The Effectiveness of Automatic Inventory Replenishment in Supply Chain Operations: Antecedents and Outcomes

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The issue of buyer-seller relationships in supply-chain management research is becoming increasingly critical. Global competition and maturing domestic markets have driven supply-chain members to reassess their distribution techniques to remain competitive in the market. Firms need inventory replenishment systems that enhance customer service whereas at the same time reduce inventory costs. Many retailers are demanding time-phased replenishment. They want delivery made just as they need the stock for sale. High levels of anticipatory inventory are no longer acceptable. Retailers want high-volume, high-turn items delivered on a just-in-time basis. In this study, we investigate the use of automatic replenishment programs (ARPs) and the effectiveness of these ARPs in today’s markets. Through a survey of U.S. retailers and manufacturers, we examine the transaction specific, strategic, and organizational antecedents that drive automatic replenishment efforts, as well as the effects of these efforts on the firms’ strategic and economic performance.

Global competition and maturing domestic markets are creating increasingly competitive conditions for channel partners, often necessitating a reassessment of distribution techniques (Siguaw, Simpson, and Baker, 1998). Trading partner relationships in the supply chain have received greater attention recently. Much of the attention has
centered on the issue of inventory management. Many manufacturing firms have focused on the need for more effective management of production-inventory systems (Hahn, Bragg, and Shim, 1988). Many retailers have focused on time-phased replenishment rather than holding anticipatory stock (Andel, 1999).

Some of the more effective efforts at projecting demand levels have involved relationships in which sellers replenish or restock inventory based on the actual product usage and stock level information provided by buyers. These inventory systems have been referred to as automatic replenishment systems, or ARPs. ARPs are designed to make inventory commitment more efficient through precise planning and replenishment practices. Ideally, minimal stock levels are maintained without jeopardizing service levels. Automatic replenishment is most often associated with retail level inventory practices; however, ARP-type systems are applicable throughout the distribution channel. Retailers implement ARPs to trigger replenishment from manufacturers (or middlemen). In addition to the outbound connection with retailers or wholesalers, manufacturers may use the systems to manage inbound inventory replenishment from their suppliers.

One of the first high-profile examples of automatic replenishment involved Proctor and Gamble’s involvement with Schnuck’s Markets, a regional grocery chain in the St. Louis area. They later extended the ARP system to Kmart and Wal-Mart. Initial programs covered only soap products and disposable diapers. Today, more than 40% of P&G’s sales to retailers are sold on automatic replenishment basis (Cooke, 1998).

Schnuck’s credits its automatic replenishment program for permitting significant reductions in inventory holdings. Standard demand forecasting was dramatically improved by working with actual sales data. However, the retailer still encountered stockout problems on promotional items. Their solution has been to increase automatic replenishment commitment by extending involvement to Collaborative Planning, Forecasting, and Replenishment (CPFR), which is expected to better forecast “big spikes in demand” due to promotions.

Because of their relative newness, little is known about ARP programs. However, the results of a preliminary investigation of U.S. firms currently involved in automatic replenishment programs presented in the following narrative provide greater insight into ARPs. The research focuses on antecedents influencing the effectiveness of automatic replenishment efforts. Additionally, the research examines the relationship between automatic replenishment effectiveness and firms’ economic and strategic performance.

The paper is organized in the following manner. First, a theoretical foundation is proposed based on the existing literature. In this framework, we posit that automatic replenishment program effectiveness is driven by three functional perspectives of the firm: transaction costs, strategic philosophy, and organizational influences. Second, we develop a series of research hypotheses that link these perspectives with ARP effectiveness, and subsequently ARP effectiveness with the subjective and objective measures of firm performance. Finally, we offer a discussion of the research implications, as well as suggested directions for future exploration.
Efficient replenishment systems require effective information linkages between buyers and sellers; sharing of information reduces uncertainty. A recent paper by Closs, Roath, Goldsby, Eckert, and Swartz (1998) reporting on an empirical comparison of traditional anticipatory (forecast oriented) and response-based supply chain systems (consistent with the ARP format) provides an excellent illustration of the benefits resulting from decreased uncertainty through utilization of automatic replenishment type systems. Response-based supply chain strategies were found to consistently outperform anticipatory systems in terms of both improved service and lower inventory holdings. More precise demand-oriented information resulted in substantial inventory savings.

The trade literature (e.g., Casper, 1998; Robins, 1995) provides examples of company-specific programs. For example, Efficient Consumer Response (ECR) is widely used within the grocery industry. Retailers such as Giant Food in Maryland credit the cooperative programs with achieving “immediate, significant reductions in inventory” (Garry, 1994). The retailers routinely work with manufacturers such as Kellogg and Nabisco to improve replenishment efficiency. However, automatic replenishment is not limited to the grocery industry. Apparel retailers such as Dillard’s and JC Penney utilize Quick Response programs to improve inventory efficiency (King and Maddalena, 1998).

Although a few case examples of ARP’s are available, empirical investigations remain sparse. Little inquiry has been made into the antecedents, which drive replenishment effectiveness or the value of these systems. Previous research suggests that a number of changes in operating systems are associated with effective automatic replenishment programs (Cottrill, 1997; Fiorito, May, and Strong, 1995). These changes include reduction, efficiency, and reliability. Reduction in production run length, shipment sizes, and reliance on forecasting allows a firm to manufacture and ship in shorter time-spans. Reduction in order cycle length and smaller size shipments limit retail inventories. Thus inventory commitment is reduced throughout the supply chain. Efficiency comes in the form of receiver friendly loads, that is, delivery of exact quantities needed and/or configured to meet customer requirements. Efficiency also results from better communication linkages between buyers and sellers, which reduces waste of both tangibles and time. Reliability includes more predictable order cycles, which enable selling firms to ship and deliver goods on time and retailers subsequently deal with fewer out-of-stock items. More simply stated, these changes are captured in the cost reduction and service enhancements of the replenishment system. These dimensions of automatic replenishment programs are not necessarily mutually exclusive; firms will attempt to achieve some level of both in their systems. To do so, a considerable commitment of resources is necessary because ARP involvement demands significant financial and managerial inputs (Keh and Park, 1997).

