Volume 1, Number 2 **ISSN Pending**

ACADEMY OF INFORMATION AND MANAGEMENT SCIENCES JOURNAL

An official Journal of the

Academy of Information and Management Sciences

Chris Lee
Editor
Central Washington University

Editorial and Academy Information
may be found on the Allied Academies web page
www.alliedacademies.org

The Allied Academies Journal is published by the Allied Academies, PO Box 2689, 145 Travis Road, Cullowhee, NC 28723, (828) 293-9151, FAX (828) 293-9407. Those interested in subscribing to the Journal, advertising in the Journal, submitting manuscripts to the Journal, or otherwise communicating with the Journal, should contact the Publishers at that address.

ACADEMY OF INFORMATION AND MANAGEMENT SCIENCES JOURNAL

CONTENTS

LETTER FROM THE EDITORS

Welcome to the first edition of the *Academy of Information and Management Sciences Journal.* The Academy of Information and Management Sciences is an affiliate of the Allied Academies, Inc., a non profit association of scholars whose purpose is to encourage and support the advancement and exchange of knowledge, understanding and teaching throughout the world. The *AIMSJ* is a principal vehicle for achieving the objectives of the organization. The editorial mission of this journal is to publish empirical and theoretical manuscripts which advance the disciplines of Management Science and Information Systems.

As has been the case with the previous issues of the journals supported by the Allied Academies, the articles contained in this volume have been double blind refereed. The acceptance rate for manuscripts in this issue, 25%, conforms to our editorial policies.

The Editor of this Journal will continue to welcome different viewpoints because in differences we find learning; in differences we develop understanding; in differences we gain knowledge and in differences we develop the discipline into a more comprehensive, less esoteric, and dynamic metier.

Information about the Allied Academies, parent organization of the *AIMS*, the *AIMSJ*, and the other journals published by the Academy, as well as calls for conferences, are published on our web site. In addition, we keep the web site updated with the latest activities of the organization. Please visit our site and know that we welcome hearing from you at any time.

JoAnn and Jim Carland
www.alliedacademies.org

THE ECONOMETRIC ANALYSIS OF ATTENDANCE AND GIVING IN THE LOCAL CHURCH

James E. McIntyre, Jr., Jacksonville State University
Faye S. McIntyre, State University of West Georgia
Norman Keith Womer, University of Mississippi

ABSTRACT

The purpose of this paper is to explain variations in church attendance and collections using economic variables and service-specific events (e.g., communion, special music, holiday services). Two-stage least squares regression analysis is used to model the relationships. The study finds that attendance is responsive to service-specific events and collection levels depend primarily on the proximity of the service to the congregation's payday. Policy implications are discussed.

INTRODUCTION

Like many charitable organizations, churches receive most of their income from donations of local patrons. Therefore, the effectiveness of a church, at both the denomination and local levels, is dependent upon its ability to attract donations from its congregations (Hansmann, 1980). Given the interdependence of donations and attendance (Ehrenberg, 1977) and evidence indicating that the general time trend of donations is negative (Hood, Martin & Osberg, 1977), a thorough understanding of church attendance and donations is imperative. Further refinement of economic models assessing such topics is indicated (Hoge 1994).

Though economic analysis of religious behavior is receiving increasing attention in the literature (e.g., Hoge 1994; Sullivan 1985), little is known at the micro, or church, level. The purpose of this paper is to demonstrate econometric analysis as a viable method to explain variations in church attendance and collections at the microeconomic level.

LITERATURE REVIEW

Church attendance at the macro level shows little change over time (Hout and Greeley 1987; Markides 1983); however, attendance at local levels may be more volatile. There is evidence to suggest a pattern of increasing attendance (Chaves 1989) and increasing giving (Feldstein and Clotfelter 1976) with age, raising the question of the significance of the elderly population within a local congregation. In addition, a local church that offers more than one morning service may find that attendance at one service has an impact on attendance at the other.

Overall, religious giving is responsive to economic activity (Pickering 1985). At the micro level, economic activity (particularly in a small community) can be highly dependent on one business or institution.

A number of micro-level studies have examined the level and determinants of charitable contributions at the household level, with particular emphasis on the effect of tax policies as an incentive to giving (e.g., Clotfelter 1980; Feldstein 1975). Though evidence indicates that charitable contributions, as a whole, are sensitive to tax policy, Feldstein's (1975) findings indicate that religious organizations are less sensitive than other types of charitable organizations (e.g., hospitals, educational institutions). Anecdotal evidence at the local church level indicates that a portion of contributors will either increase giving as the tax year approaches an end or will postpone giving until the end of the tax year, suggesting that tax policy may have a significant effect on contributions at this level of analysis.

A totally overlooked phenomenon with potential explanatory power is that of special "events" at the local church level. If these events are viewed by patrons as content-providing, they may have an effect on attendance (Myers 1975). So far as these special events are above and beyond the normal scope of the church service, they may engender increased donations as well (Vickery 1962).

The preceding discussion leads to the need to test the following five relationships: 1) the effect of special church events on attendance; 2) the effect of attendance at one service on attendance at the second service; 3) the effect of attendance on collections; 4) the effect of economic variables on collections; and 5) the effect of special church events on church giving.

THE SAMPLE

This study is based on data obtained from one congregation of a United Methodist Church located in Oxford, Mississippi. Oxford is the home of the University of Mississippi; students and employees of the university comprise a major segment of the congregation. Data were taken from church records (including church bulletins, newsletters, accounting records, and Sunday School attendance records) over a four-year period. After accounting for missing values, the final sample contained 199 observations. Additional data were obtained from the budgets and payroll records of the university (the major employer in the area).

Table I defines the model variables, placing each variable into one of four categories: *attendance*, *collection*, *event*, and *economic*. *Attendance* variables measure the size of the congregation at each of the two morning services (8:45 and 10:55). The *collection* variables represent the financial contributions of the congregation. These are expressed in terms of November 1986 values to eliminate the effects of inflation on the statistical tests. November 1986 serves as a useful reference point for the collection variables since November is the pledge month for this congregation, and the congregation's first decision affecting giving during the study period occurred during November 1986.

The *event* variables are designed to measure the effect of special events on collections and/or attendance. All *event* variables are coded 1 if the event occurs and 0 otherwise. The *economic* variables measure the effect of events occurring outside the church on collections and/or attendance. With the exceptions of the BUDGET variable (which is dollar-denominated and expressed in terms of November 1986 dollars), the *economic* variables are coded 1 if the event occurs and 0 otherwise. Since many congregation members are paid on the last business day of each month, these variables measure the relation between church collections and the proximity of the service to the congregation's payday.

METHODOLOGY

At the micro level, church attendance and giving are the result of individual decisions. Frequently, the individuals involved make decisions that simultaneously affect several other variables of interest. For example, a decision to attend one service is often a decision not to attend another. The existence of variables that are simultaneously determined requires econometric modeling, a term referring to a system of simultaneous multiple regression equations (Makridakis, Wheelwright, and McGee 1983). The principle advantage of econometric modeling is the ability to deal with interdependencies among the variables. The most popular of the several techniques to estimate simultaneous equations models, two stage least squares, is employed in this study.

The problem in simultaneous equations systems is that one endogenous variable (e.g., attendance at the 8:45 service) may explain another (attendance at the 10:55 service) and also be correlated with the error term in the second equation (equation for attendance at the 10:55 service). This correlation results in inconsistent estimates when classical least squares regression is applied to the equation. In effect, two stage least squares replaces attendance at the 8:45 service with an instrumental variable that is highly correlated with 8:45 attendance but uncorrelated with the error term, thus removing the problem. This instrumental variable is a weighted sum of all of the exogenous variables in the system.

