

IOS ASSIMILATION STRATEGIES:
AN EMPIRICAL APPRAISAL

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Abstract

Interorganizational information systems (IOS) are increasingly relied on to facilitate the electronic exchange of data among organizations. Though substantive progress by the research community toward understanding IOS technology has been made, one unattended issue is understanding more fully the efficacy of alternative management strategies for assimilating IOS into organizational processes. Referred to here as *IOS assimilation strategies*, these strategies may offer to management useful alternatives for planning for and proceeding with IOS implementation.

Conceptually based on Keen's (1991) notions of "reach" and "range" regarding organizations' computing infrastructure, two IOS Assimilation Strategies are tested for their comparative effects on three efficiency and six effectiveness measures. The empirical results, based on data from forty-eight organizations of the Group Insurance industry and the nonparametric Friedman test for significance testing, indicate that a significantly different ranking on the efficiency measures occurs across groups inhering varying strengths of IOS use pursuant to the alternative IOS Assimilation Strategies. The results suggest that greater efficiency gains may obtain by pursuing a strategy to extend IOS range over IOS reach. Consequently, management is advised to weigh carefully which IOS benefits, in terms of efficiency and effectiveness, are more important for substantiating IOS investments, and to make decisions regarding IOS implementation accordingly.

1. Introduction

Interorganizational information systems (IOS) are increasingly relied on to facilitate the electronic exchange of data among organizations. Though the maturity of IOS technology varies across industries, IOS is generally considered to be leading-edge technology. Straub and Wetherbe (1989) for example reported the results of a Delphi Survey involving twelve information systems experts, which indicated that communication technologies, including IOS, are second in innovative technologies anticipated to have dramatic impacts on organizational outcomes, structures, processes and cultures during the 1990s. Perhaps reflective of the relative recentness of IOS technology in many industries is the growing body of research on IOS of late, which may be classified into empirical [Zaheer and Venkatraman 1994, Bouchard 1993, Hammer 1993, Venkatraman and Kambil 1991, Hart and Estrin 1991, Swatman and Swatman 1991, Venkatraman and Zaheer 1990, Hansen and Hill 1989, Nidumolu 1989], conceptual or prescriptive [Mukhopadyay 1993, Emmelhainz 1993, Johnston and Vitale 1988, Cash and Konsynski 1985, Cash 1985, Parsons 1983, Barrett and Konsynski 1982] and analytic economic modeling domains [Wang and Seidmann 1995, Nault and Dexter 1993, Chismar and Meier 1992, Clemons and Kleindorfer 1992, Bakos 1991a, Bakos 1991b, Clemons and Kimbrough 1986].

Though substantive progress by the research community toward understanding IOS technology has been made, one unattended issue is understanding more fully the efficacy of alternative management strategies for assimilating IOS into organizational processes. Referred to here as *IOS assimilation strategies* and in pursuit of the performance benefits, these strategies may offer to management alternatives for planning for and proceeding with IOS implementation. Though some organizations are forced into IOS relationships by other organizations [Bouchard 1993], many organizations elect to enter into IOS-mediated interorganizational relationships due to the presumed organization performance advantages. That some organizations *elect* to enter these relationships instills an element of discretion in managerial decision-making regarding IOS, and accentuates the practicality of discretionary IOS assimilation strategies.

Classified into the empirical domain noted above, this paper's objectives are to introduce alternative IOS assimilation strategies, to propose their diverse impacts on associated IOS costs and performance benefits, and to empirically evaluate their proposed impact on performance benefits. Should the empirical results show comparative differences between the IOS assimilation strategies in attainment of the performance benefits, management's subscription to a more deliberate and proactive planning posture is warranted.

2. IOS Assimilation Strategies

Keen (1991) identified two conceptually distinct ways in which an organization may extend its computing infrastructure which he labeled "reach" and "range". He explained that an organization's telecommunication infrastructure's "reach" may be extended by connecting with other additional organizations¹. An increase in "reach" is an extension of the computing infrastructure's *breadth*. For example, "reach" is extended when an insurance company connects additional geographically dispersed regional sales offices to their internal electronic mail system. Alternatively, an organization's computing infrastructure's "range" may be extended by implementing additional functionality on it. An increase in "range" is an extension of the computing infrastructure's *depth*. So, for example, "range" is extended when the same insurance company implements file transfer capability, in addition to electronic mail, on the computing infrastructure for use with the existing set of "connected" organizations.