In any managed inventory program, the issue of control in key supply decisions is critical (e.g., Gaski, 1984). The transfer of control of financial responsibility and asset management to the supplying organization provides a fundamental shift in buyer-seller relationships (Nannery, 1994). That transfer is an important aspect of this study:
the transfer of control balance within ARP relationships requires an understanding and trust in the confidentiality of sales data and pricing information shared among organizations (Fiorito et al., 1995). Firms rely most heavily on information exchange in channel relationships characterized by high levels of interdependency (Frazier and Sommers, 1984). Control of the movement of tangible goods between supply chain principles is an obvious function of any ARP. Control of market-related information is equally important to organizations. Because of this major shift in control to the selling organization, our unit of analysis in this study is the most important ARP relationship of the firm. Thus, the focus is on the ARP movement of goods within a critical organizational relationship.

We see three multidimensional perspectives as appropriate for discussing the control and resource issues associated with automatic replenishment programs: These are (1) transaction cost analysis, (2), the strategic considerations of the firm, and (3) organizational factors. The three perspectives are believed to influence the degree of ARP effectiveness and the role of ARP operations in the decisions of the supplying organization. Transaction cost factors are useful in understanding the problems associated with bilateral bargaining in individual relationships in dynamic environments (Aulakh and Kotabe, 1997; Kogut, 1988), which in turn enables us to investigate control related perspectives of shared systems. The strategic orientations of the firm allow investigation of the differing competitive postures of firms and their association with working ARPs. Concentrating on the organizational factors allows examination of the resource-related issues that are relevant to inventory management systems.

A dominant paradigm used to explore supply-chain relationships is based on transaction cost analysis. Although TCA provides a parsimonious theoretical explanation of these relationships, it focuses on individual economic exchanges (Aulakh and Kotabe, 1997; Williamson, 1975). There is a need to complement the efficiency perspective of the transaction cost model with “strategic issues concerning governance modes, for it is argued that firms may be willing to sacrifice the cost advantages... in order to improve their competitive position vis-à-vis rival firms” (Aulakh and Kotabe, 1997, 146). This is also reflective of traditional supply chain management practices of balancing or assessing cost and service trade-offs.

Transaction costs analysis addresses the behavioral assumptions of self-interest and bounded rationality of the entities involved in supply chain relationships (Williamson, 1975). Shared information provides the opportunity for firms to behave opportunistically, which increases the transaction costs associated with the exchange relationship (Aulakh and Kotabe, 1997). High transaction costs often drive firms to increase control within the channel, and in an ARP context this can affect the balance of responsibility between buyer and seller. This is very similar to the channel integration arguments made by Anderson and Gatignon (1986), and Klein, Frazier, and Roth (1990), where enhanced transaction costs drove firms to increase their channel control by integrating distribution channels. Theory suggests that firms act in such a way as to minimize the sum of transaction costs and production costs (Klein, Frazier, and Roth, 1990). From the ARP perspective of transaction costs, the critical factors associated with cost minimization are systems
standardization, underlying product costs, and market uncertainty in the form of competitive intensity.

The strategic considerations of the firm involve the relationships between organizational goals and the effectiveness of automatic replenishment programs. Traditionally, managed inventory arrangements have been used to reduce costs and thereby increase margins and revenues (Stratman, 1997). This would provide the profit-oriented firm with the motive to implement ARP strategies and subject itself to the related control and resource commitment issues of these systems. However, the strategic orientation of many supply chain members is toward the market, with goals of competitive differentiation and enhanced market share position. ARPs accomplish this by consistently providing an array of customers with on-time products, but with less emphasis on cutting costs. Thus, two strategic factors are relevant to the discussion: market and profitability orientation (Cavusgil and Zou, 1994; Porter, 1980). Market oriented strategy deals with meeting competitive moves within the market, creating barriers to entry, and other broad strategic aims associated with enhancing market position and meeting customer needs. A profit-oriented strategy instead focuses on revenues and therefore is more likely to be associated with costs versus time.

The third dimension associated with control and resource issues and ARPs is that of organizational factors. The capabilities of any organization will affect its ability to effectively move products (Day, 1994). This is particularly true when implementing sophisticated transfer systems such as ARPs. Capabilities are based on organizational structure and competence, and influence the organization’s ability and management’s willingness to invest resources in distribution decisions (see Madhok, 1996). According to Aulakh and Kotabe (1997, p. 148), “... a major distinction [exists] between transaction cost and organizational capability perspectives... while the former focuses on the transaction characteristics to minimize the sum of transaction costs and production costs (Kogut, 1988; Klein et al., 1990), the latter deals primarily with firm capabilities in order to better manage its skills and resources.” Successful implementation of automatic replenishment programs will be influenced by the structural and experiential capabilities available to manage these systems, encompassing both financial and human resources. Management commitment of dedicated resources to the programs, however, is also conducive to efficient distribution systems (see Gilliland and Bello, 1997), as is the degree of autonomy and trust that exists to allow successful information exchange between channel partners. Therefore, we see three organizational factors as influential to ARP effectiveness: firm size, centralization of decision making, and commitment to the automatic replenishment program.

Given this background, Figure 1 is proposed as a conceptual framework for investigating the relationships between these three sets of factors and ARP effectiveness, and in turn the linkage between ARP effectiveness and firm performance, both economic and strategic. In this study, we concentrate on two measures of ARP effectiveness: that of cost effectiveness and service effectiveness. In the following section, specific hypotheses are presented that address these linkages, and where appropriate distinguish between the proposed influences of antecedents on these distinctive ARP outcomes.
RESEARCH HYPOTHESES

Transaction Specific Factors

Standardization

Just as some products require technical adjustments to fit buyer and market needs, individual inventory management systems will also need customization (see Rangan, Menezes, and Maier, 1992). Williamson’s (1985) work on transaction cost theory provides a useful foundation for the justification of standardization strategies, whether of products, services, or systems. Both program and process standardization are relevant (Jain, 1989). Program standardization refers to various aspects of the marketing mix and process standardization includes tools that aid in marketing program development and implementation. The latter is seen to include ARPs, because ARPs support the firm’s distribution strategies. ARP-related needs will vary across buyers and sellers. Although it may be desirable to standardize ARP systems and thus achieve scale economies, in actuality ARP standardization is seen as a spectrum between complete standardization of the system for
all customers served and customized replenishment for each relationship. The more
standardized the ARP system, the greater the benefits of cost reduction will be; however,
meeting the individual needs and providing reliable service will be difficult with stan-
dardization. Therefore:

\[ H_1: \text{The greater the standardization of the ARP system, the} \]
\[ a. \text{greater the cost effectiveness of the automatic replenishment} \]
\[ \text{program, and} \]
\[ b. \text{lower the service effectiveness of the automatic replenishment} \]
\[ \text{program.} \]