EMPIRICAL RESULTS

Table 2 provides descriptive summary measures for the attendance and collection variables. The table indicates the attendance of the 10:55 service is almost four times that of the 8:45 service and that most church contributions are not given anonymously (i.e., the identity of the giver is known).

Table 3 shows the parameters estimated from the two-stage least squares regressions. Since the study uses time series data over four years, the regression results are compared with naive models which designate dummy variables for week of the month, month of the year, and year as exogenous variables. The R^2 of the most effective model is reported for each of the endogenous variables in Table 3.

The first two regressions model church attendance. The equation for attendance at the 8:55 service shows none of the coefficients of the model variables are significantly different from zero. This reflects the consistent attendance patterns of this congregation, perhaps also related to the fact that many of those attending this early service are elderly. It is interesting to note the occurrence of a communion service has a negative effect on attendance, though this effect is not significant.

Attendance at the 10:55 service shows significant and positive relationships with attendance at the 8:45 service, the presence of invited guests, the occurrence of other events (such as baptisms and the appearance of guest speakers), and the performance of special music. Communion service has a significant negative effect on attendance at this service. Thus, attendance and event variables explain a significant portion of the attendance at the 10:55 service.

The other three equations explain the variability observed in the three types of church collections. Identified offering is explained by the timing variables WEEK1 and WEEK2, indicating that the service was held during the first or second week of the month, respectively. Not surprisingly, these variables indicate that the proximity of the service to the university payday is significantly related to the size of the identified collection. The lack of significance of the other variables indicate the offering is invariant with the attendance variables, event, and remaining economic variables.

Anonymous unidentified offerings bear no significant relation to any of the variables tested. This offering in invariant with respect to all economic, event, and attendance variables. Special appeal collections is significantly related to whether an appeal is made from the pulpit, the proximity of the service to the university payday (both positive relationships)

and the presence of invited guests (a negative relationship). The negative coefficient of the presence of invited guests is likely due to the special nature of the appeals, which have meaning for the church membership but may have less meaning for others.

Table 3 also compares the models' adjusted R^2s with those obtained using the naive time series model. Only the 10:55 attendance model and the appeals collection model have more explanatory power than the naive models. However, even the naive models do little to explain attendance at the 8:45 service or the level of unidentified collections. The higher R^2 observed for the identified collections equation contains week-of-the-month dummies as exogenous variables and simply emphasizes the importance of the proximity of the church service to the size of the collection. The higher R^2 observed for the 10:55 attendance and special appeal equations point to the added importance of non-timing variables for these items.

One less than satisfying feature of the regression are the less than satisfactory Durbin-Watson statistics. We are unable to reject the null hypothesis of no autocorrelation in several of the regressions. Specifically, the null hypothesis of no serial correlation cannot be rejected for regressions in the 10:55 and 8:45 attendance equations and the unidentified and special appeal collections equations. However, because the level of autocorrelation does not appear too extreme, its effect on the efficiency of the parameter estimates should be minimal.

CONCLUSIONS

The two-stage least squares technique is found to be successful in explaining a significant portion of the variability in measures of church attendance and collections. Findings indicate that with the exception of communion, attendance at the 10:55 service can be increased by providing more service-specific events. For cash planning purposes, the results indicate the church leadership can simply observe the proximity of the service to a university payday to estimate identified collections. Given the invariance and relatively small size of unidentified offerings, efforts by the church leadership to increase the size of this collection would seem misdirected. Findings of the special appeal collection regression suggest that the pastor time appeals for special projects on the first or second Sunday of each month.

The lack of significant relationship between attendance and giving is most surprising. We believe that the preponderance of once-a-month giving is the source of this result. That is, we would expect a long term relationship between the general level of attendance and giving, but over this four year window there is too little change in average attendance for the long term to show up. The short term effect, if any, appears negligible.

The results achieved in this study should provide encouragement for further research in the area of church attendance and collections. Specifically, a useful next step would be to analyze the different patterns observed for attendance and collection variables for two or more churches in the same geographical area differing in denomination and member demographics. Another contribution would be to study the attendance and collection patterns for an entire denomination, either state-wide or country-wide. Studying these patterns should ultimately enable a deeper understanding of the motivations behind church participation and charitable giving.

REFERENCES

Chaves, M. (1989). "Secularization *and* Religious Revival: Evidence from U.S. Church Attendance Rates, 1972-1986." *Journal of the Scientific Study of Religion* 28 (4), 464-77.

Clotfelter, C.T. (1980). "Tax Incentives and Charitable Giving: Evidence From a Panel of Taxpayers." *Journal of Public Economics* 13, 319-40.

Ehrenberg R. (1977). "Household Allocation of Time and Religiosity: Replication and Extension." *Journal of Political Economy* 85 (April), 415-23.

Feldstein, M. (1975). "The Income Tax and Charitable Contributions: Part II--The Impact on Religious, Educational and Other Organizations." *National Tax Journal* 28 (June), 209-26.

Feldstein, M. And C.T. Clotfelter (1976). "Tax Incentives and Charitable Contributions in the United States: microeconomic Analysis." *Journal of Public Economics* 5, 1-26.

Hansmann, H.B. (1980). "The Role of Nonprofit Enterprise." *The Yale Law Journal* 89, 835-901.

Hoge, D.R. (1994). "Introduction: The Problem of Understanding Church Giving." *Review of Religious Research* 36 (December), 101-110.

Hood, R.D., S.A. Martin, and L.S. Osberg (1977). "Economic Determinants of Individual Charitable Donations in Canada." *Canadian Journal of Economics* 10 (November), 653-69.

Hout, M. And A.M. Greeley (1987). "The Center Doesn't Hold: church Attendance in the United States, 1940-1984." *American Sociological Review* 52 (June), 325-45.

Markides, K.S. (1983). "Aging, Religiosity, and Adjustment: A Longitudinal Analysis." *Journal of Gerontology* 38 (September), 621-25.

Myers, R.A. (1975). "Another Look at Religious Indicators: A Search for Understanding." *Character Potential: A Record of Research* 7 (August), 143-50.

Makridakis, S., S.C. Wheelwright, and V.E. McGee (1983). *Forecasting: Methods and Applications*. New York: John Wiley & Sons.

Sullivan, D.H. (1985). "Simultaneous Determination of Church Contributions and Church Attendance," *Economic Inquiry* 24 (April), 309-20.

Vickery, W.S. (1962). "One Economist's View of Philanthropy." In F.G. Dickinson (ed.), *Philanthropy and Public Policy*. New York, 31-56.

Table 1: Variable Definitions

COLLECTION VARIABLES	
IDENT	Contributions by identified contributors
UNIDENT	Contributions by unidentified contributors
APPEAL	Contributions for causes in response to a pulpit request
ATTENDANCE VARIABLES	
AT845	Attendance at 8:45 service
AT1055	Attendance at 10:55 service
GUESTS	1 if group was invited to attend 10:55 service, 0 otherwise
EVENT VARIABLES	
APPEALSUN	1 if service included pulpit appeal, 0 otherwise
COMMUNION	1 if service offered communion, 0 otherwise
HOLIDAY	1 if service occurred during religious holiday, 0 otherwise
SPECMUS	1 if service featured special music (other than choir), 0 otherwise
OTHER	1 if an infrequently repeated event occurred (guest preacher or presentation of bibles to children), 0 otherwise
ECONOMIC VARIABLES	
TAX	1 if service occurred during last two Sundays of December, 0 otherwise
BUDGET	Amount of university's annual budget (lagged 6 months)
SCHOOL	1 if university classes are in session, 0 otherwise
WEEK1	1 if service occurred during first Sunday of month
WEEK2	1 if service occurred during second Sunday of month

Table 2: Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
AT845	86	20	0	167
AT1055	333	40	151	716
IDENT	$4621.47	$2241.49	$ 697.10	$11699.47
UNIDENT	$ 120.42	$ 54.01	0	$330.28
APPEAL	$ 41.72	$ 101.58	0	$496.79

