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# A LONGITUDIAL STUDY OF PRIVATE WAREHOUSE INVESTMENT STRATEGIES

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## ABSTRACT

*This article revisits private warehouse investment decision making, a topic previously examined in 1989 by McGinnis, Kohn, and Myers (1990). Since then there has been a substantial amount of discussion regarding the scope and nature of logistics/supply chain management. In particular the roles of private, contract, and public warehousing has been discussed, increased emphasis on financial performance and strategic decision making may have altered the criteria for investment decisions in private warehousing, increased coordination of supply chains may have altered the relative importance of private, contract, and public warehousing, and increasing emphasis on controlling inventory investment may have shifted inventory responsibilities onto suppliers and customers. Empirical data was collected in 1999 and 2008 regarding warehouse investment decisions in large United State manufacturing firms. This research focused on private warehouse investment decisions, topics that might affect those decisions, and the mix of private, contract, public, and other warehouse options. The results of the 1999 and 2008 data were compared to the earlier findings reported by McGinnis, Kohn, and Myers. Changes in private warehouse investment strategies, the roles of market/product mix uncertainties and availability of for-hire warehouse providers, and changes in warehouse mix were examined. Implications for practitioners, teachers, and researchers of transportation, supply chain management, logistics, and warehousing are discussed.*

## INTRODUCTION

During the last decade of the 20<sup>th</sup> century, conventional purchasing and logistics functions expanded into a broader strategic approach to include materials and distribution management known as supply chain management (Tan, 2001). Warehousing, as part of this larger system, enables companies to store purchases,

work-in-progress, and finished goods while simultaneously performing break bulk and assembly activities. The ability to complete these functions rapidly results in providing faster delivery and better customer service (Wisner, et al 2009). The consequence of this capability is the establishment of a competitive edge in the marketplace.

Traditionally, manufacturers fabricated products for storage in warehouses and then sold from inventory. Several warehouses were required to maintain inventory levels of 60 to 90 days supply in order to meet production needs, customer needs, and avert stock outs. Warehousing of the past appeared to be an inescapable cost center that functioned like a large stock-keeping unit (Coyle et al, 2003).

According to De Koster (1998) strong global competition that has emerged caused warehousing to assume a considerably more important competitive role in delivering high quality customer service, in a timely fashion, and within budget allocations. Warehouses have been redesigned and automated for high speed, high throughput rate, and high productivity in order to shrink processing and inventory carrying costs. With the arrival of innovative management ideas such as just-in-time inventory control, strategic alliances, and integrated logistical supply chain thinking in the 1990s, the function of warehousing changed to facilitate the goals of a shorter cycle times, lower inventories, lower costs, and better customer service. At present, warehouses are less likely to be long-term storage facilities. They are more than likely to be high-speed technologically equipped facilities with greater attention focused on high levels of stock turnover and meeting customer service objectives. The contemporary approach to the movement of goods allows product to remain in a warehouse for only a few hours or days, at most (Nynke et al, 2002). Extra emphasis is now directed towards flow-through warehouses where products stay in the warehouse for a short period of time and then move on to their destination (Nynke et al, 2002).

Another area of warehouse management that has become an important focus of supply chain management is financial performance. Stock and Lambert (2001) use a Strategic Profit Model, which highlights the importance of logistics/supply chain management as an important part of organizational financial performance. They show the impact of investments in inventory, warehouse assets, fixed and variable costs, and cost of goods sold on return on net worth.

In this context, one of the management decision's that can affect a firm's financial performance is whether to use private or for-hire (public or contract) warehousing. Stock and Lambert's (2001) discussion of the advantages and disadvantages of these two warehousing strategies can be summarized as follows: private warehouses provide a.) higher levels of control, b.) flexibility of design, c.) opportunity to operate the

facility to meet specific product and customer needs, d.) lower costs if utilization is high, e.) greater use of specialized human resources, and f.) tax benefits. However, private warehouses offer less flexibility to respond to fluctuations in demand and require substantial investment.

Conversely, public (for-hire) warehousing can: a.) conserve capital, b.) provide flexibility in responding to changes in market demand, c.) avoid the risk of obsolescence of private facilities, d.) offer a wide range of specialized services, e.) provide tax advantages, and f.) enable a manufacturer to better manage its storage and handling costs. Disadvantages of public (for-hire) warehousing include communication problems, uneven availability of specialized services, and space availability problems during peak demand. A combination of the public and private choices is contract warehousing. With this approach, the firm and provider enter into a long-term agreement to outsource some, or all, of the manufacturer's warehousing requirements. When contract warehousing operates well the advantages of both private and public warehousing can be realized. When it does not work well the disadvantages of both may dominate.