Product Cost Volatility

The term “efficiency” is generally associated with cost reduction (Robinson, 1991). Successful cost reduction requires clear understanding and precise definition of all underlying costs including inputs and components, labor, and distribution. The task is usually complicated by the fact that many costs are volatile. Product costs, and therefore prices, are often pre-established, making volatile costs problematic in maintaining margins and revenues. Given that supply-chain members often lock in prices for several months, volatile input and production costs can lead to inaccurate price quotes. This affects both ARP cost effectiveness and service effectiveness, because buyers may be less than satisfied if products arrive at prices that are higher than expected. Therefore:

\[ H_2: \text{The greater the volatility of product costs, the} \]
\[ a. \text{lower the cost effectiveness of the automatic replenishment pro-} \]
\[ \text{gram, and} \]
\[ b. \text{lower the service effectiveness of the automatic replenishment} \]
\[ \text{program.} \]

Competitive Intensity

According to transaction cost analysis, external uncertainty influences contractual arrangements between organizations (Williamson, 1975). External uncertainty often takes the form of market competitiveness, where changing competitive offerings in the marketplace force firms to react to volatile pressures. This sort of uncertainty has been shown to influence firms to internalize transactions and decision making to absorb the volatility of markets (Aulakh and Kotabe, 1997). Studies show that external uncertainty allows negative information asymmetries to develop and provides the opportunity for outside forces to behave opportunistically (Klein, Frazier, and Roth, 1990). High market competitiveness increases the need for quick decisions, dictating a fluid, and simple information dissemination method (see Engleson, 1995). Responsiveness in highly competitive markets is enhanced with reduced lead-times and predictable order cycles, driving firms
to implement and maintain effective ARPs. Rather than being a detriment to ARP effectiveness, we see competitive intensity as a positive influence of ARP effectiveness, because firms often implement these programs as a result of this uncertainty, rather than despite it. Highly competitive markets would drive firms to differentiate and become more responsive to partner demands. Thus:

**H₃:** The greater the competitive intensity of the market, the
  a. greater the cost effectiveness of the automatic replenishment program, and
  b. greater the service effectiveness of the automatic replenishment program

### Strategic Factors

#### Market-Oriented Strategy

Regarding distribution management, the strategic perspectives of organizations are seen to fundamentally influence outcomes (Dwyer and Oh, 1988). Traditionally, managerial strategic perspectives have been classified as either economically or market oriented; most research has focused on the former (Cavusgil and Zou, 1994). However, firms often seek power positions in the market and block potential movement of competitors through the creation of market imperfections/monopolistic power and barriers to entry (Aulakh and Kotabe, 1997), rather than focusing on short-term economic benefits. The creation of these barriers can take the form of blocked distribution channels or exclusive arrangements with value-chain members. Strategic positioning can be enhanced by locking supply-chain partners into ARP agreements thus limiting supplier-switching by retailers or by enhanced relationships via improved inventory replenishment. Such tactics will be viewed as conducive to enhanced market share, customer satisfaction, and a differentiated company image, which are key strategic goals to many firms. Thus:

**H₄:** The greater the market orientation of a firm, the
  a. lower the cost effectiveness of its automatic replenishment program, and
  b. greater the service effectiveness of automatic replenishment program.

#### Profit-Oriented Strategy

Firms with a profit-oriented strategy are more concerned with bottom-line issues and short-term profitability than market-oriented firms. Economic goals are considered paramount. The profit versus market strategic orientation can be seen as conflicting as well as complementary and subject to hierarchical considerations regarding level of importance
(increased market share brings increased profits, yet to increase market share the firm may have to experience losses in the short-term by undercutting competitive price offers) (see Paun and Albaum, 1993). Much of the conflicting nature in strategic perspectives may be attributed to temporal issues. From the supply-chain perspective, short-term strategies are not easily synthesized with long-term objectives. Organizations involved in ARPs are interested in the long-term survival of the firm, which in turn is reliant on the ability of the organization to adapt to a variety of environmental pressures and constraints (see Thach and Axinn, 1991). Preliminary interviews with managers indicated that firms often have specific profitability-related strategies. It is posited that these firms will view ARPs as a means by which to reduce costs and increase margins. This orientation will enhance the overall cost effectiveness of the automatic replenishment program.

**H₅:** The greater the profitability orientation of a firm, the
a. greater the cost effectiveness of its automatic replenishment program, and
b. lower the service effectiveness of automatic replenishment program.

**Organizational Factors**

**Firm Size**

The effect of firm size and its influence on decisions and outcomes of applied systems has been investigated in a number of inventory management and distribution studies, (e.g., Dröge and Germain, 1998). In these studies, the issue of resource commitment to inventory management systems is examined, with a particular focus on the relationships between the degree of financial assets, technological assets, and manpower assets consigned to the systems and that system’s effectiveness. Although the willingness to commit resources is certainly critical to ARP effectiveness, the ability to do so is equally important (Aulakh and Kotabe, 1997). The ability to commit resources to inventory systems is related to the firm’s holdings and human resources. This suggests that firm size will influence ARP effectiveness. Larger firms have the resources required to bear the risks and invest in systems with high fixed costs (Lambkin, 1988; Aulakh and Kotabe, 1997). Thus, the following relationship is posited:

**H₆:** The greater the size of the firm, the
a. greater the cost effectiveness of its automatic replenishment program, and
b. greater the service effectiveness of its automatic replenishment program.
Centralization of Decision-Making