These same concepts may be applied to IOS. Defined as automated systems to support the exchange of data in structured formats between two organizations,² IOS reach may be extended by exchanging structured data with additional organizations. For

¹ For purposes of the conceptual and theoretical discussions in Section 2 IOS Assimilation Strategies and Section 3 Costs and Benefits, these other organization entities may or may not be part of the organization as legally constituted. ¹ With regards to the empirical results, these other organization entities are not part of the organization as legally constituted and may be appropriately referred to as *trading partners*.

² This definition is comparable to that used by Hansen and Hill (1989).

example an insurance company, that has been exchanging claim data over an IOS with some organizations, may extend the IOS's reach by electronically exchanging claim data with additional organizations. Alternatively, the same insurance company may extend IOS range by implementing additional functionality on the IOS with existing trading partners. So, for example, the insurance company may additionally implement the electronic exchange of eligibility data over the IOS with its trading partners.

These two alternatives for IOS extension correspond to Keen's notions of "reach" and "range" regarding the computing infrastructure, and represent the IOS assimilation strategies. Borrowing from his terminology, this paper employs the **IOS Reach Strategy (IReS)** and **IOS Range Strategy (IRaS)** terms to represent alternative strategies which *comparatively* emphasize an expansion of the IOS infrastructure through extension of IOS reach and range respectively. Following an IReS strategy, an IOS manager would implement³ a single transaction-type (t_1)⁴ or function⁵ with one organization, and then direct resources to exhaust penetration of t_1 by electronically exchanging these structured data with as many organizations that are willing. Subsequently, the IOS manager can follow with implementation of t_2 and proceed with exhaustive penetration of it. The IOS manager can continue in this fashion until all available transaction-types have been implemented. An IOS manager following an IRaS strategy, on the other hand, would first implement all available transaction-types with one organization, and then follow with concurrent exhaustive penetration of all transaction-types with the remaining organizations.

In practice, rigid subscription to IReS and IRaS by IOS management is unlikely to

³ The term 'implement' is intended to refer to the purchase or development and testing of the necessary hardware, software and procedures required to support the IOS. The end of this phase is demarcated by the organization's ability to effectively exchange data through electronic means with at least one organization.

⁴ The term transaction-type is intended to correspond roughly to a particular document-type, such as a medical claim, purchase order, invoice, etc.

⁵ The specification of functions is an arbitrary decision. Though multiple transaction-types may be necessary to support a given function, for purposes of discussion it is assumed that one transaction-type will support one function and represents an extension of IOS range.

occur for various reasons⁶, therefore a typical organization's IOS assimilation strategy will fall between the extreme cases as the organization concurrently extends both the reach and range of its IOS infrastructure over time. However the *comparative* emphasis on either IReS or IRaS across organizations within a given industry will likely vary, as is demonstrated in the empirical results later. A focus on these "extreme" cases does, nevertheless, aid in highlighting the substantive differences in costs and performance benefits which may theoretically obtain.

3. Costs and Benefits Associated with IOS Assimilation Strategies

The *types* of IOS vary by industry. Bako's (1991b) theoretical work on IOS distinguishes between two types: information links and electronic marketplaces. One distinctive criterion between the two types is in regards to the IOS's *primary* purpose or function--defined by whether the motivation for IOS participation is ex ante or ex post a transaction⁷ between two organizations. If the primary purpose is ex ante (e.g., a price inquiry into an airline computer reservation system), then the IOS is considered an electronic marketplace. If the primary purpose is ex post (e.g., an automobile supplier's invoice), then the IOS is considered an information link.⁸

Another distinctive criteria Bakos used for characterizing an IOS is multi-lateral (not asset specific) versus bi-lateral (asset specific). According to Bakos' discussion, a multi-lateral IOS (i.e., a many-to-many formation) corresponds to an electronic marketplace and a bi-lateral IOS (i.e., a one-to-one or one-to-many formation) corresponds to an information link. However we suggest that these distinctive criteria are different dimensions, because it is possible to have a multi-lateral information link (e.g.,

⁶ The decision to exchange data electronically is made by two organizations, therefore an IOS manager does not have complete control over decision-making. In addition, the development of transaction-types within a given industry evolve over time, and are introduced intermittently not simultaneously.

⁷ Transaction is defined as either manifesting, or activating a process leading to later manifestation of, a monetary exchange.

⁸ As recognized by Bakos, most IOS evolve into a hybrid of these two types.

check clearinghouses of the banking industry). Such IOS are characterized as non-asset specific IOS with a primary ex post purpose. The ensuing discussion on costs and performance benefits is in regards to a *multi-lateral information link IOS type*.