McGinnis, Kohn, and Myers (1990) investigated a wide range of topics related to private warehouse investment decisions in large United States manufacturing firms. Based on empirical data gathered in 1989, they identified two factors (constructs) that explained private warehouse investment decisions, developed two private warehouse investment strategies based on these factors, and then assessed the impact of three variables (product mix uncertainty, availability of contract warehouse providers, and post-audit private warehouse investment decisions) on the choice of strategy. Finally, McGinnis, Kohn and Myers gathered data on the current, past, and expected future mixes of private, contract, public, and other (usually supplier or customer storage) warehousing. A review of this research presents two challenges and an opportunity. The first challenge is that the study has not been replicated. This means that one is not able to ascertain whether the strategies and conclusions developed can be generalized. The second challenge is that this topic has not been studied over time to assess whether private warehouse investment strategies have changed since 1989. The opportunity is that this study is reported in sufficient detail to enable replication. This opportunity makes it possible to revisit the topic of private warehouse investment decisions with a reasonable level of confidence that subsequent results would be able to assess the validity of the strategies identified earlier,

and report on changes in private warehouse investment decision constructs and strategies, variables that may impact private warehouse investment strategy, and the blend of (private, for-hire, and other) warehousing used.

The balance of the manuscript is composed of five sections. The first section presents an overview of the literature associated with private warehouse investment. Next the methodology, survey used, and data collection process are discussed. The third section presents the data analysis. Findings based on the analysis section are discussed in the fourth section. The final section discussed the authors' conclusions and the implications of this research for practitioners, educators and researchers.

## LITERATURE REVIEW

McGinnis, Kohn, and Myers' (1990) work on private warehouse investment decisions in large United States manufacturing firms provides some major conclusions about their decision-making processes. They discovered that 59.1% of the firms surveyed selected an Analytic-Intuitive approach to warehouse investment strategy that blended formal capital budgeting techniques with strategic considerations, subjective issues, and decisions in other logistics activities. Forty point nine percent followed an Intuitive Private warehousing Investment strategy that focused on subjective, strategic considerations, subjective issues, and decisions in other logistics activities with only modest consideration of capital budgeting techniques.

From another perspective, Thai and Grewal (2005), focused on the location selection process for distribution centers. They documented the importance of investment in warehouse logistical operations and argue for its inclusion in the firm's strategic planning. Thai and Grewal also argued that investment in warehousing is not a simple exercise. Rather, it requires the selection of the right location with careful consideration to the firm's special needs. Undoubtedly mathematical models can do a comprehensive analysis of the financial alternatives and location schemas, but good investment decisions must include a variety of factors such as customer access, manufacturing facility nearness/farness and the availability of transportation facilities (Anonymous, 2004). These arguments are supported by Sanchez (2005) who indicated that location tops the list of considerations in buying or leasing a warehouse. Nearness to major transportation routes-highways, arterial roads, airports, rail yards, ports and labor pools are critical. However, these issues

raise the investment cost and complicate the decision making process.

An investment in warehousing requires analysis of a variety of options because paying too much can create a competitive disadvantage. Warehouse building budgets, as with all capital expenditures budgets, are always tight and consequently there is little flexibility to cover overruns. When the warehouse logistics market is tight and costs are increasing, the firm will not be able to compete (Sanchez, 2005). An alternate approach is to use quantitative finance models to analyze the return on invest (ROI) or return on asset (ROA) from warehouse investment (McLemore, 2004).

Based on the previous paragraphs, it would be reasonable to expect that warehouse or distribution center investment decisions would be thoroughly evaluated to insure that decisions to invest in private warehousing would result in a strategy which was an efficient component of a firm's supply chain. The path to successfully achieving this objective will depend upon how managers evaluate the qualitative and the quantitative aspects of the investment decision. The purpose of the research reported in this manuscript is to revisit the decision making process of private warehouse investment decisions in United States manufacturing firms and ascertain whether the process has evolved during last decade of the 20<sup>th</sup> century and first decade of the 21<sup>st</sup> century.

After reviewing the literature the authors developed a series of research questions. They are listed as follows:

- a. Have private warehouse investment decisions in United States manufacturing firms changed substantially between 1989 and 2008?
- b. If they have changed, how have they changed?
- c. Do market/product mix uncertainties affect private warehouse investment decision strategies?
- d. Does the availability of good contract warehousing providers affect private warehouse investment decision strategies?
- e. Has the mix of warehousing types changed during the period studied? If so, how?
- f. Does the mix of warehousing types vary with private warehouse investment decision strategy?

