ABSTRACT
This paper uses discriminant analysis to examine the usefulness of two information technology managerial control ratios as discriminating factors: (1) the ratio of information technology expense to premium income, and (2) the ratio information technology expense to total operating expense. The ratios are used as predictors to differentiate organizational performance among systems technology leaders in the insurance industry. The overall classification accuracy of the discriminant model is 87.84% for the original sample (1984 firms) and 84.25% for the hold-out sample (1985-1986 firms). The predictive ability of the model demonstrates that information technology managerial control ratios can be used to expose areas where a firm may be weak.

INTRODUCTION
Information technology managerial control ratios (e.g., information technology costs/sales, data processing personnel cost/total data processing expense, etc.) are used by industry associations, consulting firms, investors, and management to compare firms with their competitors [Synnott and Gruber, 1981, p. 157; Life Office Management Association, 1988; Food Marketing Institute, 1987; Arthur Young, 1987]. Though the ratios are used widely in practice, there is a need for empirical research to verify their value and usefulness. Today we lack a firm understanding of the relative value of information technology (managerial control) investment ratios. We also lack an understanding as to which ratios are the most appropriate and representative for the different levels of decisions that managers face.

Our hope here is initiate this line of research by considering the potential discriminatory power of information technology investment ratios. The purpose of this study is to examine the usefulness of information technology managerial control ratios by studying their predictive ability to differentiate organizational performance among systems technology leaders in the insurance industry, 1984-1986.

The emphasis on information technology ratios is not intended to imply that these are the only ratios that are useful when differentiating organizational performance, nor does it imply that only ratios are useful. The primary concern in this study is not with identifying the factors that differentiate organizational performance per se, nor is it to determine if information technology investment ratios are useful. The intent is to examine whether the ratios are useful as predictors of important structural characteristics that differentiate organizational performance in insurance firms. Though this is only one potential application of the ratios, it represents a starting point on which future evaluation and verification research can be built.

RELATED RESEARCH
Financial ratios have used been extensively to predict firm performance. McGowan [1965] used accounting measures to differentiate domestic and multinational firms. Pinches and Mingo [1973] used financial ratios to predict bond ratings, and Beaver [1966] and Altman [1968] used financial ratios to predict bankruptcy. The ratios that are often used in these studies include: cash-flow ratios, net income ratios, turnover ratios, debt to total asset ratios, and liquid asset to current debt ratios. Buzzell and Gale [1987] used more general operating ratios to evaluate firm performance (e.g., R & D/sales, marketing costs/sales, etc.). Whereas conventional financial and general operating ratios are often used to evaluate firm performance, we know very little about the usefulness of information technology investment ratios in this context.

The research literature now contains several well publicized cases where information technology has helped firms to penetrate new markets, develop new channels/opportunities for product distribution, increase/decrease product differentiation, and centralize/de-centralize operations geographically [Benjamin et al, 1984; Cash and Konsynski, 1985; Clemons and McFarlan, 1986, Clemons and Kimbrough, 1986; Clemons and Row, 1987, 1988]. There have been three insurance industry related studies that have investigated the link between organizational productivity and the utilization of information systems, Bender [1986], Clement and Gottlieb [1987], and Harris and Katz [1988].
Bender (1986) attempted to relate information processing expense as a proportion of total operating expense and the ratio of total operating expense to premium income in one hundred and thirty-two (132) life insurance companies. Using 1983 industry data, the author assumes a linear relationship between the two measures and uses correlation analysis to show that the relationships are significant.

Clement and Gottlieb (1987) studied the information system installed in the New Business department of the Maple Leaf Life Insurance Company. The system reduced the length of the transaction processing chain associated with the issuance of new policies, improved productivity and processing time in the department, and allowed the company to offer services that were previously infeasible. Collapsing the transaction processing chain allowed management to gain greater control over the operations in the department by simplifying both the organizational structure and the non-computerized information processing tasks.

Harris and Katz (1988) studied the relationship between organizational performance and information technology investment rates for systems technology leaders using 1983-1986 insurance industry data. Organizational performance was measured as the ratio of total operating expense to premium income, and information technology investment intensity was measured as the ratio of information technology expense to total operating expense. The authors reported that the most expense efficient (lowest ratio of operating expense to premium income) firms tended to allocate a significantly higher proportion of their total operating expense to information technology [Harris and Katz, 1988].