All IOS require an intermediary--one or several organizations which assume primary responsibility for development, maintenance and operation of the IOS. The intermediary is also (typically) one participant, among many, in the industry. For the ensuing discussion on costs and benefits, the perspective of a non-intermediary participant, henceforth referred to simply as *participant*, is assumed.

It is widely recognized that IOS implementation incurs substantial fixed costs [Nault and Dexter 1993, Clemons and Kleindorfer 1992, Chismar and Meier 1992, Bakos 1991a, Bakos 1991b].⁹ Nault and Dexter (1993) classify these costs as *hard assets* and *soft assets*; Bakos (1991a) categorized these costs into hardware, software, training and organization transformation. Though the largest share of these fixed costs are borne by the intermediary, substantial fixed costs manifested in hardware, communication software, application software, training and organization transformation are incurred by the participant as well. Corresponding to an extension of IOS range, successive implementation of *individual* transaction-types will incur substantial fixed costs *for each*, even though learning effects and singular investment in hardware and communication software may reduce the marginal costs.

Once a transaction-type is implemented, the participant incurs variable costs by an increasing penetration of IOS-based exchange with other organizations--an extension of IOS reach. These variable costs include primarily telecommunication transmission fees. It is generally accepted that these variable costs are comparatively low in contrast to the fixed costs [Nault and Dexter 1993, Bakos 1991a, Bakos 1991b].

Often referred to as network externalities, performance benefits that manifest through IOS use accrue primarily through an increasing penetration of IOS-based

⁹ The various terms used in these research works include 'IOS Adoption Costs', 'Sunk Capital', 'Sunk Investment', 'Fixed Investment', 'Investment'.

exchange with other organizations as the organization shifts data exchange away from the manual (or paper) system to the electronic system [Wang and Seidman 1995, Chismar and Meier 1992, Bakos 1991b, Bakos 1991a]. Though substantial uncertainty regarding and variability of these performance benefits are likely across organizations [Clemons and Kleindorfer 1992, Bakos 1991a], one may safely reason that an increasing penetration of IOS-based exchange--an extension of IOS reach, will exact greater performance benefits which generally arise through IOS use.

Given these differences, one may reason that, pursuant to a comparative emphasis on IReS and IRaS, differences in costs and performance benefits will manifest. An IReS is likely to be associated with comparatively low fixed costs, high variable costs and greater performance benefits; an IRaS is likely to be associated with comparatively high fixed costs, low variable costs and lesser performance benefits. These differences are summarized in Table 3-1.

Due to limitations regarding cost data, the remainder of this paper focuses on assessment of the performance benefits. Specifically, the empirical data are used to assess whether organizations placing a comparative emphasis on IReS realize greater performance benefits than do organizations placing a comparative emphasis on IRaS. The following proposition is made.

Proposition 1: Organizations that place a comparative emphasis on IReS to guide IOS assimilation will realize greater performance benefits than will organizations that place a comparative emphasis on IRaS.

	Fixed Costs	Variable Costs	Benefits
IReS	Low	High	Greater
IRaS	High	Low	Lesser

Table 3-1: IOS Assimilation Strategies' Comparative Costs and Benefits

4. Method

A nonparametric data analysis technique is used to test the proposition. Based on

rank-order analysis common to many nonparametric analyses, the Friedman test [Kendall 1948, Friedman 1937] is presented following sections on data sources, IOS assimilation strategy measures, performance benefit measures, and reliability and validity testing.

4.1 Data Sources

Primary and secondary data are used to test the proposition. Primary data were gathered through a survey instrument, which was distributed to sixty-six Group Insurance' organizations in the United States and Canada. Forty-eight organizations returned the survey which represents a 73% response rate. Secondary data were obtained from the Life Office Management Association (LOMA) and are used to augment the primary data set for some benefit measures. LOMA data have been used in prior research studies [Harris and Katz (1991), Harris and Katz (1991b), Bender (1986)].

The Group Insurance industry includes primarily medical, life, disability and dental insurance services, which contrasts to the Personal Insurance industry offering primarily property and casualty insurance services. The Personal Insurance industry has been the sample industry of prior research studies [Zaheer and Venkatramen 1994, Venkatramen and Zaheer 1990], however the Group Insurance industry, to the best of the author's knowledge, has not been.