## METHODOLOGY

Before gathering data, the McGinnis, Kohn, Myers (1990) article was examined. Data for this article, collected in 1989, was based on a subset of questionnaire items in a seven-page questionnaire that was an extensive survey of logistics managers in United States manufacturing firms. The precise wording of these questionnaire items, the method of data collection, and methods of analysis were adequately described in the article for future replication. Additional data for this manuscript was collected 1999, and 2008 using the methodology described in the referenced article. Because the raw data on which the McGinnis, Kohn, and Myers (1990) article was based was not available the authors were not able to conduct any statistical analyses beyond that which appeared in the article. However, the table in that article was adequate for visual comparison with the results from the 1999 and 2008 data.

In 1999 the authors sent a four-page, 36-item questionnaire to 732 randomly selected managers working in United States manufacturing firms who were members of the Council of Logistics Management. A pre-notification letter was sent one week before the questionnaire and cover letter, and a follow-up letter was sent one week after the questionnaire. This criteria and methodology was similar to that of the earlier cited 1990 study. Eighteen questionnaires were returned for a net mailing of 714. A total of 172 questionnaires, 24.1% of the net mailing, were returned by the response cut-off date. Contingency table analysis and Chi-square analysis of respondent ZIP codes indicated that the respondents were geographically representative of the sample.

In 2008 a four-page, 46-item questionnaire was electronically sent to 905 Council of Supply Chain Management Professionals members who worked for United States manufacturing firms and had job titles of manager or higher in logistics, distribution, or supply chain management. One hundred and twenty-three were undeliverable for a net sample of 782 subjects. After two follow-ups a total of fifty (6.4%) usable responses were returned. Forty-seven (47) responses were usable for the subject of the research reported in this manuscript. While the response rate was lower

than the previous surveys, it is understandable given the results of similar recent studies reported in the logistics/supply chain management literature (Flint, Larsson, and Gammelgaard, 2008). After examining the means, standard deviations, and reliability coefficients for the six variables the authors concluded that the 2008 results were adequate for inclusion in the longitudinal analysis. The eight questionnaire items that are the basis for the research reported in this manuscript are shown as Table 1.

## ANALYSIS

The analysis was conducted in three stages as described by McGinnis, Kohn, and Myers (1990). In the first stage five questionnaire items that addressed the private warehouse investment decision process were factor analyzed. Factor analysis is useful for identifying any underlying constructs that explain the variance in a set of questions. The factor analysis method was principle components. Factors with eigenvalues of one or greater than one were rotated orthogonally. These results are presented as Table 2.

In the second stage of the analysis scores were calculated for each factor for each respondent. The values for all questionnaire items loading on a factor at 0.5 or greater were added and the sum divided by the number of items loading on the factor. Based on the factor scores of each respondent, cluster analysis was used to classify the subjects into mutually exclusive groupings. Each grouping was then examined and then named based on its factor score average values. Each name reflects the "Private Warehouse Investment Strategy" based on its average factor scores. Table 3 presents the results of this stage of analysis.

The third stage of analysis was comprised of two evaluations using the identified warehouse strategies as independent variables. The first evaluation assessed mean differences of three questionnaire items concerned with market/product mix uncertainties, perceived availability of warehouse providers, and auditing of warehouse decisions. Next, perceived warehouse mixes were identified and evaluated relative to warehouse strategies. These results are shown as Tables 4 and 5.

**TABLE 1**  
**QUESTIONNAIRE ITEMS\***

**Private Warehouse Investment Decision Process Questions**

- WH-1 Formal capital budgeting techniques, such as discounted cash flow, net present value, and/or payback period dominate the decision whether to invest in private warehousing capacity.
- WH-2 Strategic considerations dominate the decision whether to invest in private warehouse capacity in my company/division.
- WH-3 My company/division explicitly considers subjective, hard to measure, service issues when considering whether to invest in private warehousing.
- WH-4 Formal cost analysis is tempered by other subjective factors before final decisions are made in my company/division.
- WH-5 Decisions whether to invest in private warehousing are increasingly intermingled with decisions in other logistics activities.

**Other Questions Related to Private Warehouse Investment**

- WH-6 Market and/or product mix uncertainties make it difficult to plan for future private warehouse needs.
- WH-7 The use of contract warehousing by my company/division is limited by the number of good providers that are available.
- WH-8 In my company/division private warehouse investment decision are audited after the project is in place.