Table 3: Coefficients of Two-Stage Least Squares Regressions

			Exogenous Variables		
	AT845	**AT1055**	**IDENT**	**UNIDENT**	**APPEAL**
Intercept	65.25	88.77	1346.40	-439.18	-105.61
APPEAL				.74	
APPEALSUN					66.80**
AT845		2.33*	-69.82	.88	.38
AT1055	.05		3.63	-2.41	.47
BUDGET			77.44	13.79	-.84
COMMUNION	-1.90	-42.67*			
GUESTS		60.62*	-19.05	232.10	-79.56*
HOLIDAY	4.32	10.60	1368.12	66.35	-24.65
OTHER		41.50*		88.62	
SCHOOL	3.77	27.82	663.18	129.24	-16.98
SPECMUS		46.42**		97.00	
TAX			-1436.45		28.05
WEEK1			4238.42**	207.76	96.76
WEEK2			1556.35**	-94.33	59.82*
Model R^2	.07	.26	.51	.01	.18
Naive R^2	.10[m]	.20[m]	.60[w]	.10[m]	.11[m]
F value	3.40**	9.35**	19.54**	.11	4.13**
Durbin-Watson	1.78	1.64	2.08	1.57	1.68

* significant at $p \leq .05$
** significant at $p \leq .01$
m = monthly naive model
w = weekly naive model

IMPACT OF JIT ON ORGANIZATIONAL CAPABILITIES

J. Michael Rayburn, University of Tennessee-Martin
L. Gayle Rayburn, Southeast Missouri State University

ABSTRACT

The JIT concept has evolved into a corporate philosophy that emphasizes continuous improvement by performing correctly the first time and eliminating any non-value added activities. To improve its chances of success, a company must realize that JIT is a two-way opportunity. A company has to involve the supplier in the process. All parties involved should receive mutual benefits. The relationship between the supplier and the customer must be one of respect, trust, and open and honest communication. Limiting the supplier base is essential.

INTRODUCTION

Japanese manufacturing and business practices attracted the attention of United State (U.S.) manufacturers because they achieved high levels of international competitiveness in the 1980s. One of today's most popular business concepts - just in time (JIT) - was adopted from the Japanese during this period. U.S. businesses continue to monitor Japanese operations in hopes of finding tools they can adapt to improve their own operation.

JIT is a philosophy that focuses on performing activities as they are needed by other internal segments of an organization. JIT is not solely an inventory reduction system as it is a management philosophy whose theme is to have continuous improvement. With JIT, the idea is to: (a) minimize inventory investment; (b) react faster to demand changes; (c) uncover any quality problems; and, (d) shorten production lead times. JIT means less capital tied up in inventory. Less inventory means less floor space required and less handling. JIT manufacturing makes managers and workers aware of manufacturing roadblocks which have gone undetected in their manufacturing operation for years (Congdon, 1995).

According to Purchasing magazine's most recent survey of procurement professionals, 86% of respondents say that cost reduction is more important than it was in 1990 (Cruz, 1996). A total of 81% of those polled said that their companies had implemented programs to cut costs. Price negotiation, inventory reduction, and quality improvement are the most popular methods that companies use to cut costs. Suppliers are becoming more involved in the cost-cutting process by establishing just-in-time delivery.

JIT purchasing has been an accepted practice in the perishables industries, such as food and fresh flowers for some time. Today, JIT purchasing is increasingly adopted by organizations that acquire nonperishables. Previously these organizations ordered in lots much larger than required by short-run demand or use and often stored inventory in large warehouses for weeks or longer. This reduces the cost and time associated with the purchasing activity by decreasing the number of suppliers and in turn the resources devoted to purchase negotiations.

JIT AND PERFORMANCE

Under a JIT system, all activities that do not add value to a product or service are eliminated, such as holding inventory in warehouses or storage areas. The focus is on product lines with an emphasis on teamwork. Management must first evaluate system flow; JIT works back to the receipt of raw material and avoids snake type of organizations. Huson and Nanda (1995) attempted to measure the impact of JIT on accounting measures of performance. However, most technologies and investments are justified on the basis of their impact on financial and accounting measures which are not easily quantified. The results showed that after JIT adoption, firms reduced the labor content in facilities, increased inventory turnover, and enhanced earnings. However, there was no significant impact on prices charged by the firm.

Balakrishnan et al. (1996) examined whether firms exhibiting improved inventory utilization subsequent to JIT adoption achieve a corresponding increase in their return on assets (ROA) and whether firm-specific characteristics affect such ROA responses. On average, they did not find a significant ROA response to JIT adoption. Cross-sectionally, JIT adopting firms with a diffuse customer base have a superior ROA response relative to both adopting firms with a high degree of customer concentration and their matched control firms. JIT is designed to reorganize plants by simplifying operations, improving flows and reducing inventory. JIT also impacts the organization in the following ways: (1) Improves the traceability of costs, (2) Heightens commitment to quality, (3) Emphasizes control of inventory, and (4) Increases importance of preventive maintenance.

TRACEABILITY OF COSTS IMPROVED

There is normally better control of cost incurrence in a JIT environment because the focus is on reducing total costs for the organization as a whole, rather than decreasing individual costs or departmental costs. JIT increases the direct traceability of costs because in a traditional purchasing environment many material handling and warehouse costs are incurred for multipurpose facilities that service different product lines and typically, companies classify these as indirect costs. Using JIT many of these become direct costs because there is an increase in direct traceability of costs to individual retail areas or production lines.

There is also a commitment to a high level of quality. Doing things right the first time is essential when there is no time allowance for rework. Workers strive for continuous improvements in the efficiency of activities. Simplifying and increasing the visibility of value-adding activities are emphasized. This helps identify activities that do not add value which can be eleminated.

JIT also means companies must plan better and develop very responsive, dependable suppliers because it is essential to receive parts from suppliers as they are needed in manufacturing. Quality control by the supplier is essential and zero percent defects is the only acceptable level with just-in-time. Companies should screen suppliers for such non-price factors as quality and reliability and use a limited number of reliable vendors to avoid inspecting incoming materials. Also if managers seek out more reliable local suppliers, they might be able to reduce their investment in inventory which would free significant monies for use elsewhere.

In the JIT philosophy, purchasing strategies advocate the use of fewer sources of supply to enable a firm to improve the quality of its products. However, there is limited empirical evidence in support of this theory. Kekre et al. (1995) developed

a model by integrating concepts from manufacturing, marketing, and business strategy to better understand the links between operating decisions of the firm, supplier availability, and product quality. The analysis shows that operating decisions and environmental factors such as wider product lines, lower levels of competition, and greater frequency of product changes increase the likelihood of a firm's reduction of supplier base, which in turn raises quality levels.

The lowest quoted purchase price could become the most expensive if costs of poor quality resulting from machine downtime, customer dissatisfaction and illwill, rework, and scrap are considered. The lowest bidder may be unwilling to make frequent small quantity deliveries or may lack the reliability to supply defective-free units, delivered on time. Further, knowing these vendors can be depended on to deliver on schedule is often worth paying a slightly higher invoice price.

Few purchasers would argue that electronic component quality from suppliers has improved over the last 10 years (Purchasing, 1996). But buyers say quality needs to be further improved because it has such a big impact on total cutting cost. High quality means inventory levels can be lowered, just in time programs can be instituted and incoming inspection and testing can be eliminated. Because of total cost concerns, many buyers say their responsibility in component quality is increasing. The buyer's role with quality also includes setting the expectations with suppliers.