4.2 IOS Assimilation Strategy Groups

Based on two measures that reflect the organizations' IOS *use intensity* in terms of IOS reach and IOS range--referred to as **IOS Reach** and **IOS Range** respectively, allocation of the forty-eight organizations into five distinct groups is conducted. The five groups include High Reach-High Range, High Reach-Low Range, Low Reach-High Range, Low Reach-Low Range, and No IOS.¹⁰ The median value (computed exclusive of the No IOS organizations) separates the 'High' and 'Low' groups for both IOS Reach

¹⁰ The last group represents absence of any IOS Assimilation Strategy as described above, but these organizations are included as no IOS use may be construed as a deliberate strategy on IOS management's behalf. Moreover, results pertaining to the 'No IOS' group provide an interesting contrast to the other four groups.

and IOS Range measures. These groups inhere varying *comparative* emphases on IReS and IRaS.

4.2.1 The IOS Reach and IOS Range Measures

Identified through external data sources and pretesting, five transaction-types specific to the Group Insurance industry were included on the survey instrument. These include the Eligibility, Enrollment, Claim Payment, Claim and Claim Status transaction-types. Respondents were instructed to indicate the *number of trading partners* that their organization has implemented each transaction-type with, and the percentage of total data exchange volume that is mediated through each transaction-type--referred to as *electronic exchange volume*. To arrive at organization-level measures, the *average electronic exchange volume*¹¹ across and *the number of the transaction-types with electronic exchange volumes greater than or equal to one percent* were used to represent IOS Reach and IOS Range respectively. Refer to Figure 4-1 for a hypothetical example using the electronic exchange volume measure.

The distributions of the IOS Reach and IOS Range measures are shown below in Figure 4-2 and Figure 4-3 respectively. These measures are used to allocate the organizations into the five groups noted above.

Organizations	Electronic Exchange Volumes					IOS Reach	IOS Range
	Enrollment	Eligibility	Claim	Claim Status	Claim Payment		
1	0%	0%	10%	10%	0%	20/2=10%	2
2	50%	0%	5%	5%	0%	60/3=20%	3
3	0%	0%	0%	0%	0%	= 0%	0
4	5%	5%	5%	5%	0%	20/4= 5%	4

Transaction-type Level Data
(Recorded as Survey Data)

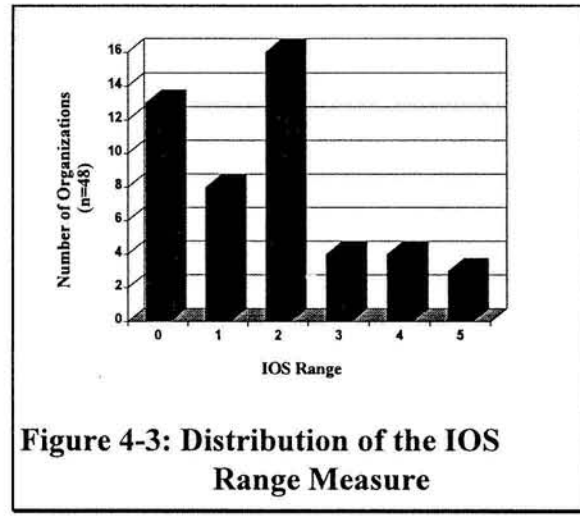
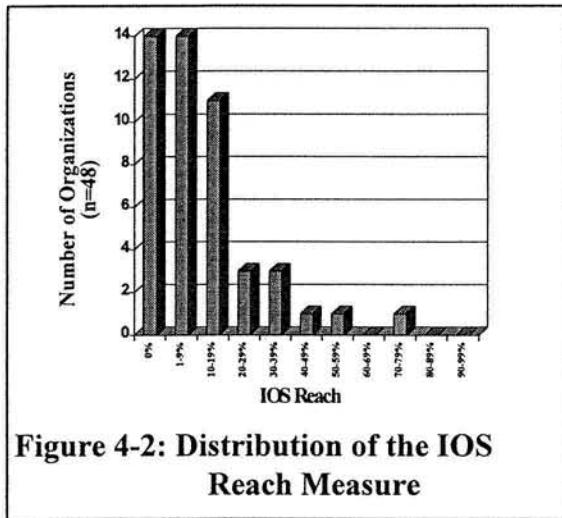
Organization
Level Data
(Computed)