\*Scale: 1 = Strongly Agree, 2 = Agree 3 = Neither Agree nor Disagree, 4 = Disagree, 5 = Strongly Disagree

**Table 2**  
**FACTOR ANALYSES**

1989 N = 220

**Factor 1: Intuitive Decisions**

Questions	Factor Loading
WH-2 Strategic considerations dominate the decision whether to invest in private warehouse capacity in my company/division.	0.640
WH-3 My company/division explicitly considers subjective, hard to measure service issues when considering whether to invest in private warehousing.	0.713
WH-4 Formal cost analysis is tempered by other subjective factors before final decisions are made in my company/division.	0.730

**Table 2**  
**(continued)**

Questions	Factor Loading
WH-5      Decisions whether to invest in private warehousing are increasingly intermingled with decisions in other logistics activities.	0.651
(Reliability Coefficient = 0.621)	
<b>Factor 2: Analytical Decisions</b>	
WH-1      Formal, capital budgeting techniques, such as discounted cash flow, net present value, and/or payback period dominate the decision whether to invest in private warehousing capacity.	0.912
Amount of total variance explained by both factors = 60.1%	
Source: Adapted from McGinnis, Kohn, & Myers (1990)	
<b>1999 N = 170</b>	
<b>Factor 1: Analytical/Strategic Decision</b>	
WH-1      Formal, capital budgeting techniques, such as discounted cash flow, net present value, and/or payback period dominate the decision whether to invest in private warehousing capacity.	0.825
WH-2      Strategic considerations dominate the decision whether to invest in private warehouse capacity in my company/division.	0.754
WH-5      Decisions whether to invest in private warehousing are increasingly intermingled with decisions in other logistics activities.	0.700
(41.3% of variance, reliability coefficient = 0.904)	
<b>Factor 2: Subjective Decisions</b>	
WH-3      My company/division explicitly considers subjective, hard to measure service issues when considering whether to invest in private warehousing.	0.806
WH-4      Formal cost analysis is tempered by other subjective factors before final decisions are made in my company/division.	0.808
(23.5% of variance, reliability coefficient = 0.893)	
Amount of total variance explained by both factors = 64.8%	
<b>2008 N = 47</b>	
<b>Factor 1: Strategic/Subjective</b>	
WH-2      Strategic considerations dominate the decision whether to invest in private warehouse capacity in my company/division.	0.755
WH-3      My company/division explicitly considers subjective, hard to measure service issues when considering whether to invest in private warehousing.	0.689

**Table 2**  
(continued)

Questions	Factor Loading
WH-4      Formal cost analysis is tempered by other subjective factors before final decisions are made in my company/division.	0.801
(37.5% of variance, reliability coefficient = 0.633)	
<b>Factor 2: Analytical/Integrative</b>	
WH-1      Formal, capital budgeting techniques, such as discounted cash flow, net present value, and/or payback period dominate the decision whether to invest in private warehousing capacity.	0.857
WH-5      Decisions whether to invest in private warehousing are increasingly intermingled with decisions in other logistics activities.	0.856
(29.9% of variance, reliability coefficient = 0.651)	
Amount of variance explained by both factors = 67.4%	

**TABLE 3**  
**PRIVATE WAREHOUSE INVESTMENT STRATEGIES**

1989					
Factor Scores*					
		Factor 1	Factor 2	Number of Respondents	Percentage of Respondents
Private Warehouse Investment Strategies	Intuitive Decisions	Analytical Decisions	Number of Respondents	Percentage of Respondents	
1. Analytical-Intuitive	2.38**	1.73***	130	59.1	
2. Intuitive	2.43	3.59	90	40.9	
			220	100.0	
Source: Adapted from McGinnis, Kohn, and Myers (1990)					
**Differences between Factor 1 means not significant, alpha = 0.05					
***Difference between Factor 2 means significant, alpha = 0.05					
1989					
1. Unfocused	2.46**	3.35**	46	29.3	
2. Subjective	3.14	2.31	36	22.9	
3. Intense	1.94	2.08	81	47.8	
			157	100.0	
**Differences among factor means significant, alpha = 0.05					



Table 3  
(continued)

Factor Scores*				
	Factor 1	Factor 2		
Private Warehouse Investment Strategies	Intuitive Decisions	Analytical Decisions	Number of Respondents	Percentage of Respondents
2008				
1.	3.18**	1.81**	11	23.4
2.	2.18	2.71	36	76.6
			47	100.0

\*Factor scores are the value (means) of the questionnaire item(s) loading on the factor  
Scale: 1 = Strongly Agree; 2 = Agree; 3 = Neither Agree nor Disagree; 4 = Disagree; 5 = Strongly Disagree  
\*\*Differences between factor means significant, alpha = 0.05

TABLE 4  
COMPARISON OF MEANS (OF SELECTED ITEMS)  
AMONG WAREHOUSE INVESTMENT STRATEGIES

1989		Mean Responses*		
		Strategy 1: Analytical- Intuitive Decisions	Strategy 2: Intuitive Decisions	
Questions		N = 130	N = 90	Significance
WH-6	Market and/or product mix uncertainties make it difficult to plan for future private warehousing needs.	2.86	3.01	Not Significant
WH-7	The use of contract warehousing by my company/division is limited by the number of good providers that are available.	3.48	3.36	Not Significant
WH-8	In my company/division, private warehouse investment decisions are audited after the project is in place.	2.50	2.93	< 0.01

