesis that IS had increased costs. Any cost increases seemed minor, especially when compared to the reported large cost savings. For example, the only extra cost reported by Firm D was the need to replace disk drives.

The firms provided evidence that the process over time of increasing their use of information systems incurred extra costs: Firm C acquired replacement hardware and a new costing system; Firm F a CAD system; and Firm E acquired an MSDOS computer, plus accounting software. Of the other firms, one had not increased their level of IS, while the other two had, but from within the firm. None of the firms indicated that these further developments had led to further cost reductions. However, only at firm C could the costs be considered significant, and likely to affect performance.

At Firm F there was evidence of IS affecting performance in a different way. IS developments were pushed by the owners' perceived need for the organisation to be flexible and to cope with market uncertainties. Firm F spent large amounts of money buying various types of technology to remain competitive.

There was evidence also of financial performance having an impact on IS. The two poorest performing firms, B and D, both wanted to invest in more modern IS, but knew that they would have to wait as the costs would be significant considering their poor financial positions. However, at Firm A, where their IS level was quite low, but financial performance high, there was no hurry to upgrade their outdated system. Firms C and E were examples of well performing firms which had been able to invest in IS. Here IS was seen as necessary support.

In summary, the case studies provided evidence of IS affecting performance in a positive way at two firms through reduced costs, and negatively through increased costs at one firm. Furthermore, performance had affected IS investments, particularly by preventing the poorer performing firms from upgrading. Thus, the case stud-

ies showed there to be a two way relationship between IS and performance.

Indirect Impacts of IS on Performance

Prior research has shown that performance in small firms can be viewed as multi-dimensional (Friedlander & Pickle 1968, Robinson 1983). Owners have many reasons for being in business, and many stakeholders exist. Possible effects of information systems on stakeholders were examined, including managers, employees, suppliers and customers.

The firms provided evidence that the process of IS growth absorbs managerial time. At Firm A, a lack of support and co-operation from the software vendor and from their accountant, meant the firm implemented the general ledger system themselves. As well as taking 2.5 years to implement, the process absorbed much managerial time. For Firm C, liaison with the software developers took time, although this was the time of a junior rather than a senior manager.

Firm D, the one-person firm, developed IS internally using the owner's expertise and time. The owner provided clear evidence to support King & McAulay's (1989) concept of "technological fascination". They described managers who seemed "to spend significant time ensuring the success of IS in order to meet personal needs" (p 116). Such systems may not be cost effective, as they could divert scarce resources from more useful endeavour. The owner had enjoyed designing and building numerous systems. Their IS had grown, but the firm had performed poorly.

The other three firms provided no evidence of systems development absorbing excessive managerial time. In the two firms where IS development had taken place (E and F), the managers had been active in this process; one as a hands-on developer and the other involved in decisions. Management time had been consumed in the process of systems development, but neither firm reported this as excessive.

The interviews provided no evidence to suggest that IS had decreased the performance of non-managerial personnel. Users had positive attitudes to computers, partly because the computer had relinquished clerical staff from very repetitive tasks. Typically, owners still relied on office

staff for information, particularly for computer printouts. Relationships between staff seemed to be good, though this was not examined in a comprehensive manner.

Computers had had no impact on relationships with suppliers. The data also suggested that customers gained very little from computerisation, except smarter, and possibly earlier bills. Potentially negative effects on customers had been experienced by Firm A in that some early “foul-ups” had taken place, when invoices had been sent out after a payment had been received. Firm A felt that they could use the technology to identify customers whose business had dropped off for whatever reason, and hence use the technology to increase rather than decrease sales. The view at Firm C was that the computer had helped customers considerably by keeping specific customers informed of recent product developments and prices. These owners considered their computer had improved customer service. It would seem that computerisation had not had significant negative effects on customers. However, customers were not interviewed.

The evidence on possible direct and indirect negative effects of IS on financial performance is summarised in Table 3, where any significant supporting or contrary evidence is reported. Costs was the only variable to provide evidence of a direct impact between IS and performance, and this provided mixed evidence. There was evidence of two variables having an indirect effect, one positive and one negative. Improved customer service at two organisations had led to increased sales. Developing IS capability, rather than resolving problems with IS, had absorbed managerial time at three firms.

Factors Simultaneously Influencing IS and Performance

The case data was also analyzed for other causal variables which could potentially support the negative correlation between IS growth and financial performance. For a causal variable to support the negative correlation between IS and financial performance, the variable must have opposite rather than similar correlations with the two variables of IS growth and financial performance. The prior literature identified two potential variables: market conditions and the owner’s wish for firm growth.

Cron & Sobol (1983) speculated that firms experiencing difficult market conditions could turn to IS in an attempt to try and solve the problem. Similarly, better performing firms could feel little pressure to improve their performance by investing in IS. The cases provided evidence both for and against this hypothesis. Of the two poorly performing firms, B and D, only Firm D had turned to IS for support. Similarly, of the two highest performers, while Firm A had almost ignored IS, Firm E was taking IS quite seriously. Thus, two firms supported the hypothesis (A and D) and two contradicted it (B and E).