Figure 4-1: IOS Reach and IOS Range Measures

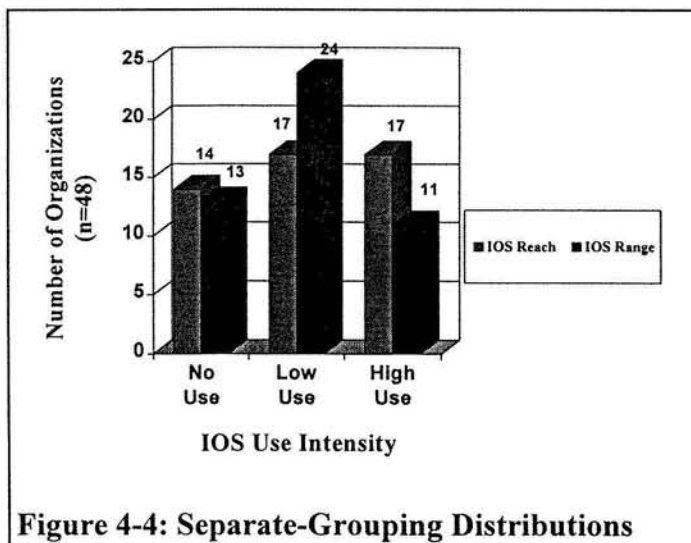
The median value for IOS Reach is 11% and for IOS Range is ‘2’. Because ‘2’ is also the IOS Range distribution’s mode, the ability to force equal numbers of organizations into Low Use and High Use groups for IOS Range was constrained. Therefore an IOS Range value

¹¹ The number of trading partners measure was deemed unreliable, which is discussed in section 4.3 Reliability and Validity.

equal to '2' was designated as Low Use, because to have designated the value '2' as High Use would have made the two groups even more unequal.



The resulting distributions of the organizations into No, Low and High Use groups for IOS Reach and Range are shown separately in Figure 4-4: Separate-Grouping



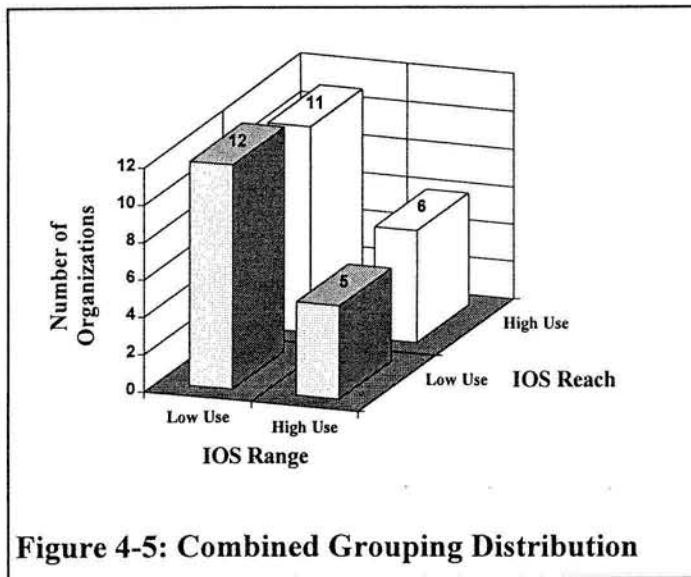
Distribution¹² and combined in Figure 4-5: Combined Grouping Distribution. The distribution in Figure 4-5 does not include the No IOS group as measured by IOS Reach.

4.2.2 The Benefit Measures

Meier and Chismar (1991) suggested that IOS performance

¹² The unequal number of cases for the two No Use groups occurs because one respondent provided the number of trading partners figures, while the electronic exchange volume data were left missing. Therefore this organization is included in the No Use group for the IOS Reach measure, while it is not included in the No Use group for the IOS Range measure.

benefits fall into one of two categories: efficiency and process (or effectiveness) benefits. Selection made with consideration of the *expected* IOS performance benefits imparted by



the transaction-types under study, the benefit measures used here are grouped into efficiency and effectiveness categories.

The efficiency measures include the number of total full-time equivalent employees (Total Employees), professional full-time equivalent

employees (Professional Employees), and administrative full-time equivalent employees (Administrative Employees). Total Employees is collected as a nominal figure. Professional Employees and Administrative Employees are computed according to a percentage of Total Employees, specified by the respondent as the proportion of Total Employees performing professional and administrative roles.¹³ All recorded figures represent employment levels at 1993 year-end. All efficiency measures are controlled for organization size effects by dividing by annual premium income.

The effectiveness measures include the number of new policies (New Policies), the number of renewed or retained policies (Renewals), the number of claims processed (Claims Processed), the percentage of claims in error (Claim Error Rate), the time between receipt of claim information and claim payment (Claim Payment Time), and the time required for a policy member to enact a change in enrollment information or terms, e.g., change in marital status or deductible amount (Administrative Change Time). The first three effectiveness measures are nominal figures and are controlled for organization

¹³ The survey instrument was designed such that the percentage figures had to 100%.

size effects by dividing by annual premium income. The fourth effectiveness measure is a percent figure, while the last two effectiveness measures are scaled on the number of days and reflect averages. All figures are for 1993. Refer to Table 4-1 on page 11 for a summary.