Source: Adapted from McGinnis, Kohn, and Myers (1990)  
\*Scale: 1 = Strongly Agree; 2 = Agree; 3 = Neither Agree nor Disagree; 4 = Disagree; 5 = Strongly Disagree

Table 4  
(continued)

1999		Mean Responses*			Significance
		Strategy 1: Unfocused	Strategy 2: Subjective	Strategy 3: Intense	
Questions		N = 46	N = 36	N = 75	
WH-6	Market and/or product mix uncertainties make it difficult to plan for future private warehousing needs.	2.98	2.69	2.61	0.172
WH-7	The use of contract warehousing by my company/division is limited by the number of good providers that are available.	3.54	3.28	3.22	0.236
WH-8	In my company/division, private warehouse investment decisions are audited after the project is in place.	2.87	3.22	2.57	0.003**

\*Scale: 1 = Strongly Agree; 2 = Agree; 3 = Neither Agree nor Disagree; 4 = Disagree; 5 = Strongly Disagree  
 \*\*WH-8 Strategy 1 mean not significant, alpha < 0.05, from Strategy 2 and Strategy 3 means

2008		Mean Responses*		Significance
		Strategy 1: Analytical	Strategy 2: Intuitive	
Questions		N = 11	N = 36	
WH-6	Market and/or product mix uncertainties make it difficult to plan for future private warehousing needs.	3.27	2.89	0.322
WH-7	The use of contract warehousing by my company/division is limited by the number of good providers that are available.	3.45	3.47	0.963
WH-8	In my company/division, private warehouse investment decisions are audited after the project is in place.	2.45	2.78	0.373

\*Scale: 1 = Strongly Agree; 2 = Agree; 3 = Neither Agree nor Disagree; 4 = Disagree; 5 = Strongly Disagree

**TABLE 5**  
**WAREHOUSE MIX 1989 THROUGH 2008**

<b>1989</b>						
<b>Warehouse Mix Percentages</b>						
	N	Private	Contract	Public	Other	Total
	208	68.5	10.8	13.7	6.9	99.9*

\*Totals vary from 100% due to individual respondent totals not equaling 100%.

Source: Adapted from McGinnis, Kohn, and Myers (1990)

<b>1999</b>						
Strategy	N	Private	Contract*	Public	Other**	Total
1. Unfocused	46	50.7	34.8	9.0	5.5	100.0
2. Subjective	36	27.7	13.0	9.4	19.9	100.0
3. Intense	75	52.0	23.7	13.7	10.6	100.0
Overall	157	53.0	24.5	11.3	11.3	100.1***

\*Means for contract warehousing significantly different at alpha < 0.05. Mean of Strategy 3 not significant, alpha < 0.05 from Strategy 1 and Strategy 2 means based on post hoc analysis.

\*\*Means of other warehousing not significant, alpha < 0.05. Mean of Strategy 3 not significant, alpha < 0.05, from Strategy 1 and Strategy 2 means based on post hoc analysis.

\*\*\*Total varies from 100% due to rounding.

<b>2008</b>						
Strategy	N	Private	Contract	Public*	Other	Total
1. Analytical	11	51.4	31.4	15.9	1.4	100.1**
2. Intuitive	34	54.2	37.1	3.0	5.7	100.0
Overall	46***	53.2	35.7	6.2	4.7	100.1**

\*Means for public warehousing significantly different at alpha = 0.05

\*\*Total varies from 100% due to rounding.

\*\*\*On respondent whose totals did not equal 100% was not included.

### FINDINGS AND DISCUSSION

Examination of Table 2 reveals some similarities and differences among the three replications (1989, 1999, & 2008). First, two factors were identified in each replication. In each replication one of the factors is

relatively "analytical" and the other is relatively "subjective". For example "subjective" variables WH-3 (My company/division explicitly considers subjective, hard to measure, service issues when considering whether to invest in private warehousing) and WH-4 (Formal cost analysis is tempered by other subjective

factors before final decisions are made in my company/division) loaded on the same factor in all three replications but never loaded on the "analytical" variable WH-1 (Formal capital budgeting techniques, such as discounted cash flow, net present value, and/or payback period dominate the decision whether to invest in private warehousing capacity). Variable WH-2 (Strategic considerations dominate the decision whether to invest in private warehouse capacity in my company/division) loaded on the same factor as "subjective" variables, WH-3 and WH-4, twice and the "analytical" variable, WH-1, once. WH-5 (Decisions whether to invest in private warehousing are increasingly intermingled with decisions in other logistics activities) loaded on the "subjective" variables only once but loaded on the "analytical" variable twice.

