“Coordination of procurement activities with demand: an expanded conceptual model”

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Coordination of procurement activities with demand: an expanded conceptual model

Abstract

Intensifying global competition, rising commodity prices, added product complexity, rapidly evolving technology, and changing customer preferences combined with increasing demands on cost reduction, continuity of supply, product and materials quality, productivity, and customer service have significantly broadened the scope and highlighted the importance of procurement, thereby elevating its stature at the top-management level. Today's purchasing executives command greater decision-making authority, are more active in developing and implementing strategies for different departments within the firm, and participate in formulating corporate policies and strategies. In order to effectively perform and coordinate these new responsibilities with their traditional tasks, procurement managers will require a reconceptualization of their role. An urgent need exists among purchasing executives for an integrative, conceptual model to serve as an aid in decision making. Specifically, there is a necessity for a set of carefully conceived procurement activities sequenced according to some workable framework. The product life cycle concept represents such a guideline. It can integrate, coordinate, and relate the effects of various purchasing practices to a dynamic business environment, thereby assisting procurement managers in the timely and effective performance of their ever-growing duties and responsibilities for the optimal benefit of the company. In the following article, the authors present an expanded, updated, and synthesized product life cycle-purchasing operations model, which consists of 174 procurement actions sequenced according to five stages of a product's sales trend.

Keywords: product life cycle-purchasing activities model, strategic procurement planning, product life cycle concept, purchasing strategies or actions.

Introduction

In order for procurement executives to successfully perform their role in an organization, they must develop effective purchasing operations and implement these in a timely fashion. The primary objective of these actions is to optimize the company's profitability, thereby enhancing its long-run survival. This goal can be accomplished through achieving an optimal balance between the firm's desired level of customer service and corresponding costs. However, with intensifying global competition, rising commodity prices, added product complexity, rapidly evolving technology, and changing customer preferences combined with increasing demands on cost reduction, continuity of supply, product and materials quality, productivity, and customer service, this task assumes Sisyphean dimensions.

Traditionally, purchasing managers may have found themselves involved in such duties as having to gather information on and evaluate prospective suppliers, conduct value analyses, and expedite vendors' shipments. Other situations may have required them to develop a list of preferred and standby suppliers, ensure vendors' products met the organization's quality standards, solicit and evaluate bids from suppliers, and negotiate with vendors for lower materials prices or better delivery times. Hence, procurement executives had to be effective negotiators as well as possess an expert understanding of contract law, government regulations, product liability, transportation, to name a few. In addition, these managers had to have an appreciation of their relationship with other functions in the company (e.g., accounting and production) and groups external to the firm (e.g., vendors and trade associations).

1. Development of the problem

The role of purchasing executives is evolving as they are continually confronted with more challenging demands from within their department, other functions in the organization, and various external groups. Today's procurement managers do more forecasting and planning, command greater decision-making authority, are more active in developing and implementing strategies for different departments in the company, and participate in formulating and implementing corporate policies and strategies (Burt and Sukoup, 1989; Kappler, 1990; Pearson and Gritzmacher, 1990; Adamson, 1991; Watts et al., 1992; Rajagopal and Bernard, 1993; Biemans and Brand, 1995; Carr and Smeltzer, 2000; Cousins and Spekman, 2003; Tassabehji and Moorhouse, 2008). As a result of this significant broadening of the scope of purchasing and increased recognition of its importance (Cavinato, 1991; Monczka, 1992; Heberling, 1993; Gadde and Hakansson, 1994; Spekman, 1994; Trent and Monczka, 2002; den Butter and Linse, 2008), many firms have created top-management positions for procurement executives, thereby elevating its stature at the corporate level (Ferguson et al., 1996; Trommer, 1997; Ball, 2004; Hawkins, 2006).

In order to effectively perform and coordinate these new responsibilities with their traditional tasks, pur-

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chasing managers will require a reconceptualization of their role. Their functioning as an indispensable link within the organization will also necessitate revision. Finally, it will be necessary for procurement executives to think and act in a more strategic and corporate manner (Browning et al., 1983; Freeman and Cavinato, 1990; Carter and Narasimhan, 1996; Chapman, 1996; Read, 2005; Wolf, 2005; Blake, 2008).

"There is an urgent need to sensitize purchasing managers to the importance of planning and defining strategy for themselves as well as their potential contribution to those at the corporate level. Such an involvement ... will help to preserve and enhance an organization's competitive edge" (Caddick and Dale, 1987).

A need exists among procurement executives, therefore, for an integrative, conceptual model to serve as an aid in decision making. Specifically, there is a necessity for a set of carefully conceived purchasing activities sequenced according to some workable framework. The product life cycle concept represents such a guideline. It can integrate, coordinate, and relate the effects of various procurement practices to a dynamic business environment, thereby assisting purchasing managers in the effective and timely performance of their ever-expanding duties and responsibilities for the optimal benefit of the company.

2. Product life cycle

The product life cycle (PLC) is a generalized model depicting the unit sales trend of some narrowly defined product from the time of market entry until later withdrawal by the firm. Schematically, the PLC can be approximated by a bell-shaped curve, which is divided into several stages. Most writers reference a four-stage PLC – introduction, growth, maturity, and decline (Kotler and Keller, 2009). However, in discussions with various business executives, the authors have found that a five-stage PLC is more appropriate for strategic planning purposes. Many strategic and operational decisions must be made at the corporate and functional levels of an organization before a new product can be placed on the market (Perreault, Jr. et al., 2009). Hence, a PLC curve with these five stages will be adopted: design, introduction, growth, maturity, and decline. Table 1 summarizes the major characteristics of each stage in the PLC (see Appendix), while Figure 1 depicts typical unit sales and profit curves.