Cragg (1984) reported that one of the benefits from computerisation in small firms was that it supported firm growth. IS had provided small firms with effective and efficient clerical systems, which could cope with considerably increased sales turnover, without any significant increase in clerical costs. A firm may be willing to sacrifice short term financial performance, and decide to invest in technology with a view to longer term growth. Similarly, some successful small firms that have no wish to grow may feel that any investment in IS would have to be

Table 3. Evidence of Positive and Negative Effects of IS

Detrimental Effects	A	B	C	D	E	F
Costs	+ve	+ve	-ve			
Managerial time	-ve		-ve	-ve		
Customer Service	+ve		+ve			

Note: “+ve” indicates evidence that IS had had a positive/beneficial impact on performance. A “-ve” indicates evidence to the contrary, ie negative effects from IS. Blanks indicate no significant evidence of either type.

justified in terms of extra sales, which may not be desired as this implied growth.

This hypothesis was difficult to test as none of the firms expressed any desire to grow, though there was evidence that the firms had grown in response to market success. Firms C, D and F sought both short and long term benefits from their investment in IS. Firm C had acquired an expensive system, but was confident that it would pay its way after a few years. Firm D wanted to survive, and saw IS as a way of saving time in the future. Firm F was keen for everyone to be exposed to the technology with a view to being flexible. None of these three firms was a high performer. They therefore lend support to the hypothesis. Evidence to the contrary was provided by Firm A, which had been frustrated from hiring more skilled labour, a sign of wanting to grow, but had made no attempt to support growth through investing in IS.

A summary of the analysis of factors which could simultaneously influence both IS and performance is given in Table 4. Both factors gained some support. However, the support was mixed for both factors, rather than a clear YES or NO.

Discussion

Before discussing the implications of these results, the limitations of the research should be recognised. Six engineering firms were studied, and this limits the generalizability of the results. Also, all the firms had acquired computers in the early 1980's, and were thus relatively early movers into IS compared with other small firms. Furthermore, the research was exploratory, and variables like "managerial time" and "market conditions" were not measured using validated instruments.

Most research linking IS and performance assumes a positive, one way, relationship. Studies have provided mixed evidence, but little explanation for unexpected findings. This study

provided both positive and negative findings linking IS and performance. On the positive side, costs had decreased at two firms, and customer service had led to increased sales at two firms. However, on the negative side, costs had increased at one firm, and excessive managerial time had been consumed at three firms. The study therefore demonstrates that there is no simple relationship between IS and performance. Future studies must recognise that both positive and negative impacts can occur, even within the same firm. Some impacts of IS may be direct, and others indirect. Studies must also recognise that the relationship can be a two way relationship, ie, that IS can influence performance, and performance can influence IS.

Four firms provided some support for two factors which simultaneously influenced IS growth and financial performance: market conditions, and owner's wish for firm growth. Both variables relate to investment motives. Firms invest in IS for different reasons, and these must be considered in studies of IS and performance, possibly as a moderating variable.

The variables also relate to owner characteristics. This topic has received little attention in studies of information systems, even in studies of large firms. Therefore, one area for further research is to study the interaction of owner characteristics with IS acquisition, control and development. This research should build on the prior work in small firms by Martin (1989) and Nickell & Seado (1986), as well as models of entrepreneurship (Keats & Bracker 1988, Chell & Haworth 1988). This could consider managerial behaviour and type (Carland et al 1988, Dussault & Dussault 1987, Routamaa & Vesalainen 1987), and include characteristics of direct relevance to information processing. For example, planning behaviours and information processing styles (Pelham & Clayson 1988), and decision comprehensiveness (Smith et al 1988).

Table 4. Evidence of factors simultaneously influencing IS and Performance

Factors	A	B	C	D	E	F
Market conditions	YES	NO		YES	NO	
Wish for firm growth	NO		YES	YES		YES

Kling (1987) offers a different perspective. Kling prefers "Web" models, which "treat computerised systems as a form of social organisation with important information processing, social, and institutional properties" (p 309). Examples from the case firms support this approach as owners had made decisions about their work which influenced the way technology was used. For example, the owner at Firm A was not keen on computer technology. After much persuasion, he saw IS as being of use in the office, where it would have low impact on his work. The opposite could be said of the owner of Firm D who wanted to work with technology all the time, so took every opportunity to implement new systems. Chell & Haworth (1988) would argue that these decisions reflect the owner's value systems. As yet there has been no known research on owner's value systems in relation to IS in small firms.

Conclusions

The case studies provided mixed evidence to help understand the negative findings of prior studies of IS and financial performance. The analysis of possible negative effects of IS found little evidence of a substantial influence on performance other than absorbing managerial time in IS growth. However, two further factors could be associated with both IS growth and poorer performance: influence of market conditions and the owner's wish for firm growth. All three variables are worthy of further research, and are likely to require longitudinal studies based on theories of entrepreneurship. This call for further research supports the plea by Cooper & Zmud (1990) who saw rational decision models being useful in explaining IS adoption, but political and learning models being more useful when examining IS infusion. Such studies have not yet been conducted in small firms.

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