Based on the previous paragraph it appears that the factor analyses in each replication identified one factor that was primarily "analytical" and one that was primarily "subjective". The "analytical" factors in 1989, 1999, and 2008 were "Analytical Decisions", "Analytical/Strategic Decisions", and "Analytical/Integrative" respectively. The "subjective" factors were "Intuitive Decisions", "Subjective Decisions", and "Strategic/Subjective Decisions" respectively. Two variables, WH-2 (strategic considerations) and WH-5 (private warehouse decisions intermingled with other logistics decisions) appear to be less fundamental to either of the two factors.

The major difference in the factors presented in Table 2 are that one variable, WH-2, did not consistently load on either the "analytical" or the "subjective" factor. In the three replications, no clear pattern was observed that would lead to a conclusion that strategic considerations are inherently "analytical" or "subjective". However, an argument could be made that variable WH-5, private warehouse investment decisions being intermingled with decisions in other logistics activities, which loaded on the same factor as WH-1 in 1999 and 2008 may have become integrated into the analysis. In summary the results, shown as Table 2, indicate that there are two constructs that affect decisions to invest in private warehousing. They are "analytical" and "subjective". The private warehouse investment strategies based on the factor analysis are

shown as Table 3 and are discussed in the following paragraphs.

Examination of Table 3 reveals that two warehouse investment strategies were identified in 1989 and 2008 and three distinct strategies were identified in 1999. While the strategies in the data sets are not identical, some generalizations can be made for purposes of discussion. First, there are strategies in all three replications that emphasize an "analytical" factor. They are "Analytical-Intuitive" in 1989, "Intense" in 1999, and "Analytical" in 2008. If 1999 strategies 1 (Unfocused) and 2 (Subjective) are combined and described as "non-analytical" then some observations can be made regarding relative to trends that have occurred during the time period studied. First, the percentage of "analytical" focused (Analytical-Intuitive in 1989, Intense in 1999, and Analytical in 2008) strategy respondents declined steadily (59.1% to 52.2% to 23.3% in 1989, 1999, and 2009 respectively) during the period studied. However, the focus of "analytical" focused strategies evolved from capital budgeting (WH-1) in 1989 to capital budgeting (WH-1) + strategic considerations (WH-2) + warehouse investment decisions intermingled with other logistics decisions (WH-5) in 1999 to capital budgeting (WH-1) and warehouse investment decisions intermingled with other logistics decisions (WH-5) in 2008. These results suggest that "analytical" approaches to private warehouse investment decisions evolved from a quantitative focus to include a combination of quantitative and qualitative issues. In the process "analytical" approaches became more inclusive (or comprehensive).

Second, while the percentage of "non-analytical" strategies increased (from 40.9%, to 52.2%, to 76.6% in 1989, 1999, and 2008 respectively) steadily during the period studied, the nature of "non-analytical strategies" evolved. In 1989 the strategy "Intuitive Decisions" included all questionnaire items that were not capital budgeting focused. They were WH-2 (strategic considerations), WH-3 (subjective issues), WH-4 (formal cost analysis tempered by subjective factors), and WH-5 (warehouse investment decisions intermingled with other logistics decisions). In 1999 the strategy "Subjective Decisions" included only two items (WH-3 and WH-4) which focused on subjective issues. By 2008

"Strategic/Subjective" was comprised of three items, strategic considerations (WH-2) and the two subjective items (WH-3 and WH-4). Finally, an examination of Table 2 reveals that, although the percent contribution of each cluster to total variance in 1989 was not available, the percent variance of strategy clusters explained by "analytical" and "subjective" changed from 41.3%/23.5% in 1999 to 29.9%/37.5% in 2008. While difficult to conclude with finality, these results suggest that

- a. "quantitative" and "strategic" techniques in private warehouse investment decisions appear to remain two distinct approaches,
- b. strategic approaches to private warehouse investment decisions increased in importance relative to formal capital budgeting techniques between 1999 and 2008, and
- c. "subjective" considerations remain a significant component of private warehouse investment decisions.

Further examination of the results shown in Table 3 together with the interpretations discussed in the previous paragraph indicate that emphasis on "analytical" strategies declined from 59.1% of respondents in 1989 to 47.8% in 1999 and 23.4% in 2008. By comparison the percentage of respondents selecting a "subjective" strategy increased from 40.9% in 1989 to 76.6% in 2008. Further, the combination of Strategies 1 and 2 in the 1999 data suggests 52.2% "non-analytical" strategies. These findings suggest that, during the period from 1989 to 2008, the analysis of analyzing private warehouse investment strategies became less "analytical" and more "subjective". The implications of these findings will be discussed later.