Decision-making centralization is defined as the degree to which upper-level management makes firm-related decisions versus those managers closer to the point of sale. Recent studies have argued that a centralized decision making structure within the organization is related to inventory management success (Williams, Magee, and Suzuki, 1998). The political economy framework suggests that the more centralized a decision-making process the more efficient and effective the channel irrespective of transactional form (Stern and Reve, 1980). This perspective is supported at the firm level in past studies (e.g., Myers, 1997), where a more centralized approach to decision making was found to allow managers to integrate cost associated information into strategic moves within the distribution channel. An understanding of underlying costs is most evident at relatively high decision levels. Because centralization of decision making (this in the form of hierarchical information exchange) is a basic tenet of ARPs, program cost effectiveness will be enhanced with this form of managerial decision making. Benefits should be realized in the form of scale economies and the possible cost advantages of increased automated distribution programs (cf. Stern and Reve, 1980). Furthermore, these cost benefits will be shared with the downstream supply-chain partner, enhancing the service performance associated with these relationships. Hierarchical decision-making, however, often comes at the expense of customer satisfaction (Myers, 1997), because lower level managers generally have greater contact time with buyers and are more familiar with their needs. Hence, a centralized approach is seen as detrimental to ARP service effectiveness. Therefore:

\[ H_7: \text{The more centralized the managerial decision making in the firm, the:} \]
\[ a. \text{greater the cost effectiveness of its automatic replenishment program, and} \]
\[ b. \text{lower the service effectiveness of its automatic replenishment program.} \]

Commitment to Automatic Replenishment Programs

Given that ARPs require substantial financial and managerial resources, significant managerial commitment to the program is required for success (Cottrill, 1997). Because ARPs are relatively new within managerial practice with no proven track record (Andel, 1996), commitment by the firm becomes even more critical to realization of program goals. Furthermore, managerial commitment is important to programs in which information sharing between channel members is a key component. Managerial commitment is seen as the degree to which management dedicates manpower and other resources to its automatic replenishment program, as well as the advanced planning, which takes place within the firm for the system. The more managerial commitment to the program, the better is the ARP’s overall effectiveness in both cost and service.
The greater the managerial commitment to the automatic replenishment relationship, the
a. greater the cost effectiveness of its automatic replenishment program, and
b. greater the service effectiveness of its automatic replenishment program.

The ARP Effectiveness-Firm Performance Relationship

Similar to strategic orientation, performance should be viewed in two distinct manners: (1) strategic, where market share, creating barriers to entry, and meeting customer demands serve as performance measures; and (2) economic, which addresses the profit, ROI, and sales volume goals. Performance is defined as the extent to which a firm’s economic and strategic objectives are achieved with respect to their activity in the market.

As previously discussed, two theoretical foundations underlie the implementation of automatic replenishment programs, that of (1) cost reduction and of (2) service to supply-chain partners. Thus, the investigation of the relationships between these two effectiveness measures and the different types of firm performance is a key point of this study. Such a distinction will provide greater understanding of the outcomes of ARP effectiveness, in that firms that achieve one ARP effectiveness measure may benefit from either (1) economic performance, (2) strategic performance, or both. Firms achieving ARP cost effectiveness will experience reduced waste and lower expenditures associated with inventory replenishment, which should enhance margins and the overall profitability of the firm. Organizations with high levels of ARP service effectiveness thereby establish more satisfied supply-chain partners and create barriers to competitors by maintaining these relationships. This also positively influences market share and enhances the strategic performance of the firm. Given this, the following hypothesis is offered:

H₉a: The greater the cost effectiveness of the automatic replenishment program, the greater the economic performance of the firm.

H₉b: The greater the service effectiveness of the automatic replenishment program, the greater the strategic performance of the firm.

RESEARCH METHODOLOGY

Data Collection

The unit of analysis for this study is the individual ARP relationship between buyers and sellers. We investigate two dependent variables: degree of ARP effectiveness and overall performance of the firm. Little empirical data has been published on this topic;
therefore; a survey method of data collection was considered appropriate (e.g., Klein et al., 1990). The sampling frame for the data collection included members of the Council of Logistics Management (CLM). CLM members are likely to be involved in the inventory management of the firm.

A survey instrument was developed and pretested with business executives. After modifying the questionnaire to incorporate their suggestions, telephone contact was made to a random sampling to screen potential participants regarding involvement in any type of automatic replenishment program. Of the 762 contacts made or attempted, 247 (32.4%) were ineligible because no automatic replenishment program was utilized in their firms. Of the remaining 515 contacts, 24 refused to participate in the survey, 209 did not respond after repeated attempts to contact, and 282 gave permission for mailing the survey. The surveys were then sent to these individuals, with reminder cards being sent two weeks later. A total of 104 surveys were returned; however, 6 had excessive missing values and were excluded from the analysis, resulting in an effective response rate of 33.7%. \( t \) tests were used to make comparisons between the 75 manufacturer and 23 retailer respondents. Key constructs were analyzed (such as firm size, centralization of decision making, etc.). No significant differences between manufacturers and retailers were found for the relevant constructs. Thus, the two groups were combined for analysis purposes. The manufacturer respondent base was comprised of 50 firms selling directly to retailers and 25 firms selling to other businesses. Again, \( t \) tests were used and comparisons of key constructs made to determine whether differences exist between the manufacturer selling directly to retailers and manufacturers selling to other (intermediary) businesses. No significant differences were found between these two groups. Table 1 provides a summary of the descriptive characteristics of the responding firms and managers.

Several concerns regarding survey research methodology warrant investigation before hypothesis testing. These are (1) nonresponse bias that could lead to a systematic exclusion of firms from the population, and (2) common method variance (Podsakoff and Organ, 1986). To test for nonresponse bias, and following the method suggested by Armstrong and Overton (1977), \( t \) tests were performed to compare late and early respondents across a number of key variables. These variables included firm size, industry, and age. No significant differences were discovered. The issue of common method variance was addressed in survey design. Also, great care was taken to vary anchors and reverse code where appropriate when utilizing scales within the survey.

**Operational Measures**

To make central constructs operational within the study, existing scales were utilized wherever possible. When appropriate measures could not be found, scales were developed or adapted to meet the study’s requirements. Items were measured on one through seven Likert-type scales except where indicated. Where units of measurement differed across items in the scale, items were standardized. The response format and specific items used for individual variables are described in Appendix I.
Standardization

A simple, one item scale was adopted from Cavusgil and Zou (1994) that directly asked managers to what degree their automatic replenishment programs were standardized or adapted to individual customer-supplier use.

Product Cost Volatility

To measure the volatility of input costs, a three-item scale was developed. Each respondent was asked to assess the fixed, variable, and total cost volatility associated with their products used in ARPs.