RESEARCH FRAMEWORK

At the firm level, information technology is one potential source of competitive advantage among insurance companies. Information technology influences: (1) the economies of scale which may result from decreasing the costs associated with each transaction or unit of work executed, (2) the economies of scope which may result from offering related complementary products or services, and (3) the extent of product and service differentiation by firms and the industry.

Information Technology and Economies of Scale

Economies of scale from information technology use result when the cost per transaction (e.g., customer requests, policies, etc.) declines as the number of transactions executed increases. In this context, the larger the firm the greater the advantage because of the potential to spread the costs over more transactions and thereby spend less per transaction executed. Economies of scale also result when firms use some form of IT resources (e.g., optical disks, integrated systems, etc.) that lead to lower costs per unit executed. Substantial scale economies for either of these reasons create a market barrier to entry because a prospective entrant can expect higher average unit costs (if the firm enters at a relatively small scale) than firms already serving the market [Pappas and Hirschey, 1987].

Information Technology and Economies of Scope

Although information technology is only one source of economies of scope, it can help insurance firms potentially to create differential economic advantage by enabling the firms to be more customer and market responsive [LOMA and Arthur Andersen, 1984; Malmberg, 1988]. This would be the case particularly when a firm is able to translate superior skill or productive capacity in one product line into unique advantage in the production and delivery of complementary or related products [Pappas and Hirschey, 1987]. Where economies of scope advantages exist, they are also dependent on control over other specialized complementary assets (e.g., adequate capital, marketing and advertising expertise, product know-how, etc.) [Malmberg, 1988]. Increasingly, large and mid-size insurance companies are expected to expand their product offerings by moving into group insurance, property/casualty insurance, and personal investment management products [LOMA and Author Andersen, 1984].

Information Technology and Product Differentiation

The economic climate, increased competition from alternative savings vehicles, and growing consumer sophistication have led to significant changes in policyholder options [LOMA and Author Andersen, 1984]. The key areas in which firms are currently differentiating their products include: (1) flexibility in premium payment, (2) premium amount, (3) cash accumulation vehicles, and (4) loan rates. Other product characteristics likely by 1990 include payment by credit card, no-penalty trade-in on new products, new dividend options, and cash value policies with checking accounts. Though these changes in product characteristics rely heavily on administration and systems support, IT may be used to enhance or eliminate opportunities for product differentiation in a competitive setting [Clemons and Row, 1988; Porter, 1986, p. 214].

THE STUDY

In this paper we examine the predictive ability of information technology investment ratios to differentiate organizational performance in insurance firms. The data source for this study is the Life Office Management Association (LOMA) Information Processing database. LOMA is the insurance industry trade association for life insurers.

Performance Measure

Organizational performance is measured using the ratio of total operating expense to premium income, the operating expense ratio. This measure of expense efficiency and productivity measures a firm's cost advantage or disadvantage standing from current operations. It is a short-run measure of organizational performance and one of two financial measures used by A.M. Best to evaluate and certify the financial performance of life/health insurance companies. The numbers for total operating expense and premium income are based on the sub-totals for operating expense and premium income by line of business (e.g., life, group, property and casualty).
Investment Measures

Information technology investment intensity is examined using two measures: (1) the ratio of information technology expense to premium income, the IT cost efficiency ratio; and (2) the ratio of information technology expense to total operating expense, the IT expense ratio. The IT cost efficiency ratio is a proxy measure for the effectiveness and efficiency of information technology (assets) resources in supporting the revenue generated by the firm. At the industry level, changes in the IT cost efficiency ratio over time would signal a change in the significance of information technology as a barrier to entry. This type of change should be expected when there are significant changes in the technological sophistication (requiring higher levels of fixed investments) of the industry or when industry concentration (consolidation) is increasing or decreasing. When the level of technological sophistication is controlled and the IT cost efficiency ratio averages at the industry level are relatively constant (stable) over time, variations in the IT cost efficiency ratio values between firms can be accounted for by one or more of several factors: excess productive capacity, inadequate and/or ineffective use of information technology, or disadvantageous scale or scope economies.