4.3 Reliability and Validity

Table 4-2: Reliability and Predictive Validity Tests on page 12 shows the reliability and validity test results which, though limited due to data availability constraints, were obtained where possible. Since all measures require largely objective data, the limited reliability and validity testing is not considered a major methodological weakness.

Measure Name	Measure Description	Measure Scale
IOS Assimilation Strategy Measures		
IOS Reach	Electronic exchange volume as percent of total exchange.	Percent Figure
IOS Range	Number of transaction-types implemented	Nominal figure
Efficiency		
Total Employees (Adjusted)	Number of Total FTE Group employees per million dollars of premium income	Nominal figure
Professional Employees (Adjusted)	Number of Professional FTE Group employees per million dollars of premium income	Nominal figure--computed as percent of Total Employees
Administrative Employees (Adjusted)	Number of Administrative FTE Group employees per million dollars of premium income	Nominal figure--computed as percent of Total Employees
Effectiveness		
New Policies (Adjusted)	Number of New Group Policies for 1993 per million dollars of premium income	Nominal figure
Renewals (Adjusted)	Number of Renewed Policies for 1993 per million dollars of premium income	Nominal figure
Claims Processed (Adjusted)	Number of Claims Processed for 1993 per million dollars of premium income	Nominal figure
Claim Error Rate	Of total claims, the percentage held in suspense or requiring successive forms	Percentage
Claim Payment Time	The number of days between claim receipt and claim payment disbursement	Average number of days
Administrative Change Time	The number of days between information receipt and appearance on claims system	Average number of days

Table 4-1: Measure Summary

Inter-item and inter-rater reliability tests were conducted for IOS Reach (at the transaction-type level) and the Total Employees variables respectively. The Electronic Exchange Volume and Number Of Trading Partners measures for IOS Reach are unreliable with alpha values ranging from .00 to .06. Review of the raw data suggests there may have been a misinterpretation as to the meaning of trading partner.

Variable	Reliability		Predictive Validity
	Cronbach's α	Items	Pearson's r
IOS Assimilation Strategy Measure Bases			
IOS Range	(no test) \Rightarrow		
IOS Reach	(computed variable)		
IOS Reach by Transaction-types¹			
Eligibility	.00 (n=9)	2	n/a
Enrollment	.06 (n=20)	2	n/a
Claim Payment	.01 (n=10)	2	n/a
Claim	.00 (n=24)	2	n/a
Claim Status	.00 (n=10)	2	n/a
Efficiency Benefits			
Total Employees ²	.79 (n=33)	2	n/a
Professional Employees	(no test) \Rightarrow		
Administrative Employees	(no test) \Rightarrow		
Effectiveness Benefits			
New Policies	(no test) \Rightarrow		
Renewals	(no test) \Rightarrow		
Claims Processed	(no test) \Rightarrow		
Claim Error Rate	(no test) \Rightarrow		
Claim Payment Time (# of days) ³	n/a	n/a	.82** (n=12)
Administrative Change Time (# of days) ³	n/a	n/a	.53 (n=5)
Organization Size			
Premium Income (millions of dollars) ³	n/a	n/a	.99** (n=17)
1- Inter-item Reliability; 2- Inter-rater Reliability; 3- Predictive Validity **- Significant at the .01 level *- Significant at the .05 level n/a- not applicable			

Table 4-2: Reliability and Predictive Validity Tests

The raw data show that '1' was recorded by many respondents, interpreting 'trading partners' as the 'intermediary' and *not* the participant as requested. Consequently the

Number Of Trading Partners as a measure of IOS Reach is considered unreliable, resulting in use of the Electronic Exchange Volume measure which provides the advantage of controlling for organization size effects. The α value for Total Employees is .79, which is close to the recommended .80 threshold.

Validity may be discussed in terms of content and predictive/convergent validity[Ives, Olson and Baroudi 1983]. Established through consideration of the process followed in constructing the measuring instrument, *content validity* may be justified through pretesting as measures are identified according to the sampling population.¹⁴ The survey instrument was pretested by seven individuals: five senior information systems personnel in three insurance companies and two employees of LOMA.