Table 1

<table>
<thead>
<tr>
<th>Industry</th>
<th>Frequency</th>
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<tbody>
<tr>
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<td>9.2</td>
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<tr>
<td>Apparel</td>
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<td>8.2</td>
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<tr>
<td>Miscellaneous Manufacturing</td>
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<td>6.1</td>
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<tr>
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<td>4.1</td>
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<tr>
<td>Medical Equipment</td>
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<td>4.1</td>
</tr>
<tr>
<td>Health and Beauty Care</td>
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<td>3.1</td>
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<td>Logistics Manager</td>
<td>15</td>
<td>15.3</td>
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<tr>
<td>Director of Logistics</td>
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<td>Distribution Manager</td>
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<tr>
<td>Director (Miscellaneous)</td>
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<td>Director of Distribution</td>
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<tr>
<td>Vice President Distribution</td>
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<td>Director of Transportation</td>
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<td>Distribution Center Manager</td>
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<tr>
<td>Customer Service Manager</td>
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<td>2.1</td>
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<tr>
<td>Other</td>
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</table>
Competitive Intensity

Competitive intensity of the market was measured using a four-item scale adapted from John and Weitz (1988). Respondents were asked to evaluate their competitors’ aggressiveness, impact on the respondent’s decisions, and predictability, as well as the overall competitive intensity of the market.

Market-Oriented Strategy

Following the scale used by Aulakh and Kotabe (1997), managers were asked to evaluate the level of importance placed on two strategic objectives: improving the company’s market share position and differentiating the company in the marketplace.

Profit-Oriented Strategy

To measure the firm’s profit oriented strategy, respondents were asked to evaluate the level of importance placed on increasing the profitability of the firm and responding to competitive pressures (Porter, 1986).

Firm Size

Two items were utilized to measure firm size, the number of employees in the organization and the total annual sales volume in dollars for the last three years. Items were standardized to create the scale.

Centralization of Decision Making

To make centralization operational, a two-item scale was developed based on Cavusgil and Zou’s (1994) measures. Managers were questioned as to the extent of upper-level management’s involvement in decision-making, and the extent of decisions made at the division level.

Commitment to Automatic Replenishment Programs

Modifications of several scales from the distribution literature (e.g., Hunt and Morgan, 1994) resulted in a three-item scale, which addressed management’s commitment to ARP, the extent of resources committed to ARP, and the extent of thorough advance planning for ARP.
ARP Effectiveness

Two constructs were established for ARP effectiveness to capture the major benefits of these programs, namely cost reductions and improved service.

1. *ARP Cost Effectiveness* was made operational using a four item scale that addressed the firms’ degree of effectiveness in implementing shorter production runs, smaller shipments, delays in final production (postponement), and reduced reliance on forecasts.

2. *ARP Service Effectiveness* was measured using a four item scale that addressed the degree to which the firm had effectively implemented more frequent deliveries, new communications linkages, more receiver friendly loads, and more predictable order cycles.

Firm Performance

Two measures were used to identify firm performance.

1. *Economic Performance* was measured using a three item scale addressing overall profitability of the firm, increase/decrease in profits over the last three years, and degree to which profitability goals were met (Bello and Gilliland, 1997).

2. *Strategic Performance* was adopted from Myers (1999), and consisted of a two-item scale. These included the firm’s total increase/decrease in market share over the last three years, and the degree to which strategic goals were met by the firm.

ANALYSES AND RESULTS

Measurement Properties and Psychometric Considerations

To evaluate measurement quality, five steps were taken to determine discriminant validity and composite reliability of the scales. First, measurements were assessed by using a procedure advocated by Gaski and Nevin (1985) whereby a correlation between two scales that is lower than the reliability of each of those scales is taken as proof of good discriminant validity. All scales had reliability estimates in excess of the between-scale correlations. Next, we utilized Anderson’s (1987) method to determine that the confidence interval (±/− two standard errors) for each pairwise correlation estimate between latent constructs did not include the value of one. The scale for each construct met this test.

The third step was to incorporate the method recommended by Fornell and Larcker (1981) to test for discriminant validity. With this method, a construct is deemed empirically distinct if the average variance explained by that construct’s items [i.e., that
construct’s $p_{ve(r)}$ is greater than the construct’s shared variance with every other construct (the square of the intercorrelation). Thus, Competitive Intensity demonstrates discriminant validity because its average variance extracted ($p_{ve(r)} = .61$) is greater than the square of its correlations with Market Oriented Strategy ($-.09^2 = .01$), Profit Oriented Strategy, (.13$^2 = .02$), Product Cost Volatility ($-0.14^2 = .02$), and so forth. All constructs displayed discriminant characteristics in this manner.

Next, an overall confirmatory factor analysis was conducted on all items and constructs to examine the adequacy of the construct measures. Each item was restricted to load on its prespecified factor, with the factors themselves being left free to correlate (Gerbing and Anderson, 1988). Elliptical reweighted least squares (ERLS) estimation in EQS provides evidence for model fit (see Sharma, Durvasula, and Dillon, 1989). For each construct and item, the standardized loadings and $t$-values exceeded the recommended minimums for measurement quality. Examination of the individual item loadings showed that each was large and significant ($p < .01$), with the exception of one item (fixed costs of our ARP is generally stable) within the cost volatility construct, which measured 0.68. All $t$ values were greater than 3.0. The Bentler–Bonnet normed fit index (NFI) and non-normed fit index (NNFI) and the comparative fit index (CFI) indicate good fit of the confirmatory measurement model (Bentler, 1990) ($\chi^2 = 93.7$; d. f. = 48; NFI = .97; NNFI = .95; CFI = .95).

These results provide evidence for the convergent validity for each of the measures. Further testing was conducted to ensure that, for each pair of factors, the $\chi^2$ value for a measurement model that constrains their correlation to equal one is significantly greater than the $\chi^2$ value for the model that does not place such a constraint. The results of each pairwise construct comparison suggest that the two-factor solution was better than the single factor solution, with all but two differences being significant at the $p < .05$ level. Both the market oriented strategy-profit oriented strategy and commitment-centralization pairings were significant at the $p < .1$ level (see Appendix II for these results).