The IT expense ratio is a proxy measure for the relative value of information technology among the resources (e.g., ratio of marketing costs to total costs) that create value of the firm. At a minimum, above average values of the IT expense ratio reflect a greater effect on the composition of total costs than below average ratio values, relatively. The data available do not permit us to separate out process-oriented technological effects (typically cost directed) from product-oriented technological effects (typically differentiation and performance directed) [Clement and Gotlieb, 1987]. Nonetheless, both effects exist and are reflected partially in the size of the IT expense ratio value. It is the pattern of effects from a dynamic and synergistic relationship between the two domains, technology-based product and process innovations, that determines competitive impact [Clark, 1987, p. 83; Porter, 1988, p. 219]. These IT investment ratios are commonly used managerial control measures [Synnott and Gruber, 1981, p.180]. Information technology expenses includes all expenses for information processing in the firm (e.g., hardware, software, personnel, data communications, miscellaneous) in both data processing and line/staff departments including depreciation.

Sample Population

Our source of data for the study is the Life Office Management Association Information Processing database. The data base was started in 1981 and LOMA began reporting summarized information back to the companies in 1982. The firms in the database are members of the association. Annually LOMA surveys the member firms to obtain expenditure information on revenue (by line of business), total cost by product category (i.e., life, group, and property and casualty), and information technology expense (e.g., hardware, software, personnel, and miscellaneous). The financial information in the database only reflect insurance operations and is reported to LOMA consistent with insurance company reporting for the U.S. Annual Statement, U.S. Consolidated Annual Statement, and Annual Statements as Respects Life Insurance in Canada. All other expense items are reported consistent with the definitions provided with the survey instrument. For inclusion in the study, firms must provide at least two years of data. In a given year, the firms in the database typically account for over seventy (70%) percent of the premium income in the life industry and over ninety-five (95%) percent of the total admitted assets in the industry.

The database captures the sophistication of the firms' data processing installation. In this paper, we restrict consideration to those firms that are the systems technology leaders (i.e., the firms with the most advanced configuration of hardware, software, operations, and management). In the matrix of the types of data processing installations in insurance which LOMA uses, systems technology sophistication is defined by five dimensions: (1) hardware environment, (2) operations, (3) systems software, (4) applications software, and (5) management. Table 1 characterizes the systems technology sophistication of the leading firms in the database. Controlling for the level of technology eliminates differences in technological sophistication as a complicating factor when evaluating firm level differences in the IT cost efficiency ratio values.

Table 1. Leading Edge Systems Technology Sophistication

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Operations</th>
<th>Systems</th>
<th>Software</th>
<th>Applications</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directly Connected or via Telecommunications</td>
<td>Database Management System, TSO, CICS</td>
<td>Multiple Operational Environments</td>
<td>Modular Programs/Structured Techniques</td>
<td>Multiple Program Execution</td>
<td>Multiple Locations/Disparate Operations</td>
</tr>
<tr>
<td>Remote and Local Area</td>
<td>Multiple CPUs/Multiple Program Execution</td>
<td>High Level Languages</td>
<td>Remote Control</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each firm self-types its data processing installation based on the definitions that are supplied with the survey instrument. The identification of systems technology sophistication represents an overall assessment of the firm's sophistication on the five dimensions. The systems technology leaders are not necessarily the most sophisticated in the industry in all five areas, but they are the leaders relative to a majority of the five dimensions.

In 1984, there were seventy-four firms that were systems technology leaders reflecting fifty-nine (59%) percent of the premium income in the life industry [A. M. Best, 1984]; in 1985 there were seventy-nine firms reflecting fifty-nine (59%) percent of the industry's premium income [A. M. Best, 1985], and in 1986 there were sixty-seven firms reflecting sixty-two (62%) percent of the premium income in the life industry. During the full three year period, 1984-1986, the firms used in this study were very representative of the top 50 insurance companies as measured by premium income: more than 10 out of the top 20; more than 20 out of the top 50. Forty-five companies are represented in the sample for the full period of analysis, 1984-1986.
To protect the confidentiality of the data from individual companies, LOMA summarizes the information annually before making it available to member companies. Each firm’s data is reported back to the company (along with the summarized information from all firms) in a format that facilitates comparisons with the summarized information from all firms. Errors in individual company data are recognized and corrected. The database documents the information technology expenditures in each company and tracks key financial indicators.