Predictive/Convergent validity is represented through the convergence of two measures for the same variable, but from different data collection instruments and/or data sets. Predictive validity tests have been conducted on two measures using the primary and secondary data sources. The Claim Payment Time measure is significantly correlated at ($p<.01$), providing evidence of predictive validity. The Administrative Change Time measure is not significantly correlated, though this is likely due to a small 'n=5' as the correlation is quite high at .53 and in the expected direction.

4.4 The Friedman Test

Appropriately applied when the same groups are observed multiple times [Kerlinger 1986], the Friedman test is used to test the proposition's validity. As a nonparametric test, the Friedman test relies on the general technique of rank analysis [Kendall 1948] and is chi-square distributed

After dividing the organizations into the five groups--High Reach-High Range, High Reach-Low Range, Low Reach-High Range, Low Reach-Low Range, and the No Use organizations, the groups were ranked on each benefit measure according to the

¹⁴ Item-total correlations provide another means to assess content validity, however the survey instrument was not designed for conducting this validity procedure.

mean value for each group. As an example, the rank (indicated in parentheses) of the five groups according to Administrative Employees mean values is shown below. In this example, the group with High Reach-High Range performed best with regards to Administrative Employees and is designated as first ranking. The second ranking is assigned to the No Use group, the third ranking is given to the Low Reach-High Range group, the fourth ranking is allotted to the Low Reach-Low Range group, and the final ranking is given to the High Reach-Low Range group.

IOS Reach	None	Low	Low	High	High
IOS Range	None	Low	High	Low	High
Administrative Employees	(2) 0.63	(4) 1.19	(3) 0.65	(5) 1.57	(1) 0.46

Table 4-3: Ranking Example for Administrative Employees

After similar procedure with the eight other benefit measures, the following rankings resulted. Using the rankings in Table 4-2, three Friedman statistics were computed: (1) for all benefit measures, (2) for the efficiency measures; and (3) for the effectiveness measures.

IOS Reach	None	Low	Low	High	High
IOS Range	None	Low	High	Low	High
Efficiency Measures					
Total Employees	3	4	2	5	1
Professional Employees	2	5	3	4	1
Administrative Employees	2	4	3	5	1
Effectiveness Measures					
New Policies	1	4	5	2	3
Renewals	1	4	5	2	3
Claims Processed	5	4	3	1	2
Claim Error Rate	3	4	2	1	5
Claim Payment Time	4	1	2	3	5
Administrative Change Time	2	5	4	1	3

Table 4-4: Rankings for All Groups

5. Results

The results are shown in Table 5-1: Friedman Test Results. The Friedman test result for the efficiency measures is significant, while for the effectiveness measures and the benefit measures overall the test is not significant. These results indicate that the five

groups differed significantly in ranking on the efficiency measures, and did not differ significantly on the effectiveness measures nor on the benefit measures overall. Examination of the rankings in Table 4-4 indicates that the High Reach-High Range group performed best on the efficiency measures. The No Use group and Low Reach-High Range had average performance, while the Low Reach-Low Range and High Reach-Low Range groups had the worst performance.

	Friedman Test Observed X Square Distributed	X Square Significance Level at $p < .05$, $df = 4$
(1) Benefit Measures ($k=9$, $n=5$)	4.5	9.49
(2) Efficiency Measures ($k=3$, $n=5$)	10.9	
(3) Effectiveness Measures ($k=6$, $n=5$)	6.8	

Table 5-1: Friedman Test Results

6. Discussion

Though a significant result obtained on the efficiency measures, its interpretation does not grant unqualified support for the proposition under investigation. Unsurprisingly, the High Reach-High Range performed best with the first ranking across all efficiency measures. This group cannot qualify as pursuing IReS however, since an IRaS is also represented. Pursuant of an IReS, the High Reach-Low Range group actually performed the worst as measured by rankings on the efficiency measures. Moreover, its comparative performance lagged behind the Low Reach-High Range group which can be qualified as pursuing IRaS. Collectively these results are contrary to the proposition stated earlier, and suggest that an IRaS may lead to greater comparative improvements in organization efficiency as represented by these organizations of the Group Insurance industry.

In contrast, on five of the six effectiveness measures the High Reach-Low Range group (i.e., the group pursuing IReS) fared comparatively better than did the Low Reach-High Range (i.e., the group pursuing IRaS), even though the Friedman test results are not significantly different for all five groups. When considering only the High Reach-Low

Range and Low Reach-High Range groups for the Friedman Test however, the result is significant at $p < .10$, $df=1$ for the efficiency measures and nearly significant at $p < .10$, $df=1$ for the effectiveness measures.¹⁵ (Refer to Table 6-1.) Collectively, these results suggest that either greater efficiency or effectiveness gains may obtain contingent on the IOS Assimilation Strategy pursued, with IReS associated with improved effectiveness and IRaS associated with improved efficiency.