Inspection of the results shown as Table 4 revealed that market/product mix uncertainties (WH-6) and the availability of good contract warehouse providers (WH-7) were not concerns in the selection of a private warehouse investment strategy in any of the three studies. The 1989 and 1999 results reveal that post-audit private warehouse investment decisions were more likely to occur in "analytical" strategies. However, in the 1999 study the "Intense" strategy was not

significantly different,  $\alpha < 0.05$ , from the "Unfocused" strategy. Further examination of these two strategies in Table 3 revealed that the "Unfocused" strategy's mean score on Factor 1 was between "Intense" and "Subjective" strategies but closer to that of the "Intense" strategy (0.52) than to the "Subjective" strategy (0.68). Apparently, post-audits of private warehouse investment decisions were significantly more prevalent in "analytical" strategies, but are used equally in both "analytical" and "subjective" strategies by the time of the 2008's replication of the study. Again, the implications of these findings will be discussed later. Finally, responses to the questions WH-6, WH-7, and WH-8 suggest that the external issues, market and product mix uncertainties and the availability of good contract warehousing providers, and the internal issue, whether private warehouse investment decisions are post audited, do not appear to vary systematically among the private warehouse investment strategies.

In each study respondents were asked to estimate the percentage of inventory stored in four warehouse options. These options were Private (company owned), Contract (long-term for-hire), Public (short-term as needed), and Other (usually supplier or customer storage). Examination of the warehouse mixes of the respondents to the three studies suggests three trends. First, the use of private warehousing declined from 68.5% in 1989 to 53.0% in 1999 then remained steady. Second, the usage of contract warehousing increased over the period studied, from 10.8% in 1989 to 24.5% in 1999 to 35.7% in 2008. Finally, the usage of public warehousing declined over the period studied from 13.7% in 1989 to 11.3% in 1999 to 6.2% in 2008. These findings provide a basis for the following two observations. First, United States manufacturing firms may have completed the process of assessing the appropriate mix of private warehousing overall. However, when the percentages of inventory stored in the combination of private and contract (we will call this "controlled" warehousing) warehousing is examined the percentages are 79.3% in 1989, 77.5% in 1999, and 88.9% in 2008. Second, these figures suggest that while the emphasis on private warehousing has declined over the period studied, the need to control warehousing through a combination of private ownership and contractual arrangements increased between 1999 and

2008. Perhaps the issue that is more relevant is not “ownership” but “control” of warehouse operations. This second observation is further supported by the decline in public (inventory is stored in a for-hire basis on an as needed basis) warehouse usage from 13.7% to 11.3% to 6.2% during the period studied. Finally, the “Other” (usually supplier or customer storage) increased from 6.9% in 1989 to 11.3% in 1999 and then declined to 4.7% in 2008. This combined with the decline in public warehousing reinforces the second observation that United States manufacturing firms have increased their emphasis on the control of warehousing through a combination of private and contract operations.

### CONCLUSIONS AND IMPLICATIONS

The results of three studies of private warehouse investment decisions suggest that emphasis of decision-making processes in United States manufacturing firms has evolved from a heavy emphasis on quantitative capital budgeting techniques to a heavy emphasis on strategic/subjective processes that blends strategic and subjective (qualitative) issues. On reflection, this change in processes over a two decade period is not totally surprising since the maturity of strategic planning during that period tempered earlier emphases on quantification of decision making. In addition, the results of these studies suggest United States manufacturing firms placed increased emphasis on control of warehousing through a combination of private ownership and contractual arrangements with third-party providers. This increasing emphasis on control of warehousing may be due to the increasing need to manage the supply chain including warehousing.

While the results of the three studies reported in the research suggest that there has been a trend in private warehouse investment decisions away from an emphasis on capital budgeting focused processes towards emphasis on strategic focused processes, several issues are likely to affect the process in specific firms, or in specific situations within a firm. They include

- The availability of reliable data regarding alternatives, costs, forecasts regarding markets and

product mixes, industry stability, and market stability.

- The role of warehousing in the achievement of the firm’s objectives.
- The role of warehousing in the overall management of the supply chain.
- The extent that the firm’s strategies are proactive or reactive.
- The firm’s overall financial strategy.
- The extent to which warehousing is seen as important to the firm’s core competencies.
- The firm’s culture regarding the importance of quantitative versus qualitative decision making.