Finally, the results were assessed by examining composite reliability and variance extracted. Following Bagozzi and Yi (1988), two criteria were deemed critical: composite reliability should be greater than .60 and variance extracted should be greater than or equal to .50. As indicated in Table 2, all composite reliabilities were greater than .70. Again using the formula provided by Fornell and Larcker (1981), variance extracted was calculated for each construct. Each scale exhibited an $p_{ve(r)}$ of > .50. This indicates that the variance captured by each construct is significantly greater than variance due to measurement error, and further established validity.

**RESULTS**

The hypothesized model was analyzed using path analysis, with the ordinary least squares (OLS) criterion using the disattenuated correlation matrix as input (Loehlin, 1987). This approach was chosen for a number of reasons. First, path analysis enables the simultaneous testing of a system of theoretical relationships involving multiple dependent variables. Second, it allows for restricted models with systematic constraints on relation-
Table 2

Measurement Properties and Confirmatory Factor Analysis

<table>
<thead>
<tr>
<th>Objective</th>
<th>IR</th>
<th>SR</th>
<th>VE</th>
<th>IR</th>
<th>SR</th>
<th>VE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardization</td>
<td>NA</td>
<td>.52</td>
<td></td>
<td>.90</td>
<td>.82</td>
<td></td>
</tr>
<tr>
<td>Our ARP is standardized for all our customers.</td>
<td>commits to ARPs</td>
<td>.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product Cost Volatility</td>
<td>.73</td>
<td>.64</td>
<td></td>
<td>.75</td>
<td>.60</td>
<td></td>
</tr>
<tr>
<td>Fixed costs of our ARP are generally stable.</td>
<td>The extent of management commitment to ARP</td>
<td>.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable costs (such as labor) of our ARP: are generally stable.</td>
<td>The extent of thorough advance planning for ARP</td>
<td>.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We can always accurately estimate the total costs of our ARP.</td>
<td>ARP Cost Effectiveness</td>
<td>.51</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitive Intensity</td>
<td>.70</td>
<td>.59</td>
<td></td>
<td>.76</td>
<td>.58</td>
<td></td>
</tr>
<tr>
<td>Competitive intensity in our market is relatively low.</td>
<td>ARP Service Effectiveness</td>
<td>.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our major competitors are aggressive actions of our competitors: easy to predict.</td>
<td>More frequent deliveries</td>
<td>.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our firm changes its marketing practices to keep up with competitors.</td>
<td>New communications</td>
<td>.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market-Oriented Strategy</td>
<td>.75</td>
<td>.64</td>
<td></td>
<td>.78</td>
<td>.62</td>
<td></td>
</tr>
<tr>
<td>Differentiate our company in the marketplace.</td>
<td>Economic Performance</td>
<td>.52</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improve our company's market share position.</td>
<td>The overall profitability of this relationship</td>
<td>.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit-Oriented Strategy</td>
<td>.81</td>
<td>.74</td>
<td></td>
<td>.74</td>
<td>.66</td>
<td></td>
</tr>
<tr>
<td>Increase the profitability of the company.</td>
<td>Degree to which profitability goals were met</td>
<td>.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respond to competitive pressure</td>
<td>Increase or decrease in profits over the last three years</td>
<td>.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm Size</td>
<td>.72</td>
<td>.68</td>
<td></td>
<td>.61</td>
<td>.61</td>
<td></td>
</tr>
<tr>
<td>Number of full-time employees</td>
<td>Degree to which strategic goals were met</td>
<td>.59</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Sales volume in dollars</td>
<td>.63</td>
<td></td>
<td></td>
<td>.64</td>
<td>.64</td>
<td></td>
</tr>
<tr>
<td>Centralization of Decision Making</td>
<td>.78</td>
<td>.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We have a highly centralized managerial decision making process.</td>
<td>.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our division makes few of the important, firm wide managerial decisions.</td>
<td>.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For each construct, the item reliability (IR), scale reliability (SR), and variance extracted (VE) are provided. VE was calculated using the formula provided by Fornell and Larcker (1981).
ships among variables, testing models that include only those paths that are hypothesized a priori. Finally, the use of path analysis enables us to determine model fit based on the assessment of residuals and a \( \chi^2 \) statistic (see Singh and Wilkes, 1996). The estimates of the path coefficients (i.e., the regression beta weights) and the model fit \( \chi^2 \) statistics are presented in Table 3. The model fit \( \chi^2 = 40; \) d. f. = 22; \( p > .13) \) is found to be statistically nonsignificant suggesting that the deviation between the model and observed correlations is statistically minimal.

Table 3 shows the results of the path analysis of Hypotheses 1 through 9. Hypothesis 1 predicts that standardization of automatic replenishment programs will have a positive influence on cost effectiveness, but will be negatively related to service effectiveness. However, the data fail to support these positions (cost effectiveness: \( \beta = -.09, p > .1); \) service effectiveness: \( \beta = .13, p > .1) \). It is possible that ARPs are simply not yet standardized enough to realize the economic benefits of cost reduction. The lack of standardization also suggests the degree of customized replenishment may be common.

The relationship between product cost volatility and ARP effectiveness is predicted by Hypothesis 2, which posits a negative relationship between these constructs. The data

<table>
<thead>
<tr>
<th>Factor</th>
<th>Hypothesis</th>
<th>Expected Sign</th>
<th>Path Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARP Cost Effectiveness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standardization</td>
<td>H1a</td>
<td>+</td>
<td>-.09</td>
</tr>
<tr>
<td>Product Cost Volatility</td>
<td>H2a</td>
<td>–</td>
<td>-.28**</td>
</tr>
<tr>
<td>Competitive Intensity</td>
<td>H3a</td>
<td>+</td>
<td>.01</td>
</tr>
<tr>
<td>Market-Oriented Strategy</td>
<td>H4a</td>
<td>–</td>
<td>-.32**</td>
</tr>
<tr>
<td>Profit-Oriented Strategy</td>
<td>H5a</td>
<td>+</td>
<td>-.01</td>
</tr>
<tr>
<td>Firm Size</td>
<td>H6a</td>
<td>+</td>
<td>-.24*</td>
</tr>
<tr>
<td>Centralization</td>
<td>H7a</td>
<td>+</td>
<td>.14</td>
</tr>
<tr>
<td>Commitment to ARPs</td>
<td>H8a</td>
<td>+</td>
<td>.56**</td>
</tr>
<tr>
<td>ARP Service Effectiveness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standardization</td>
<td>H1b</td>
<td>–</td>
<td>.13</td>
</tr>
<tr>
<td>Product Cost Volatility</td>
<td>H2b</td>
<td>–</td>
<td>-.01</td>
</tr>
<tr>
<td>Competitive Intensity</td>
<td>H3b</td>
<td>+</td>
<td>-.32**</td>
</tr>
<tr>
<td>Market-Oriented Strategy</td>
<td>H4b</td>
<td>+</td>
<td>.37**</td>
</tr>
<tr>
<td>Profit-Oriented Strategy</td>
<td>H5b</td>
<td>–</td>
<td>.17</td>
</tr>
<tr>
<td>Firm Size</td>
<td>H6b</td>
<td>+</td>
<td>.10</td>
</tr>
<tr>
<td>Centralization</td>
<td>H7b</td>
<td>–</td>
<td>.25**</td>
</tr>
<tr>
<td>Commitment to ARPs</td>
<td>H8b</td>
<td>+</td>
<td>.57**</td>
</tr>
<tr>
<td>Economic Performance</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>ARP Cost Effectiveness</td>
<td>H9a</td>
<td>+</td>
<td>.11</td>
</tr>
<tr>
<td>Strategic Performance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARP Service Effectiveness</td>
<td>H9b</td>
<td>+</td>
<td>.32**</td>
</tr>
</tbody>
</table>