	IRaS	IReS
IOS Reach	Low	High
IOS Range	High	Low
Efficiency Measures		
Total Employees	1	2
Professional Employees	1	2
Administrative Employees	1	2
Effectiveness Measures		
New Policies	2	1
Renewals	2	1
Claims Processed	2	1
Claim Error Rate	2	1
Claim Payment Time	1	2
Administrative Change Time	2	1

Table 6-1: Rankings for IReS and IRaS Groups Only

These results suggest that, in the Group Insurance industry, IOS management may proceed with IOS planning and implementation more deliberately in order to focus where the performance benefits manifest. This would allow IOS management to more adequately anticipate where the performance benefits are more likely to accrue and, equally useful, where they are *not* likely to accrue. For example, if an IOS manager has exhausted the IOS's reach due to the remaining trading partners unwillingness to exchange data electronically, the IOS manager could follow an IRaS by advocating the efficiency benefits and downgrading the effectiveness benefits. Though not conclusively supported here, these results suggest that additional research centrally focused on this

¹⁵ The $p < .10$ is used because with only three observations and two groups, as is the case for the efficiency measures test based on the rankings in Table 6-1, it is not theoretically possible to achieve significance at $p < .05$.

supposition may be worthwhile and offers one research extension.

The results surprisingly indicated that the No Use group performed comparatively well. On five of nine measures the No Use group ranked first or second; on only two of nine measures did it rank fourth or fifth. It is highly unlikely that non-IOS organizations will outperform IOS organizations given the obvious advantages of enhanced speed and accuracy in exchanging data electronically over manual methods [Bakos 1991b]. These results are more likely aberrant--ensuing from an early stage of IOS technology diffusion in the Group Insurance Industry.¹⁶ These organizations may be sacrificing short-term performance degradation as they absorb the substantive organizational change which surrounds IOS implementation in order to secure long-term performance improvement. It is noteworthy that the group which consistently performed comparatively worse is the Low Reach-Low Range group.¹⁷

This result suggests that IOS implementation incurs dramatic change as it temporarily suspends and disrupts "normal" (i.e., established) organizational processes; yet, concurrently, this result begs the question of how IOS implementation may proceed without incurring, or at least diminishing either in strength or duration, these short-term periods of performance degradation. One research option is to examine in-depth the causes of short-term performance degradation. Perhaps there are organizational antecedents (e.g., a decentralized, fragmented computing infrastructure, or poor-to-nonexistent training programs) or processual concerns (e.g., IOS project management) that may attenuate these adverse short-term impacts, and can be more effectively managed if suitably identified.

¹⁶ The average IOS Reach is 11% which is relatively low and indicative of an early stage of technology diffusion. The early stage of IOS diffusion in the Group Insurance industry is also supported by many trade press articles of the early 1990s.

¹⁷ It is assumed that the IOS Reach and IOS Range measures may be used as surrogates for "IOS experience", since those organizations in the High Reach and High Range groups presumably have been working with IOS technology longer than have the Low Reach and Low Range groups.

7. Conclusions

The concurrent pursuit of IReS and IRaS may derive greater efficiency benefits, and IRaS alone may afford comparatively greater efficiency benefits to the extent one strategy must be emphasized over the other. In contrast, IReS alone may provide comparatively greater effectiveness benefits. Management is advised to weigh carefully which IOS benefits, in terms of efficiency and effectiveness, are more important for substantiating IOS investments, and to make decisions regarding the IOS Assimilation Strategy accordingly.

Additionally, short-term performance degradation, resulting (probably) from the substantive organization change associated with IOS implementation, merits specific management concern and attention. An attempt to deliberately highlight these short-term adverse consequences on performance at onset of IOS implementation may be prudent on management's behalf, in order to avoid subjugation of an IOS program's benefits to short-term reactionary concerns.

8. Contributions

To date, little research has recognized, developed, measured or assessed various strategies for managing IOS assimilation into organizations. The empirical evidence presented here suggests the adoption of a contingency perspective, which will facilitate a more proactive and purposeful management posture for focusing potential performance benefits stemming from IOS use. An important question to address in light of the increasing preponderance of electronic integration as a *strategic* means for improving organization performance in many industries (Cash and Konsynski 1985, Johnston and Carrico 1988, Johnston and Vitale 1988).

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