JIT is a philosophy of production where inventory is considered undesirable. A large percentage of the assets in many companies are held in inventories. Poor control of inventory can create a negative cash flow, tie up large amounts of capital, limit the expansion of an organization due to lack of capital, and reduce the return on investment by broadening the investment base. Cash invested in inventories could be used somewhere else for profit, debt servicing, or dividend distribution.

JIT II

Over the past few years, many buyer-supplier relationships have evolved far enough that full-time employees of suppliers work side-by-side with purchasing in the buyer's plant, placing orders as required. The system of in-plant representatives, often referred to as JIT II, is becoming increasingly common (Bradley, 1995).

JIT II, a customer-supplier partnership concept pioneered at Bose Corp. and now practiced by major companies and their suppliers, can aid in cutting both design and response lead time (Pragman, 1996). This is achieved through system integration, a basic process strategy of time-based competition. In conventional JIT purchasing, customers and suppliers conduct themselves as partners rather than as adversaries.

INCREASED CONTROL OF INVENTORY

Holding inventory is expensive even though a company has adequate warehouse space. Inventory has carrying costs even if there is no opportunity cost of the warehouse space. There are funds tied up in inventory in the form of material, labor, and overhead which could be earning imputed interest, and there is also the risk of inventory not being sold.

Large inventories also create substantial storage costs as well as consume factory floor space that could be used more productively. Long production runs carry the costs of such activities as coordinating production activities and distributing products. Quality problems are also hidden. A large factory and warehouse is more trouble to manage, simply because it covers more floor space. Communication and supervision become more difficult because more employees normally are involved.

The pressure for capital and the effective utilization of resources makes decision making about inventory very important. However, inventory camouflages significant management problems because if sales orders do not meet sales forecasts, a company's problems end up unfavorably as excess inventory. If there is poor quality, consumers will fail to buy as projected and/or return the poor quality products, so that there will also be excess inventory.

While inventory is not evidence of all management's problems, carrying large amounts of inventory is symptomatic of serious management problems. Billesbach (1994) examined Just-in-time (JIT) and its impact on select aspects of the corporate balance sheet from a long-term perspective. Data on financial statements from 28 companies were examined and statistically analyzed over a 10-year period. The results indicate statistically significant improvements in managing inventories which are reflected in relative ratios and can be documented in a company's statement of financial position. These improvements suggest that the adoption and implementation of aggressive inventory management practices such as JIT will improve inventory efficiencies.

PREVENTIVE MAINTENANCE IN JIT SETTINGS

To receive the full benefits of JIT, the preconditions of uniform plant loading, group technology, quality control at the source, minimized setup times, and nearby suppliers must exist. However, conglomerates are rarely driven by an objective to stay on the leading edge of technology, to stress product quality, or to install modern equipment.

Many conglomerates concentrate on building high-volume products on steadily deteriorating equipment and fail to install a preventive maintenance program because they evaluate all segments on a short-term performance basis. The tendency of the stockholders to be short-term-profit oriented causes managers to plan for short-term results rather than long-term successes. This drives managers into producing high output, and discouraging investment. This search for short-term profits results in obsolete machinery and production methods, accompanied by frequent machine breakdowns.

Such short-term strategies result in difficulties in utilizing JIT. Managers become aware of the problems of operating with steadily deteriorating and technological obsolete equipment that is not being maintained by a total preventive maintenance plan (TPM). TPM is the process of maintaining equipment so thoroughly that not only does it wear out much less rapidly, but it continues to manufacture products at an acceptable level of quality. TPM is also used as a tool to detect abnormalities in performance and as a feedback measure for the appropriate care of the machines. Preventive maintenance requires cost outlays before machines are in disrepair which helps assures a better quality product.

MACHINE OPERATORS DEVELOP SENSE OF OWNERSHIP

Also under TPM, since operators control the process and perform any necessary inspections themselves, the need for quality inspection by inspectors is reduced. As a consequence, operators tend to feel a sense of ownership of the equipment. If anything goes wrong with the machine, operators feel personal responsibility. They do not blame the repair department. They keep their own work space very clean. Special machine set-up crews become redundant as the machine operator comes to know all about the machine. From a behavioral viewpoint, therefore, in an automated environment each individual operator is motivated to make the best contribution in keeping the machine in perfect operating condition at all times. This motivated environment in turn results in increased productivity and profitability, thus enhancing the JIT philosophy.

Maintenance cost is likely reduced in this environment because operators can schedule some of the preventive maintenance and cleanup into the wait and delay times that operators often have. Also operators who are responsible for the product manufactured will perform better at keeping the equipment working well than a support person who does not have the responsibility. Thus, the costs for non-working equipment and poor quality output are less.

JIT DOES NOT WORK FOR EVERYONE

JIT can be simultaneously lifesaving and terrifying. Despite its wide acclaim, it is not a panacea. Early JIT advocates did not expect it to work for everyone. Their main objective was to eliminate the inefficiencies caused by excess inventories, which often included defective parts. For example, industries with lower volumes, particularly aerospace and defense, are usually not good homes for JIT because they come with unpredictable production flows and uneven schedules (Bahadur, 1995).

Enterprises that benefit most from JIT are those that import or export commodities with high inventory and financing costs (Maddow, 1995). Those firms that produce high tech materials - aerospace, pharmaceuticals, and computers - can save in the long run by initially spending extra dollars to warehouse their goods at convenient drop-ship locations or deliver them via air-expedited services. Maddow argues that other firms do not fare as well, and in all likelihood, JIT programs fail because:

1.	Suppliers with JIT-compatible manufacturing standards cannot be found.
1.	Demand for their own products fluctuates so greatly it does not permit regular deliveries of JIT supplies.
3.	Vendors are too far away and cannot respond quickly to changes in demand.
4.	Businesspeople must make a leap of faith to rely on a single supplier when they previously had four or five competing with each other.

CONCLUSIONS

The JIT concept has evolved into a corporate philosophy that emphasizes continuous improvement by performing correctly the first time and eliminating any non-value added activities. To improve its chances of success, a company must realize that JIT is a two-way opportunity. A company has to involve the supplier in the process. All parties involved should receive mutual benefits. The relationship between the supplier and the customer must be one of respect, trust, and open and honest communication. Limiting the supplier base is essential. Additionally, operational policies and procedures must be understood and practiced on a daily basis by all employees.

REFERENCES

Bahadur, B. N. (November/December, 1995). Will just-in-time work for you? And will you work for it? Secured Lender, 51(6), 118-120.

Balakrishnan, R., T. J. Linsmeier, & M. Venkatachalam (April 1996). Financial benefits from JIT adoption: Effects of customer concentration and cost structure. Accounting Review, 71(2), 183-205.

Billesbach, T. J. & R. Hayen (First Quarter, 1994). Long-term impact of just-in-time on inventory performance measures. Production & Inventory Management Journal , 35(1), 62-67.

Bradley, P. (September 1995). Just in time works, but ... Purchasing, 119(3), 34-38.

Congdon, W. S. & R. M. Rapone (August, 1995). JIT and lean production. Production, 107(8), 22-26.

Cruz, C. (May 23, 1996). Purchasing execs take shears to corporate costs. Purchasing, 120 (8), 22-23.

Huson, M. & D. Nanda (June, 1995). The impact of just-in-time manufacturing on firm performance in the US. Journal of Operations Management, 12 (3,4), 297-310.

Kekre S., B. P. S. Murthi, & K. Srinivasan (June, 1995). Operating decisions, supplier availability and quality: An empirical study. Journal of Operations Management, 12(3,4), 387-396.

Maddow, J. (October 1, 1995). Time to demystify JIT. Transportation & Distribution, 36(10), 76.

Pragman, C. H. (July/August, 1996). JIT II: A purchasing concept for reducing lead times in time-based competition. Business Horizon, 39(4), 54-58.

Purchasing (March 21, 1996). Quality demands are just beginning. Purchasing, 120 (4), 55-56.