**Research Approach**

The discriminant model will be employed to differentiate the different levels of organizational performance as a linear combination of the information technology (IT) investment measures. Discriminant analysis is a method by which a function is developed to differentiate between two or more unlike groups. In this study, the most expense efficient (based on the operating expense ratio) firms will be differentiated from firms that are less efficient. In order to make the predictions the operating expense ratios are arranged in ascending order and divided into quartiles. A discriminant model is derived based on the IT investment ratios to classify the quartile ranking of the firms that will minimize the percent of incorrect predictions. Intuitively, discriminant analysis is an appealing technique because it resembles the decision-making situation that users of the ratios face. This analysis should be viewed as an extension of multiple regression and multivariate analysis of variance.

As background to the discriminant analysis results, for the overall three year period we constructed a two-way mathematical model of the operating expense ratio as the dependent variable and the IT cost efficiency ratio and IT expense ratio as factor inputs (Table 2). The mathematical model was constructed using the multiple classification analysis of variance (ANOVA) procedure in SPSS [1988]. Each factor is measured at four levels, ranking I represents the lowest 25% of the ratio values, ranking II the next largest 25%, ranking III the third highest 25%, and ranking IV the largest 25%.

**FINDINGS**

In 1984, the seventy-four firms in the study reflected total premium income of $104.7 billion, total operating expenses of $23.0 billion, and IT expenditures of $3.2 billion; at the firm level premium income ranged from $16.7 million to $15.3 billion. In 1985, the sixty-seven firms had total premium income of $103.4 billion, total operating expenses of $23.0 billion and IT expenses of $3.0 billion; at the firm level premium income ranged from $16.7 million to $15.3 billion. In 1986, the seventy-nine firms had total premium income of $104.7 billion, total operating expenses of $24.9 billion, and information technology expenditures of $3.2 billion; at the firm level premium income ranged from $16.8 million to $19.3 billion.

The 1984-1986 year to year averages for the operating expense ratio were 20, 19, and 18, respectively; for the IT expense ratio the averages were .14, .15, and .16, respectively; and for the IT cost efficiency ratio the overall averages were .027, .028, and .027, respectively. During the three year period there was a ten (10%) percent improvement in the operating expense ratio averages for the sample and a 14.2% increase in the IT expense ratio averages. The averages for the IT cost efficiency ratio were relatively stable for the study period.

**Operating Expense Ratio Averages as a Function of the Information Technology Investment Ratios**

<table>
<thead>
<tr>
<th>Variable</th>
<th>IT Expense Ratio</th>
<th>IT Cost Efficiency Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartile</td>
<td>1984-1986²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rankings³</td>
<td>I</td>
</tr>
<tr>
<td>1</td>
<td>.16 (22)</td>
<td>.11</td>
</tr>
<tr>
<td>2</td>
<td>.28 (11)</td>
<td>.10</td>
</tr>
<tr>
<td>3</td>
<td>.30 (21)</td>
<td>.21</td>
</tr>
<tr>
<td>4</td>
<td>.33 (1)</td>
<td>.29</td>
</tr>
</tbody>
</table>

¹ Sample size are in the parenthesis
² Overall sample size 220 (1984-1986)
³ Interval ranging for the IT investment ratios:
IT Cost Efficiency Ratio: I (.018); II (.019), .024;
III (.025), .028); IV (.030). IT Expense Ratio: I (.116);
III (.117), .153); III (.154), .176); IV (.178).

The results in Table 2 indicate that for each level of the IT cost efficiency ratio rankings, the operating expense ratio averages varied inversely with higher levels of the IT expense ratio rankings. In addition, for each level of the IT expense ratio rankings, the averages for the operating expense ratio increase as the IT cost efficiency ratio rankings increase (except for Group III).

Generally speaking, the most expense efficient firms were characterized by low values of the IT cost efficiency ratio (rankings I and II) combined with high values of the IT expense ratio (rankings III and IV). The weakest firms or least expense efficient were characterized by high values of the IT cost efficiency ratio (rankings III and IV) and low values of the IT expense ratio (rankings I and II). The level of expense efficiency falling in between these two extremes reflected either: (1) low (rankings I and II) values for both the IT cost efficiency ratio and the IT expense ratio, or (2) high (rankings III and IV) values for both the IT cost efficiency ratio and the IT expense ratio. We will propose a deeper interpretation of these findings in section 6.