Model characteristics: \( \chi^2 = 40; d.f. = 22; p = .13. \) *\( p < .1; \)**\( p < .05. \)
partially support this hypothesis (cost effectiveness: $\beta = -0.28, p < 0.05$; service effectiveness: $\beta = -0.01, p > 0.1$). Volatile product costs detrimentally affect the firm’s ability to provide ARP-related cost effectiveness, making it difficult for managers with dynamic input costs to effectively use ARPs in increasing bottom-line efficiency. Customer service, however, was not affected to a significant degree.

Hypothesis 3 states that competitive market intensity will have a positive influence on ARP effectiveness. The results fail to support this position (cost effectiveness: $\beta = 0.01, p > 0.1$; service effectiveness: $\beta = -0.32, p < 0.05$). In fact, the data provide evidence in support of a negative relationship between highly competitive markets and ARP-related customer service. The hyper-competitive state of many modern industries may mitigate the positive effects of ARPs on cost and service effectiveness; the constantly changing and cyclical demand for goods may have made accurate replenishment simply too difficult within some industries for ARPs to maintain their effectiveness for a multitude of products.

Hypothesis 4 relates ARP effectiveness to the firm’s strategic orientation. It posits that firms practicing more market-oriented strategies will be characterized by higher service effectiveness and lower cost effectiveness. The data provide significant support (cost effectiveness: $\beta = 0.32, p < 0.05$; service effectiveness: $\beta = 0.37, p < 0.01$). When firms can successfully lock channel partners into ARP agreements, their competitors may be forced to seek alternate sources, usually at higher costs. These costs act as competitive disadvantages for the competing firms, and increase the relative value of the ARP firm’s ability to provide good customer service. Hypothesis 5 posits that a strategic emphasis on profitability has (1) a positive relationship between ARP cost effectiveness and (2) a negative relationship with ARP service effectiveness. However, the data fail to provide even minor support for this relationship (cost effectiveness: $\beta = -0.01, p > 0.1$; service effectiveness: $\beta = 0.17, p > 0.01$). ARP implementation may become more effective for the firm over the long term, as the programs are more fully integrated into corporate strategic planning.

Hypothesis 6 stated that firm size would positively influence ARP effectiveness. This is partially refuted by the data (cost effectiveness: $\beta = -0.24; p < .1$; service effectiveness: $\beta = 0.10; p > .1$). Though larger firms may have the ability to contribute increasing amounts of resources to replenishment programs, decision makers may not yet be fully aware of ARP’s contribution to overall profitability, and thus may be unwilling to allocate sufficient assets for them to be effective.

Hypothesis 7 posits that centralization of decision making will have a negative effect on ARP service effectiveness and a positive influence on cost effectiveness. Again, this is partially refuted by the data (cost effectiveness: $\beta = 0.14, p < .1$; service effectiveness: $\beta = 0.25, p < .05$). It is evident that a hierarchical approach to decision making does assist in ARPs cost reduction efforts. However, the positive relationship for customer service indicates that ARPs function well from the perspective of the buyer, regardless of the locality of the decision-making processes.

The data strongly support Hypothesis 8, which states that managerial commitment to ARPs is positively related to ARP effectiveness. The results provide solid evidence (cost effectiveness: $\beta = 0.56, p < 0.01$; service effectiveness: $\beta = 0.57, p < 0.01$) that managerial commitment leads to both greater perceived cost effectiveness and enhanced customer
service. To attain maximum ARP-related success, managers must be willing to allocate optimal amounts of assets to the replenishment programs, even though immediate improvement in performance is unlikely. Furthermore, managers will need to develop an atmosphere of long-term commitment with suppliers and retailers including the release of sensitive firm information, if the ARPs are to be mutually profitable for the firm and trading partners.

Two corollary Hypotheses, H9a and H9b, describe the relationship between ARP effectiveness and firm performance. Hypothesis 9a predicts that high cost effectiveness for the ARP will lead to greater economic performance, whereas Hypothesis 9b posits that high service effectiveness is positively related to greater strategic performance. Although the data provide support for Hypothesis 9b ($\beta = .32, p < .05$), Hypothesis 9a is not supported ($\beta = .11, p > .1$). These findings are critical to our understanding of the value of automatic replenishment programs to date. The disparity in performance-related results indicates that achievement of ARP-related strategic goals is not necessarily conducive to a healthier financial position for the firm. For example, though a firm might see an increase in market share as a result of ARP implementation, it might do so at greater levels of incurred product cost than before the ARP was put into effect, and thereby would see a lower return on assets as a result.

DISCUSSION AND FUTURE RESEARCH

The current research represents one of the few empirical examinations of automatic replenishment programs to date. Many of the posited relationships were either not supported or results were not as expected; perhaps this is explained by the newness of the programs. With little experience to draw upon, the respondents’ firms may not have benefited from a learning curve effect at this time. Also, the nature of programs (highly customized, not appropriate for all types of products, etc.) make it unlikely that the firms would enjoy significant economies of scale.