APPLICATION OF THE SPECIAL CONSTRAINED MULTIPARAMETRIC LINEAR PROGRAM TO SITE LOCATION

Michael C. Shurden, Lander University

ABSTRACT

Deciding where to locate a business is a major strategic decision that companies are faced with today. This decision could have a significant impact on the long-term success of a company. Organizations must perform a careful analysis among alternative locations and hopefully choose the best location based on the results of their analysis. However, the decision making process used in this evaluation can be very difficult as a result of the many factors that must be considered in making this decision. The purpose of this paper is to demonstrate how the special constrained multiparametric linear program model could be used for determining site location among three alternatives.

INTRODUCTION

The factors considered in making site location decisions could usually be classified as either quantitative or qualitative. Quantitative factors include measurable variables such are land/building cost and the projected cash inflows and outflows from operating the planned facility. Qualitative factors are those that are not directly measurable such as climate, schools, and recreational facilities. Presently, most organizations use two separate models to evaluate the quantitative and qualitative factors. Qualitative factors are examined using simple preference weighting and are generally used as a first screen to eliminate from further consideration those alternative locations that do not meet the minimum requirements. Once the screening process is completed, the quantitative factors can be used to determine which location would be best (Fogarty, 1989).

Based on the available models used for the purpose of site location, there appears to be the lacking of a model that would allow both the quantitative and qualitative factors to be simultaneously evaluated in a single model without converting the quantitative data to an ordinal scale. The Special Constrained Multiparametric Linear Program (SCMLP) would allow for both types of factors to be analyzed within a single model.

THE SPECIAL CONSTRAINED MULTIPARAMETRIC LINEAR PROGRAM

The SCMLP allows for the maximization of some quantitative variable subject to preferences regarding various qualitative factors. The model is expressed as follows:

Objective: Maximize ct
Subject to: At < b
t > 0
Gc < d (Wibker, 1980).

The SCMLP model allows for the decision variables (t) to be optimized while simultaneously solving for the coefficients in the objective function (c). The At < b represents the constraints placed on the decision variables (t). The Gc < d represents the constraints placed on the coefficients in the objective function (c). This type of formulation allows sets of constraints to be derived which reflect preferences toward various qualitative factors while simultaneously maximizing some quantitative factor associated with the different locations being evaluated. This model suggests which of the alternative location best satisfies both the quantitative objective and the quantitative constraints. Thus, the results from this study provide valuable input to companies in making facility location decisions while simultaneously considering both quantitative and qualitative factors.

AN APPLICATIOIN OF THE SCMLP TO SITE LOCATION

The remainder of this paper is a demonstration of how the SCMLP could be used in determining site location among three alternatives. The South Carolina Chamber of Commerce provided the data used for this demonstration. This data consisted of community profile data for three upstate communities in the State of South Carolina. These three communities were chosen based on their competitiveness to attract industry and business and the fact that this area of South Carolina is experiencing tremendous economic growth and possesses an appealing quality of life (Venable, 1992).

All three of these areas have a good population and labor force base. Both the population and labor force show positive growth trends, which should continue, in the foreseeable future. These three communities should provide for a realistic demonstration of the SCMLP.

In this example, the quantitative variable to be maximized will be the internal rate of return for each of the three mutually exclusive site locations. For the purpose of this study the following internal rate of returns (IRR) will be maximized for each of the three site locations.

SITE LOCATION	A	B	C
Internal Rate	r1		r2
r3			
of Return	12%		13%
14%			

The assumption is made that these rates reflect the costs associated with the derivation of an internal rate of return. These rates are quantitative in nature and reflect some dimension of cost. For example, Location A was given the lowest rate of return to reflect the highest average wages and salaries.

Based solely on an economic point of view, a company may chose location C since this site had the greatest internal rate of return. However, quality of life factors must also be considered and included in the analysis.

The qualitative variables, which serve as constraints in the model, are quality of healthcare and quality of education. This is not an all-inclusive list; however, this will provide a realistic application of the SCMLP.

Implementation of the SCMLP model requires that the company either ranks or place subjective weights on the two qualitative attributes of healthcare and education which are defined as c1 and c2 respectively. The sum of the weights or rankings must equal one. For the purpose of this study, the company places a simple ordering such as $c1 < c2$, which implies that the company prefers the quality of education over the quality of healthcare. However, the company believes that their preference toward healthcare should not be less than .30. This minimum weight limit placed on healthcare indicates that the company does not prefer education exclusively. The company feels that healthcare should be considered in determining site location. Constraints are derived which reflect the company's preferences toward these two factors. The constraints are presented below.

$$c2 > c1$$
$$c1 > .30$$
$$c1 + c2 = 1$$
$$ci > 0$$

c1 = Company preference toward healthcare
c2 = Company preference toward education

Next, an initial set of values must be derived for c1 and c2, which satisfy the companies set of constraints. The values chosen for c1 and c2 serve only as a starting point to derive an initial set of coefficients for the objective function. The range of values for c1 is from .30 to .50 and the range of values for c2 is from .50 to .70. The summation of c1 and c2 must equal one. Therefore, the following values were chosen as the initial value for c1 and c2.

$$c1 = .50$$
$$c2 = .50$$

For more complicated constraints, initial values for c1 and c2 may not be obvious. Therefore, other methods may need to be employed to derive an initial set of values for c1 and c2. However, since only two attributes are being considered, sets of constraints requiring such methods are assumed to be rare.

Next, the company places weights or some simple ordering of their preferences with respect to each factor and how the three site locations correspond. These variables are defined below.

Location	Healthcare	Education
A	w1	x1
B	w2	x2
C	w3	x3

The company places weights or some simple ordering of their preferences with respect to each factor and how the three facility locations correspond. Based on the data provided by the South Carolina Chamber of Commerce, the company believes that location A provides more advantages with regard to healthcare than location B and C. Location A has one hospital with 421 beds and has available 130 doctors. Therefore, the company believes that with regard to the quality of healthcare that location A has at least twice the advantage over location B, implying that $w1 - 2w2 > 0$. Also, the company believes that there is no significant difference regarding the quality of healthcare for locations B and C since both locations have similar healthcare facilities, implying $w2 - w3 = 0$. The summation of the xi's must equal one. Therefore,

$$w1 - 2w2 > 0$$
$$w2 - w3 = 0$$
$$w1 + w2 + w3 = 1.$$
$$wi > 0.$$

The company believes that location A should have 10 percent more weight regarding quality of education than location C. Location C has the smallest pupil/teacher ratio; however, location A has a Technical School that provides a wide variety of training opportunities for the company. Both locations A and C have a four-year college. Location B does not have a four year college or a technical school and has a pupil/teacher ratio that is greater than location C and equal to location A. Therefore, the company believes that location C should have 50 percent more weight than location B. The summation of the xi's must equal one. Therefore,

$$x1 - 1.1x3 > 0$$
$$x3 - 1.5x2 > 0$$
$$x1 + x2 + x3 = 1$$
$$xi > 0.$$

The w's and x's (w1, w2, w3, x1, x2, x3) are the six decision variables presented in the initial formulation of the linear programming model. The initial set of coefficients for the decision variables is derived by multiplying both c1 and c2 by the three internal rates of returns as presented below.

	c1r1 = co1	c2r1 = co4
	c1r2 = co2	c2r2 = co5
	c1r3 = co3	c2r3 = co6

An initial value of c1 = .5 and c2 = .5 was chosen as a starting point. By multiplying booth c1 and c2 by the internal rate of returns, the company's initial objective function is as follows.

maximize .06w1 + .065w2 + .07w3 + .06x1 + .065x2 + .07x3

Next, the constraints for c1 and c2 must be reformulated in terms of the model. Since cr = co, then c = co/r. In this manner,

	c1 = co1/r1	c2 = co4/r1
	c1 = co2/r2	c2 = co5/r2
	c1 = co3/r3	c2 = co6/r3

The ci constraints can be reformulated in terms of co by substituting co/r in place of c. The constraints:

(1) c2 > c1,
(2) c1 > .30,
(3) c1 + c2 = 1,

are reformulated as follows:

(1)	co4/r1 - co1/r1 > 0
(1)	co5/r2 - co2/r2 > 0
(1)	co6/r3 - co3/r3 > 0
(2)	co1/r1 > .30
(2)	co2/r2 > .30

	(2)	co3/r3 > .30
	(3)	co1/r1 + co4/r1 = 1
*	(3)	co2/r2 + co5/r2 = 1
*	(3)	co3/r3 + co6/r3 = 1

The following constraints must be added to assure that the values of both c1 and c2 remain consistent within each constraint. The addition of the following constraints cause the * constraints to be redundant.

co1/r1 - co2/r2 = 0
co2/r2 - co3/r3 = 0
co4/r1 - co5/r2 = 0
co5/r2 - co6/r3 = 0

The simplex method was used to solve this linear program to determine the optimal set of wi's and xi's based on the present set of coefficients (coi's). The objective function is subject to the constraints placed on the wi's and xi's. The formulation of the special constrained multiparametric linear program is presented below.

maximize .06w1 + .065w2 + .07w3 +
.06x1 + .065x2 + .07x3
subject to
w1 - 2w2 > 0
w2 - w3 = 0
w1 + w2 + w3 = 1
x1 - 1.1x3 > 0
x3 - 1.5x2 > 0
x1 + x2 + x3 = 1
wi, xi > 0

The simplex method was used to solve this linear program to determine the optimal set of wi's, and xi's. The optimal decision variables are presented below.

w1 = .50	x1 = .39759
w2 = .25	x2 = .240964
w3 = .25	x3 = .361446

Next, the six decision variable values are used as the objective function coefficients in a linear programming model to determine an optimal set of coi's. The objective function is subject to the constraints placed on the coi's. The objective function and constraints are presented below.

maximize	.50co1 + .25co2 + .25co3 + .39759co4 + .240964co5 + .361446co6
subject to	
	co4/.12 - co1/.12 > 0
	co5/.13 - co2/.13 > 0
	co6/.14 - co3/.14 > 0
	co1/.12 > .30
	co2/.13 > .30
	co3/.14 > .30
	co1/.12 + co4/.12 = 1
	co1/.12 - co2/.13 = 0
	co2/.13 - co3/.14 = 0
	co4/.12 - co5/.13 = 0
	co5/.13 - co6/.14 = 0
	coi > 0

The simplex method was used to solve this linear program to determine the optimal set of coi's based on the present set of coefficients (wi, xi). The results are presented below.

co1 = .036	co4 = .084
co2 = .039	co5 = .091
co3 = .042	co6 = .098

The new coi values were used as the objective function coefficients in a linear programming model to determine an optimal set of wi's and xi's. The objective function is subject to the original constraints placed on the wi's and xi's. The value of the decision variables (wi, xi) did not change from their previous values. Therefore, the simplex algorithm indicates that an optimal set of coefficients (coi) and decision variables (wi, xi) have been found.

The coi's were converted back to the original rankings on c1 and c2. The results were:

c1 = .30 c2 = .70

Next, the optimal solutions to c1, c2, wi, and xi are substituted in the following equations.

Site A: w1c1 + x1c2 = FLA
Site B: w2c1 + x2c2 = FLB

Site C: w3c1 + x3c2 = FLB
FLA = .50(.3) + .3975900(.7) = .4283 *
FLB = .25(.3) + .2409640(.7) = .2437 *
FLC = .25(.3) + .3614469(.7) = .3280 *

FLA is the weighted proportion placed on facility location A given the company's preference for education and healthcare along with their perception of how location A ranks with respect to these two attributes. Accordingly, FLB and FLC are defined similarly. Additionally, these percentages are subject to the maximization of the company's expected rate of return for each location.

These percentages indicate a tendency toward location A since this location had the largest percentage at .4283. Location C had the next highest percentage at .3280 while location B would be the least likely choice with a percentage of .2437. The results of this study would indicate a preference for location A.

SUMMARY AND CONCLUSIONS

This research demonstrates that the SCMLP model can be used to assist companies in making site location decisions. The model allows for the maximization of the quantitative variables subject to preferences regarding various qualitative factors. This model provides a company with a weighted proportion for at least one of the locations under consideration. This study was limited to three site location alternatives and two qualitative factors. However, this study could be expanded to include numerous site alternatives as well as numerous qualitative factors. Also, the application of this model would apply for comparison of site locations not only domestically, but internationally as well.

REFERENCES

Coffee, Hoyt E. (1993), Site Selection's Top Deals For 1992: When The Going Gets Tough, *Site Selection*, April, pp. 336-48.

De Meirleir, Marcel (1990), Strategic Facility Location Analysis, *Industrial Development*, February, pp. 115-18.

Fogarty, Donald W., Hoffmann, Thomas R., and Stonebraker, Peter W. (1989), *Production and Operations Management*, Cincinnati, Ohio. South-Western.

Fusi, Deborah S. (1991), Education Continues to Score High as a Factor in Quality-of-Life Location Equation, *Site Selection*, August, pp. 732-38.

Venable, Tim (1992), BMW Drives into South Carolina with $300 Million Auto Plant, *Site Selection*, August, pp. 630 - 31.

Wibker, Elizabeth A. (1980), *The Special Constrained Multiparametric Linear Programming Problem*. Doctoral Dissertation, Louisiana Tech University.

INTEGRATED SUPPLY: AN INNOVATIVE APPROACH TO COST REDUCTION

Donald D. Envick, University of Nebraska at Kearney
Brooke R. Envick, St. Mary's University of Texas

ABSTRACT

In today's business environment, there is tremendous pressure to continually reduce costs. Competitive advantage in the market place requires more than having the best product or service. It is also essential to drive costs out of the processes that support the business and from an ability to add value to one's customers through every aspect of the operation. A key strategy to accomplish this is through integrated supply. Integrated supply is a materials management strategy that goes beyond vendor reduction by using multi-line distributors to lower the total cost of supplies.

This paper offers perspectives on the integrated supply strategy, the various benefits it offers, and critical success factors required to manage the relationship and reduce total cost through four cost-saving categories.

INTRODUCTION

Minimizing total costs continues to be one of the primary focal points of business today. In most firms, the acquisition of inventory management functions contain many of the costs. Integrated supply reduces the total cost of supplies for customers through the use of multi-line distributors. For example, Keough (1994) reveals that processing orders using conventional methods costs about $141 per purchase order and requires one to two weeks for delivery. However, a company with an integrated supply program only incurs a cost of $12 per purchase order with only one day or less for delivery.

Integrated supply can include the outsourcing for such things as procurement, inventory management, and accounts payable by the multi-line distributor for the customer. Specific activities performed can include audit verification, bar coding, customized reporting, computer system design, inventory management, logistics management, material handling, plant surveys, preventative maintenance, quality reviews, repair and fabrication, site selection, staffing, and vendor selection and certification. The location of an integrated supply operation can be on or near a customer's business site.

To make integrated supply work, the distributor-customer partnership must be mutually beneficial in terms of cost-saving opportunities. In order to make the partnership effective, the relationship requires continuing trust, open communication, and long-term commitment. It also requires staff competencies and behaviors closely aligned with initiatives, scope, and objectives of each partnership contract.

Most businesses realize how important it is to manage costs. And integrated supply is one of the newest ways to achieve this goal. This paper analyzes integrated supply relationships and the four cost saving categories, which include: (1)

the cost of acquisition, (2) information and transaction automation, (3) inventory management, and (4) acquisition of original equipment.