**IT Cost Efficiency Ratio**

The results in Table 2 indicate that large values or above average values of the IT cost efficiency ratio are associated with reduced organizational performance. As stated previously, there may be several reasons for large or above average values of the IT cost efficiency ratio: excess productive capacity, inadequate and/or ineffective use of the technology, and disadvantageous scale or scope economies. In this context concentrating on achieving greater operating efficiency and scale...
economies may be more beneficial and less risky than attempting to implement major new product innovations [Gold, 1982, p. 247; Clifford and Cavanagh, 1988, p. 50]. Increased efficiency and scale economies are typically derived from increasing specialization in labor tasks and skills, changes in the costs (and requirements) for managing external transactions (e.g., client services, etc.), changes in the managerial control system, and simplification of managerial arrangements [Child, 1987; Clement and Gottlieb, 1988].

**IT Expense Ratio**

The Table 2 results are consistent with previous findings which showed that the most expense efficient firms were more heavily invested in information technology than the least efficient firms [Harris and Katz, 1988]. To the extent that increased values of the IT expense ratio reflect a deeper and richer level of organizational integration with the technology (extent and number of value-added applications in both horizontal and vertical dimensions), the IT expense ratio level is an important signal of the implementation of business system innovation in both developing distinctive ways of doing business and product design [Cash and McLeod, 1985; Daft, 1986, p. 217; Child, 1987]. It is also an important signal of the extent to which firms have built the activity-cost structure of the firm around the utilization of information technology.

**Discriminant Analysis Results**

Employing the SPSS stepwise discriminant function both information technology investment measures were entered into the model. The linear discriminant function derived from the 1984 data is presented in Equation [1]. Of the four

\[ Z = -2.1827 (A) + 2.2127 (B) \]

where:
- \( Z \) = the discriminant function score
- \( A \) = the IT expense ratio factor
- \( B \) = the IT cost efficiency ratio factor

functions computed by SPSS, this function contains 99.28% of the discriminating power relative to the other functions. In addition, the canonical correlation between the discriminant function and the operating expense group rankings was 0.93. These two measures indicate that the discriminant function is quite meaningful in explaining the group differences in organizational performance.

Though the IT expense ratio and the IT cost efficiency ratio were positively correlated (\( r = .437, p < .001 \)) in 1984, the correlation was not "large" indicating that multicollinearity is not a significant factor affecting the discriminantary power of our function [Pinches, 1980]. The strong discriminative power is related to the strength of the association between the operating expense ratio values and the discriminating factors, the IT cost efficiency ratio and the IT expense ratio.

The classification results are presented in Table 3. Of the fifteen Group I firms, nine or 60% were correctly classified, of the seventeen Group II firms, sixteen (94.1%) were correctly classified, of the 21 Group III firms, nineteen (90.5%) were correctly classified, and of the 21 Group IV firms (100%) were correctly classified. Overall 87.84% of the 1984 firms (test cases) were correctly classified. Computing the tau statistic, we can also state that the classification made based on the IT investment variables resulted in 83.96% fewer errors than would be expected by random assignment (e.g., 9 actual errors versus 17.864 expected by chance).

To test the longitudinal validity of the model, the hold-out sample (1985-1986) is classified using the model developed from the 1984 sample. For Group I firms, 73.2% of the firms were correctly classified; 83.8% of Group II firms, 82.4% of Group III, and 100% of Group IV firms were also correctly classified. Overall 84.25% of the one hundred and forty-six (146) firm hold-out sample was correctly classified, which validates the 1984 test model. In this case, the model made 78.90% fewer errors than would be expected by chance (e.g., 23 actual errors versus 36.617 expected by random assignment).

As our primary interest is in the extent to which the IT investment ratios are useful, the high percentage of correct classifications indicates the significant utility of the ratios in discriminating the structural characteristics that differentiate insurance firms. In addition, the high percentage indicates that the violation of assumptions was not harmful [Klecka, 1980].