The findings do, however, have important implications for organizations considering involvement in ARP-type systems. And, for many organizations, involvement will not be optional. Many customers are demanding sales-driven automatic replenishment. Retailers like Burlington Coat Factory are finding that they can “live with less inventory.” However, to do so they must be more disciplined about inventory management. Burlington intends to place even more emphasis on automatic replenishment systems in the future (Johnson, 1997).

ARPs represent a radical departure from traditional inventory restocking practices, that is, historically as much inventory as possible has been pushed forward within the channel with a primary goal of stocking retail locations in anticipation of customer demand. Traditional push systems are becoming more rare as retailers (and others within the supply chain) resist inventory “loading.” Instead, they frequently expect responsive restocking on a customized basis, that is, replenish exactly what was sold at the customer level (adjusted seasonally or due to promotional plans). The Right Start, a catalog and retail company specializing in upscale children’s products, relies upon an automatic replenishment system to help them handle retail growth. Stores’ expansions have not meant exorbitant increases
in inventory thanks to the systems. Instead, the company projects product movement on a store-by-store basis and places orders accordingly based upon three-year sales history and current store-level performance (Automatic ID News, 1998).

Managerial commitment is a critical component in the success of the programs. Greater managerial commitment was found to be associated with both cost effectiveness and service effectiveness. The support of management is tantamount when trying to affect change within an organization. Managerial commitment can win others over and help to ensure success—or, at the very least, managerial commitment can dissuade dissention within the ranks or outright sabotage. Higher levels of success are likely either because of management’s persuasive capability or by mandate. Thus, it is important that an internal champion (or more than one) be identified early in program development.

These results are preliminary and are necessarily limited by the low levels of involvement in ARPs at the time the survey was conducted. Many firms have indicated interest in and plans to become involved in ARPs. Thus, further research is warranted to track progress as involvement becomes more widespread and as program efficiencies and effectiveness improve with experience. Areas of interest for future research include examination of ARP performance by industry, the impact of program age/learning curve effect, and relationship dimensions, that is, does closeness of the buyer-seller relationship influence cost and service performance.

NOTES

1. To a large degree the literature that exists concerning supply chain relationships and inventory control focuses on a series of highly investigated constructs such as trust, interdependence, conflict, partner capabilities, and so forth. These dyadic level issues have received significant attention and are of obvious importance to the firm. Our interest, however, is in isolating the supplier as an independent entity and concentrating on both the influences and the value of ARPs to the manufacturing organization. Although this is only possible to a limited extent, this ‘isolated’ perspective and investigation outside of the dyadic realm is unique. Furthermore, no ARP would exist without benefit to both supplying and retailing entities, each of which experience internal and external influences independent of their supply chain relationships. Thus, we have purposely limited our investigation of interorganizational phenomena to restrict these influences within the analysis.

2. This step-wise process closely follows suggested measures of several studies and is applied in recent research such as Grewal, Monroe, and Krishnan (1998).

APPENDIX I

Listing of Research Constructs

**Standardization:** (scaled 1–7):

Our ARP is: (1) Standardized for all our customers through (7) Adapted to fit the individual needs of our customers
Product Cost Volatility: (scaled 1–7):

Fixed costs of our ARP: (1) are generally stable (7) fluctuate greatly
Variable costs (such as labor) of our ARP: (1) are generally stable (7) fluctuate greatly
We: (1) can always accurately estimate the total costs of our ARP (7) are never really sure what the total costs of our ARP are

Competitive Intensity: (scaled 1–7):

(1) Competitive intensity in our market is relatively low (7) Our market is intensely competitive
Our major competitors are: (1) not particularly aggressive (7) fiercely aggressive
Actions of our competitors are: (1) easy to predict (7) difficult to predict
Our firm changes its marketing practices to keep up with competitors: (1) rarely (1) frequently

Market-Oriented Strategy: What was the importance of the following strategic objectives set by management? (allocated 1–100):

A. Differentiate our company in the marketplace
B. Improve our company’s market share position

Profit-Oriented Strategy: What was the importance of the following strategic objectives set by management? (allocated 1–100):

A. Increase the profitability of the company
B. Respond to competitive pressure

Firm Size:

A. Number of full-time employees
B. Sales volume in dollars (last three year average)

Centralization of Decision Making: (scaled 1–7):

We have a highly (1) centralized (7) decentralized managerial decision making process
Our division makes (1) few (7) all of the important, firm wide managerial decisions
Commitment to ARPs: (scaled 1 = little - 7 = substantial):

1. The extent of management commitment to ARP
2. The extent of resource commitment to ARP
3. The extent of thorough advance planning for ARP

ARP Effectiveness: How effective has your firm been in implementing these

A. ARP Cost Effectiveness:

1. Shorter production runs
2. Smaller shipments
3. Delayed final production (postponement)
4. Reduced reliance on forecasts

B. ARP Service Effectiveness:

1. More frequent deliveries
2. New communications linkages/systems installed
3. More receiver friendly loads
4. More predictable order cycle

Performance:

A. Economic Performance:
   Rate the overall profitability of this relationship (1 = highly unprofitable–7 = highly profitable)
   Increase or decrease in profits over the last three years (expressed as a percentage)
   Degree to which profitability goals were met (expressed as a percentage)

B. Strategic Performance:
   Increase or decrease in market share over the last three years (expressed as a percentage)
   Degree to which strategic goals were met (expressed as a percentage)
APPENDIX II

One-Factor Versus Two-Factor Confirmatory Model Comparison Discriminant Validity Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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<th>12</th>
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</thead>
<tbody>
<tr>
<td>Firm Size</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
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</tr>
<tr>
<td>Centralization of Decision Making</td>
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<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<td>—</td>
<td>—</td>
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</tr>
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<td>—</td>
<td>—</td>
<td>—</td>
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<td>Volatility</td>
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<td>—</td>
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<tr>
<td>Competitive Intensity</td>
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<td>Market-Oriented</td>
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<td>.17</td>
<td>.10</td>
<td>-.11</td>
<td>-.11</td>
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The first number is the correlation between the latent constructs. The second number is the difference between chi-square: \( \chi^2 \) for the one-factor model — \( \chi^2 \) for the two-factor model (all the differences were significant at the .05 level, with the exception of market oriented strategy-profit oriented strategy and commitment-centralization which were significant at the .1 level). The third number is the \( \chi^2 \) for the two-factor model.

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