A summary of responses to the research questions is as follows:

- a. Private warehouse investment decisions in United States manufacturing firms have evolved.
- b. They have changed from an emphasis on quantitative capital budgeting techniques in 1989 to a process that blends strategic and subjective (qualitative) issues in 2008.
- c. Market/product mix uncertainties did not appear to have affected private warehouse investment decision strategies during the period studied.
- d. The availability of good contract warehousing providers did not appear to affect private warehouse investment decision strategies during the period studied.
- e. The warehouse mix evolved during the period studied. During the period studied (1989 – 2008) the percentage of inventory stored in private warehousing United States manufacturing firms declined from 68.5% to 53.0%, contract warehousing increased from 10.8% to 24.5%, and private warehousing declined from 13.7% to 6.2%. “Other” (usually supplier or customer storage) increased from 6.9% in 1989, increased to 11.3% in 1999, and then declined to 4.7% in 2008. The percentage of inventory stored in a combination of private and contract warehousing (considered by

the authors to be "controlled warehousing") increased from 79.3% in 1989 to 88.9% in 2008. In summary, the warehouse mix evolved during the period studied to reflect an overall higher percentage of inventory stored in "controlled" warehousing and a smaller percentage stored in "owned" warehousing.

- f. It was not possible to determine whether the warehouse mix of warehouse types varied with the private warehouse investment strategy from the 1989, McGinnis, Kohn, Myers (1990), study. In the 1999 study contract and "other" percentages varied among strategies and in 2008 the percentage of private warehousing varied between strategies. Overall, these variations did not appear to be systematic in the two (1999 and 2008) studies where comparisons could be made.

### Applied Implications

This research provides implications for practitioners, teachers, and researchers of transportation, supply chain management, logistics, and warehousing. For practitioners it appears that, while strategic considerations have increased in importance in private warehouse investment decisions, there is no one process that is ideal for all private warehouse investment decisions. Rather, a blend of analytical, strategic, and subjective considerations should be selected in a proportion appropriate for the organization and situation. However, the private warehouse investment decision is much less likely to be made independently of other organizational considerations than it would have been in 1989. Second, it appears that the dominant concern may not be whether warehouse capacity is owned or outsourced. Rather the dominant concern may be how warehousing will be controlled through a combination of private and contract warehousing. Future decisions regarding private warehouse investment decisions are likely to include wider participation from internal and external stakeholders including non-supply management professionals in the firm, key suppliers, and key customers.

While subtle, the implications of this research are relevant to the transportation industry, and its strategies. First, the decline in percentages of private warehousing (68.5% to 53.2%) and public warehousing (13.7% to 6.2%) indicates that approximately 22.8% of warehouse capacity moved from direct control of the manufacturer. As a result, depending on the agreement between the firm and its contract warehouse operator, responsibility for as much as 1/5 of inbound and outbound transportation decisions may have shifted

from the manufacturer to a third-party provider. This means that transportation provider strategies that emphasize manufacturers may face declines in business if the contract warehouse operator also provides (or arranges for) inbound and outbound transportation services.

However, the trend toward contract warehousing may benefit transportation providers if their strategies (a) include providing transportation services to contract warehouse and other third-party logistics providers and/or (b) expansion into value-added services. The potential of former strategy is that many contract warehouses/third-party providers serve multiple manufacturers. This means that increased focus on contract warehouse firms and other third-party providers may provide traffic increases that offset declines due to manufacturers outsourcing warehousing. The promise of the latter strategy is that the revenues and profits of non-transportation value-added services may more than offset decreases in transportation revenues that may occur if warehouse outsourcing reduces the potential of a transportation only focus.

For teachers of supply chain management, this research provides a glimpse of the dynamic nature of decision-making in one sector of logistics management. Presenting alternate perspectives on the topic of this research, as well as other decision areas (such as customer service, inventory management, supplier selection and evaluation, and transportation management) could help better prepare students for a real world where strategies and analysis models vary with situations.

For researchers of supply chain management and logistics this research provides one perspective on the changing nature of one decision-making process. The value of examining a process over a two decade period has increase the authors' understanding of the changing nature, and continuity, of private warehouse investment decisions. Perhaps researchers will revisit topics that have been previously examined with the goal of conducting additional longitudinal research in a greater array of supply chain management and logistics topics.

Logistics/supply management research would gain from a broader array of longitudinal research in a larger array of manufacturing and nonmanufacturing logistics/supply chain management topics. Such topics as transportation alternatives, customer service measures, standards of performance, the effectiveness of multinational supply chains, the importance of

financial performance versus logistics/supply chain performance, and integration of supply chains versus independent supply chains are important allied topics that would benefit from longitudinal research. Finally,

continuing longitudinal research of private warehouse investment decisions in United States manufacturing firms provide useful insights over time.

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