<table>
<thead>
<tr>
<th>Table 3. Classifications Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Group Original Sample</td>
</tr>
<tr>
<td>Group I</td>
</tr>
<tr>
<td>Group II</td>
</tr>
<tr>
<td>Group III</td>
</tr>
<tr>
<td>Group IV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Predicted Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Group Hold-Out Sample</td>
</tr>
<tr>
<td>Group I</td>
</tr>
<tr>
<td>Group II</td>
</tr>
<tr>
<td>Group III</td>
</tr>
<tr>
<td>Group IV</td>
</tr>
</tbody>
</table>

Overall Correct Classification
Original Sample 87.84%
Hold-Out Sample 84.25%
These results however are only a starting point. More empirical research is needed to understand the relationship between the information technology investment ratios and other key operating ratios (e.g., marketing expense/sales, wage cost/sales, etc.). It is not the intent of this analysis to demonstrate that the IT investment ratios of themselves will provide all of the information that is needed to understand the differences in organizational performance among insurance firms. Rather our interest is in using the ratios to determine what are the basic questions that should be asked—for example, when is an investment ratio "poor"—then understand why it is poor and be guided to take actions based on the answer.

DISCUSSION AND SUMMARY

The results of the analyses in this paper allows us to propose an insurance industry model to focus IT capital and expenditures on those areas "that matter the most" based on the way in which the operating expense ratio data varies a function of the IT expense ratio and the IT cost efficiency ratio (Table 2). Ultimately the utility of the ratios lies in the fact that they can expose areas where firms may be weak (Figure 1).

The "best" expense efficiency (organizational performance) position was exhibited by those firms with below average IT expense ratios and low IT cost efficiency ratios (Table 2). These firms should focus primary attention on both improving their competitive posture (i.e., improve their income stream) and using automation to lower their operating costs. Vertical integration may be appropriate if it will strengthen the firms' competitive position. In light of the increased competitiveness in the financial services environment, the time and the capital cost required to achieved both objectives should be weighed very carefully. Miscalculations in these areas could result in consequences that would negatively affect the survival of the firm. As a result, it is logical to argue that when IT capital and expenditures are proposed as a substitute for labor, it is critical that the firms realize the intended labor productivity benefits, otherwise organizational performance will be negatively affected. These firms should anticipate that as they build-up their IT productive and innovative capability that the IT cost efficiency ratio will probably increase during the period of build-up (possibly, 2-5 years). The second critical step is to execute efficiently while monitoring the attainment of management goals and timetables to ensure that the intended value-added benefits are realized.

Firms exhibiting high IT expense ratios and high IT cost efficiency ratios should have a strong relative cost position across the activity-cost chain of the firm. Consequently, they should focus primary attention on improving the strategic market position and income stream of the firm. The proper strategy should be tailored to the size and unique business and market strengths of the firm. Some of the competitive strategy options include: (1) opening up new channels of distribution (e.g., direct response marketing), (2) focusing on carefully chosen market segments where a niche or specialist strategy would be successful (e.g., preferred risk insurer), and (3) expanding into new products that will leverage the firms' existing business (e.g., combined underwriting/risk protection vehicles, etc.) and market infrastructures (e.g., marketing and sales methods, customers, geographic markets) [Porter, 1985, pp. 318-319]. With the strategy in place these firms should invest in those IT opportunities that contribute the most (at the least cost) to achieving the strategy objectives. Where a cost advantage does not exist, then top management should focus on automating high cost activities, reducing inefficiencies in the utilization of information technology, and strengthening the firm's strategic market position [Porter, 1985, pp. 97-115].

Firms with below average IT expense ratios and low IT cost efficiency ratios may be able to improve their organizational performance by using automation to further reduce the variable costs in the critical operations of the business. Projects that provide greater vertical integration and horizontal linkages to facilitate lateral coordination and control may be particularly appropriate. Since these firms have the most efficient position in the use of IT to support the premium income revenues generated by the firm, they should focus primary attention on those IT investment options that would reduce variable costs and improve the overall level of organizational performance (based on the operating expense ratio).
In general, it is important for all firms to be able to select and support those projects that build value-added benefits from those that offer only limited impacts in terms of changes in business processes or product specifications. This is not an easy task since some of the IT projects (e.g., strategic marketing systems) that may offer the greatest value-added benefits are often very difficult to cost justify using conventional cost benefit analysis or discounted cash flow calculations. Forward looking companies also use non-financial quantitative measures (e.g., schedule attainment, throughput time, etc.) and qualitative criteria (e.g., technology obsolescence, product/process enhancement, etc.) to evaluate investment opportunities.