LITERATURE REVIEW

The number of recent articles relating to integrated supply suggests that it is a growing area of interest among both practitioners and academics. Most of these articles are very focused on such issues as, (1) the changing roles in the distribution channel, (2) integration types, (3) problems and concerns among partners, and (4) the future direction of integrated supply.

Integrated supply initiatives target large industries with more than $1M in maintenance, repair, and operating (MRO) purchases a year. Integrators will typically operate at cost-plus 10 to 20 percent arrangement that allows them to stock "A" items that turn six to eight times per year. And they rely on sub-tier suppliers to handle the "C" lower-turn items and perhaps even "B" items (Baden and Lynn, 1996).

Streamlining operations is becoming a greater necessity for today's businesses. For example, Meyer (1997) examines what businesses are looking for in an integrated supply contract. The results show that they want to streamline their supply base, simplify their acquisition process, have more efficient servicing of multi-plant locations, and have access to greater varieties of product. However, the streamlining of the customer's procurement process may complicate the sales process for the distributor (Stainbrook, 1997). Therefore, effective communication is key.

Avery (1997) asserts that integrated supply can cut the costs of MRO acquisition when there is open communication and feedback. And Keyser (1997) contends that methods to communicate information and the systems that link customers, integrators, and manufacturers will gain importance as well as product knowledge, technical assistance, and application.

One important area of communication is costs. For example, Lingenfelter (1997) illustrates that integrated supply programs require much of the distributor's cash and that it is important to avoid misunderstandings by ill-defined contracts. And Sherry (1997) points out that the management of costs begins with information. By understanding the costs for each key activity, the distributor can determine the costs of value-added services. From this information, distributors can determine where time and technology can improve the process.

Baker (1997) contends that when the integrated supply customer evaluates the agreement, the only issue will be price. Therefore, the distributor has to control that price through the reduction in channel costs. The backbone of industrial distribution is its ability to add value to products and inventory. And integrated supply partners benefit by eliminating their own inventory and transaction costs (Harper, 1996).

After several years of ambiguity, integrated supply distributors have emerged in different forms. The structure of the integrated supply strategy is taking shape in the form of stand-alone integrated supply distributors, a consortia of small industrial distributors, alliances of large distributors, integrators that manage the procurement and inventory management process, and information managers who use their computer systems to get a foothold in this market (Baden and Lynn, 1997).

One technology, Electronically Integrated Supply (EIS), has emerged as a practical application of the Internet. As an extension of Electronic Document Exchange, EIS is specific to the business-to-business market and refers to the automated processing of corporate purchases internally between departments and externally to multiple suppliers (Fourneir, 1997).

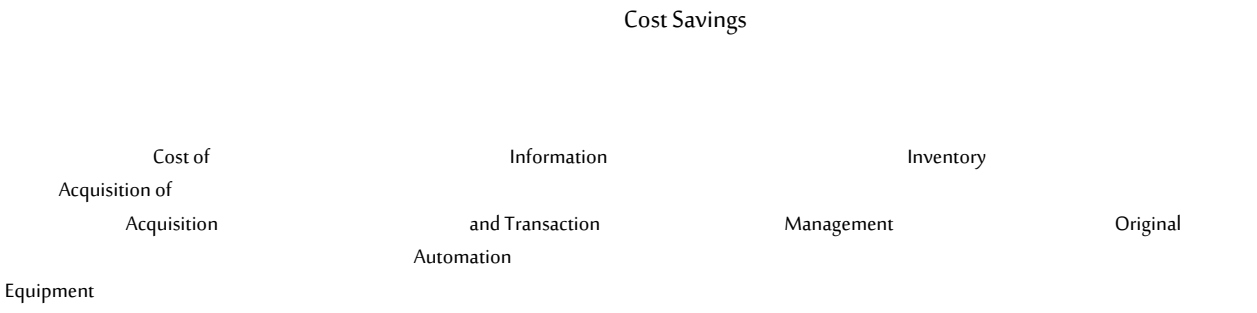
The success of any business today depends on the quality of its supply chain. Mathers (1996) states that businesses are beginning to realize the importance of integrated supply and the importance of reducing costs for their customers. This paper analyzes the four cost saving categories of most partnerships.

COST SAVING CATEGORIES

The four types of cost savers for most integrated supply relationships include: (1) the cost of acquisition, (2) information and transaction automation, (3) inventory management, and (4) acquisition of original equipment (see figure 1).

Figure 1

Integrated Supply Partnership



Proposition 1: ***It is mutually beneficial for the customer and industrial distributor if the distributor reduces the cost of acquisition.***

The main focus of most integrated supply initiatives is to reduce the cost of acquisition. Acquisition is the cost of buying which includes sourcing, inquiry, decision making, order placement, expediting, receiving, delivery or storage of the received good, and payment for the goods.

The goal of the customer is to reduce the total cost of ownership of the commodities. For example, an integrated supply contract between the customer and industrial distributor may include a goal to reduce the total cost of ownership by 5 percent per year over the next five years. This type of cost reduction goal is a one-time savings but continues forever. And the target cost reduction categories can include inventory, labor, material, and miscellaneous cost burdens.

Proposition 2: ***It is mutually beneficial for the customer and industrial distributor if the distributor automates information and transactions.***

Industrial distributors serving customers through total cost reductions are at the forefront of electronic commerce. They employ on-line ordering systems which allow users to check the location and levels of inventory on any item, even if that item is in production or on the production schedule.

Industrial distributors can provide an integrated preventative maintenance management package schedule and generate work orders. It also allows them to manage maintenance tasks, track equipment histories, maintain labor records, allocate resources, and interface with the distributor computer system for complete inventory and purchasing management.

Streamlining freight movement can also be achieved through an integrated supply contract. Logistics software can be used for on-line access to shipping methods and rates to guarantee shipment of goods at the least freight expense.

Automating accounts payable eliminates the waste of erroneous billing. An integrated supply strategy includes a paperless, electronic matching system which scans invoices storing them optically to match on-screen distributor purchase orders. When there is a match, the bill is paid.

Customers also have access to electronic mail, on-line engineering, and interchange information. Documents can be received and sent in electronic data interchange format to communicate invoicing, quoting, quote response, purchase order acknowledgment, shipping notices, and functional acknowledgment. Electronic catalogs are replacing expensive paper catalogs. Customers with Internet access can take advantage of distributor CD ROM catalogs for locating such things as product information, pricing, and purchasing.

Proposition 3: It is mutually beneficial for the customer and industrial distributor if the distributor handles all inventory management for the customer.

Part of the integrated supply strategy is for the distributor to take over the inventory management function for the customer. An example of a service provided by a distributor is in-plant surveys which identify customer needs. Other services include tracking part numbers, duplication reporting, packing slip information, and bar coding.

To reduce inventory costs, tool crib management systems track all items, automate purchasing needs, perform stock balancing, and even handle gauges, kits, and assemblies. One such system designed for Windows 95 includes a toolbar for maintenance that allows the user to view such things as employees, machines, inventory items, and vendors. Another toolbar handles transactions such as issuing, returning, rework items, and item lookup and transfer. And another toolbar is used to switch from one crib attendant to another.

Proposition 4: It is mutually beneficial for the customer and industrial distributor if the distributor manages the acquisition of original equipment.

Original equipment includes parts purchased by customers to go into the product they are selling. Once customers see the MRO cost savings derived from a successful integrated supply contract, they can request that the industrial distributor also manage the acquisition of original equipment.

DISCUSSION AND CONCLUSIONS

Every business strives to reduce costs, and using an integrated supply distributor is one way to meet this goal. As this paper illustrated, an integrated supply partnership is cost effective in four areas: cost of acquisition, information and transaction automation, inventory management, and acquisition of original equipment. It is proposed that these four areas of cost reduction are mutually beneficial for both the customer and industrial distributor. Empirical study is needed to test these four propositions as well as additional research in the area of integrated supply.