STUDY LIMITATIONS

The conclusions drawn in this study are based on industry data obtained from the Life Office Management Association. This paper restricts attention to those firms that are self-identified as systems technology leaders. The results presented reflect the full array of product offerings among insurance firms. However, the primary products are life insurance. A key question unanswered by this research is whether these findings extend to other organizational performance measures, such as return on assets (ROA) or return on investments (ROI). Though the results do not extend necessarily, in insurance companies premium income is strongly correlated with the size of the firm’s total asset base.

CONCLUSIONS

Capital investments in information technology are now a significant percentage of total capital outlays in the insurance industry [Roach, 1987]. In addition, there is strong growth in information technology investments and expenditures in spite of the risks inherent in realizing the investment returns. Nonetheless, in the insurance industry much of the focus on IT is justified; information systems have been used to alter products, and change the basis of competition in the industry [LIFE Office Management Association and Arthur Andersen Report, 1984]. One of the most significant changes for small and medium-size companies has been the electronic data interchange offerings provided by IVANS, an acronym for Insurance Value Added Network Services. IVANS is a non-profit corporation supported by insurance companies that use the IVANS services to provide data communications capability. The network currently supports electronic data interchange for 50,000 independent agents and company home offices [Konsynski, 1987]. IVANS provides on a shared cost basis to small and medium-sized insurance companies the type of communications capability only accessible traditionally to very large companies. As a result IVANS has been a significant factor in changing the basis of competition in the industry.

The research in this paper demonstrates that information technology investment ratios can be evaluated in terms of their utility, where utility is defined as predictive ability. We found that the firms with the lowest ratio of operating expense to premium income also exhibited the lowest ratios of information technology expense to premium income and were realizing perhaps the greatest scale economies. Generally speaking, in the most expense efficient (lowest ratio of operating expense to premium income) firms information technology expense accounted for a higher proportion of total operating expense than information technology expense in the least efficient firms. This ratio of information technology investment intensity is an important signal of the implementation of business systems innovation in both developing distinctive ways of doing business and the changes in product design [Cash and McLeod, 1985; Datt, 1986, p. 217; Child, 1987]. Comparing a firm with its competition using both the IT expense ratio level and the IT cost efficiency ratio level is valuable to expose areas where a firm may be weak and when predicting organizational performance.

This research was not intended to resolve the question of which information technology ratios should represent a particular factor (e.g., economies of scale). The selection of the best representative or most appropriate ratios are not likely to be totally independent of each other. Each ratio will contain common as well as unique information. What is needed in this area is a concerted effort to identify the most relevant information technology ratios, understand the common and unique information contained in the ratios, understand the relationship with traditional financial control ratios, and develop theory that will facilitate the selection of the most appropriate ratios for managerial control and decision-making.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the generous support of the Life Office Management Association, The Peter F. Drucker Graduate Management Center, The Claremont Graduate School and the College of Business Administration, Georgia State University. We would like to thank James F. Foley and Ann Purr of LOMA for stimulating discussions during the course of the study. We would also like to thank Eric Clemons for helpful comments and suggestions. Inferences and recommendations drawn from the analysis and findings only reflect the views of the authors and not necessarily the views of the Life Office Management Association.

REFERENCES


A. M. Best Reports, A.M. Best Co., 1986.


McGowan, C., "Using Accounting Measures To Differentiate Domestic and Multinational Firms", Institute for Research and Faculty Development, WP-87-017, Bentley College, Waltham, MA.


FOOTNOTES

1 The Life Office Management Association (LOMA), founded in 1924, is the insurance industry association for life insurers. LOMA promotes information exchange, cooperative research, and education and training activities to help member companies deal with the challenges of management in financial planning, operations and systems, and human resources.

2 Preliminary analysis revealed that both the dependent and independent variables varied with firm size (when ranking the firms by premium income), as a result a small firm effect may be affecting our discriminant analysis results. Controlling for firm size (as reflected in the premium income rankings) allowed us to ameliorate the significance of the small firm effect. To evaluate the significant of this effect, firms with premium incomes below $647.26 million were eliminated from the analysis.

Dividing the 1984 sub-sample (n=33) into four groups (quartiles), overall 90.91% of the original sample was classified correctly and 80.52% of the 1985-1986 hold-out sample was classified correctly. Again validating the cross-validity of the model.