Other cost saving techniques should also be studied. For example, once integrators have streamlined logistics and reduced inventory, they must find cost savings elsewhere. Continuous improvement efforts now shift to investigating the effective use of old and new products. Integrated suppliers must be knowledgeable and skilled to provide product and application expertise that make additional cost reductions. As this area of interest continues to grow, more studies should be conducted regarding cost saving techniques of integrated suppliers.

REFERENCES

Avery, S. (1997). Buyers and suppliers. *Purchasing, March*, 28-31.

Baden, J. & Lynn, F. (1996). Success in the shadows of integrated supply. *Industry Net*.

Baker, B. (1997). Taking the cost out of the channel. *Industrial Distribution, March*, 118.

Fourneir, R. (1997). Electronically integrated supply: an implementation model. *Modern Distribution Management, 27(5)*, 5-8.

Harper, D. (1996). Integrated supply creates new relationships. Industrial *Distributions, May*, 31.

Keough, J. (1994). Integrated supply continues to grow. *Industrial Distribution, December*, 9.

Keyser, R. (1997). World-class efficiency. *Industrial Distribution, January*, 106.

Lingenfelter, C. (1997). How to make money in integrated supply. Modern Distribution Management, 27(10), 6-8.

Mathers, J. (19960. Becoming knowledgeable in the industry. *Today's Distributor, November/December*, 39.

Meyer, T. (1997). Measure up. *Industrial Distribution, February,* 72-74.

Sherry, W. (1997). Cost management. *Modern Distribution Management, 27(8),* 6-8.

Stainbrook, C. (1997). Supply channel changes: What is driving us? *Modern Distribution Management, 27(3),* 6-8.

ALLIED ACADEMIES CALL FOR PAPERS
FOR THE 1999 NATIONAL CONFERENCE
IN MYRTLE BEACH, SC
April 7-10, 1999

The Allied Academies will hold its 1999 national meeting in Myrtle Beach, SC, April 7-10, 1999. To provide you with maximum outlets for your research, the Allied Academies will hold joint meetings of all its member academies:

THE INTERNATIONAL ACADEMY FOR CASE STUDIES
THE ACADEMY OF ENTREPRENEURSHIP
THE ACADEMY OF ACCOUNTING AND FINANCIAL STUDIES
THE ACADEMY OF MANAGERIAL COMMUNICATIONS
THE ACADEMY OF EDUCATIONAL LEADERSHIP
THE ACADEMY OF MARKETING STUDIES
THE ACADEMY OF STRATEGIC AND ORGANIZATIONAL LEADERSHIP
THE ACADEMY OF FREE ENTERPRISE EDUCATION
THE ACADEMY OF INFORMATION AND MANAGEMENT SCIENCES
THE ACADEMY FOR STUDIES IN BUSINESS LAW
ACADEMY FOR ECONOMICS AND ECONOMIC EDUCATION

All papers accepted for presentation at the Conference will be published in the appropriate *Proceedings.* The top papers in each Academy will receive an award. In addition, the best papers, as determined by the referees, will be published in the appropriate *Journal.* We expect 25% of the papers submitted to the Conference to appear in the respective journals.

Registration and attendance at the conference will be required of at least one author for every paper. Registration for members of the Allied Academies will be $225 and for non-members will be $275.

Manuscripts or Abstracts should be submitted by **February 10, 1999**, and should include a title page which shows name, affiliation, complete address, telephone number, FAX number, and e-mail address for **EACH** author. The title page should show the Academy for which the paper, case, workshop or symposia is intended. Include a cover letter warranting that the work is original and has not been presented or published previously. All submissions will be double-blind refereed. Authors of manuscripts accepted for presentation will be notified as to the due dates for Proceedings versions and completed manuscripts. **Complete information is displayed on our home page.** Mail four copies of manuscripts or abstracts to:

Allied Academies
PO Box 2689 (145 Travis Road), Cullowhee, NC 28723

If you have any questions, please call, fax, or e-mail. We'll see you in Myrtle Beach!

Voice: 828-293-9151; Fax: 828-293-9407; E-mail: trelby@dnet.net or jcarland@dnet.net

www.alliedacademies.org

ALLIED ACADEMIES MEMBERSHIP APPLICATION
Federal Employer ID Number 56-1964544

Please check the Academies in which you are requesting membership:

- ☐ The Academy of Entrepreneurship
- ☐ The International Academy for Case Studies
- ☐ The Academy of Accounting and Financial Studies
- ☐ The Academy of Managerial Communications
- ☐ The Academy of Educational Leadership
- ☐ The Academy of Marketing Studies
- ☐ The Academy of Strategic and Organizational Leadership
- ☐ The Academy of Free Enterprise Education
- ☐ The Academy of Information and Management Sciences
- ☐ The Academy for Studies in Business Law
- ☐ The Academy for Economics and Economic Education

Annual Membership Fees .....$ 50.00

Name: _____

Affiliation: _____

Mailing Address: _____

Office Phone: _____

Home Phone: _____

Fax Number: _____

E Mail Address: _____

Complete this form and forward it with a check made payable to **ALLIED ACADEMIES** to:

Allied Academies
PO Box 2689 (145 Travis Road)
Cullowhee, NC 28723

To complete payment by credit card, please fill out the following information:

Name as it appears on Credit Card _____

Credit Card Number _____

Expiration Date _____

Amount to be Charged to Card _____ ☐ MasterCard ☐

Signature _____

Date _____

ALLIED ACADEMIES CALL FOR PAPERS FOR THE INTERNATIONAL CONFERENCE IN HELSINKI, FINLAND Summer, 2000

The Allied Academies will hold its 2000 international meeting in Helsinki/Jyvaskyla, Finland during the Summer, 2000. The actual dates will be advertised on our webpage as soon as our contracts become finalized. To provide you with maximum outlets for your research, the Allied Academies will hold joint meetings of all its member academies:

THE INTERNATIONAL ACADEMY FOR CASE STUDIES

THE ACADEMY OF ENTREPRENEURSHIP

THE ACADEMY OF ACCOUNTING AND FINANCIAL STUDIES

THE ACADEMY OF MANAGERIAL COMMUNICATIONS

THE ACADEMY OF EDUCATIONAL LEADERSHIP

THE ACADEMY OF MARKETING STUDIES

THE ACADEMY OF STRATEGIC AND ORGANIZATIONAL LEADERSHIP

THE ACADEMY OF FREE ENTERPRISE EDUCATION

THE ACADEMY OF INFORMATION AND MANAGEMENT SCIENCES

THE ACADEMY FOR STUDIES IN BUSINESS LAW

THE ACADEMY FOR ECONOMICS AND ECONOMIC EDUCATION

Manuscripts or Abstracts should be submitted by **April 15, 2000**, and should include a title page which shows name, affiliation, complete address, telephone number, FAX number, and e-mail address for **EACH** author. The title page should show the Academy for which the paper, case, workshop or symposia is intended. Include a cover letter warranting that the work is original and has not been presented or published previously. All submissions will be double-blind refereed. Authors of manuscripts accepted for presentation will be notified as to the due dates for Proceedings versions and completed manuscripts. COMPLETE INFORMATION IS DISPLAYED ON OUR HOME PAGE. **Mail four copies of manuscripts or abstracts to:**

Allied Academies
Jo Ann and Jim Carland
PO Box 2689 (145 Travis Road)
Cullowhee, NC 28723
828 293 9151, FAX: 828 293 9407
www.alliedacademies.org
e-mail: trelby@dnet.net or jcarland@dnet.net

If you have any questions, please call, FAX, or e-mail.
We look forward to seeing you in Finland!