The PLC, however, does not occur automatically. It is a result of the interaction of a number of variables. In addition to the company's marketing efforts, the PLC is shaped by both market demand factors and other external conditions, which are usually beyond the firm's control (Swan and Rink, 1982; Kotler and Keller, 2009). Even when a product's sales level off or start to decrease, the organization has several alternative strategies it can implement to prolong or revive the product's sales (e.g., add extra features, target a new market segment, or develop a new promotional campaign) (Kotler and Keller, 2009; Perreault, Jr. et al., 2009). Also, the time length of any stage and the shape of the overall PLC will vary for different products and industries (Swan and Rink, 1982). But, excluding commodities (e.g., wheat) or premature intervention by the organization, most products follow some type of PLC curve.

3. Purchasing and the PLC

The relationship between procurement and a product's sales trend was initially recognized by Berenson (1967). He developed 34 purchasing operations that he recommended procurement executives implement in different stages of the PLC.

As part of a personal interview process, Rink (1975) asked 30 purchasing practitioners to assign each of Berenson's 34 procurement actions to the particular sales phase they felt was most appropriate. Overall, executives' assignments of these practices to PLC stages matched almost 55% of Berenson's prescriptive model. Of the remaining procurement activities, managers wanted to implement about two-thirds of them one sales phase sooner than recommended.

On the basis of business experience and discussions with several purchasing executives, Fox and Rink (1977) expanded Berenson's model to include 83 procurement actions. In addition to segregating these operations by PLC stage, the authors classified them by departmental functions (e.g., production).

Realizing an extraordinary amount of time would be required for practitioners to assign 83 purchasing practices to PLC phases, Rink and Fox (1984) randomly assigned each stage's activities to one of three questionnaire versions. From past experience, the authors found most procurement individuals think of the PLC in engineering instead of marketing terms (i.e., how long the physical product actually exists before falling apart rather than unit sales trend in some market). For these reasons, the authors attended monthly meetings of three Midwestern chapters of the National Association of Purchasing Management (NAPM). After explaining the marketing-oriented definition of PLC and addressing members' questions, the authors randomly distributed the three questionnaire versions. Finding no significant differences across respondents' replies among the Midwestern chapters of NAPM, time frames the questionnaires were administered, and questionnaire versions, the authors were able to combine the results into one data set for further analysis. One hundred and sixteen managers assigned about 60% of the 83 purchasing actions to the sales stage suggested by Fox and Rink (1977). Similar to what

Rink (1975) found, slightly more than one-half of the remaining procurement operations were assigned one PLC phase sooner than recommended.

4. Purpose

The purpose of this article is to synthesize, expand, and update these early PLC-purchasing practices models. During the 1960s and 1970s, the concepts of just-in-time (JIT) manufacturing, total quality management (TQM), and materials requirement planning (MRP), to name a few, had not been either invented, fully operationalized, or embraced by procurement practitioners and scholars. In addition, previous prescriptive models did not address such issues as hazardous materials, government regulations, social responsibility, ethical standards, professional behavior, and use of minority and local vendors. For these reasons, the authors decided to develop a synthesized, expanded, and updated PLC-purchasing activities model.

5. New PLC-purchasing activities model

The authors' new PLC-purchasing activities model, which presents procurement in a systems perspective, includes 174 purchasing actions classified according to five PLC stages – design, introduction, growth, maturity, and decline. The basic criterion for operation selection and slotting is the procurement department's contribution to company-wide profitability. For example, in the design period, purchasing strives for prompt delivery of trial orders from suppliers in lieu of cost reduction. During the introduction stage, procurement favors subcontracting over fixed investment in facilities. However, in the growth phase, it reverses this policy. During the maturity stage, purchasing evaluates the feasibility of long-run contracts with fewer vendors. In the decline phase, procurement reduces materials inventories for the product, and reverts to subcontracting when the firm's facilities are converted to other newer products.

Some purchasing practices initiated in one PLC stage will continue across the remaining phases. For instance, contacting and establishing relationships with suppliers may commence in the design period, but maintaining good rapport with them will continue throughout the PLC. Other procurement activities will change over the sales phases. For example, during the design stage, negotiating with vendors for small-volume prices on materials and components is important. However, as unit sales increase, securing larger-volume prices becomes more important. In the growth period, purchasing bargains with suppliers for lower prices. These negotiations become more intense during the maturity phase. When sales decline, procurement bargains for small-volume prices on materials and components.

The PLC is especially appropriate for organizations in which particular products dominate managerial thinking or actual volume. But, its importance varies by stage. The early periods (i.e., design, introduction, and growth) are more volatile, more consequential in their impact on purchasing actions than later ones. Seasonal patterns may override the PLC in a protracted, stable maturity phase. During the decline stage, top management's attention passes to successor products. Finally, the PLC does not apply to procurement departments or companies whose output has a steady long-term trend (e.g., unbranded hardware), or has balanced diversity such that no one product line's sales pattern justifies special attention.

In the remainder of this article, prescribed purchasing operations will be presented and discussed for each of five PLC periods. Additional procurement practices consistent with these phases may occur to the reader.

5.1. Design stage. This period involves the development and test marketing of some product the firm has never attempted to sell. Because of the uncertainty of the project, purchasing's overriding consideration is flexibility. Operating decisions should be tentative or reversible. Procurement's policy in this phase is to deemphasize unit costs, because vendors' cooperation in furnishing small quantities of materials and components is more important.

A project group is established to assume the buying function for the novelty, formulate criteria to evaluate the group's performance, and gather information on prospective suppliers. Purchasing participates with R&D, production, and quality control in developing quality standards, specifications, and descriptions for inputs. It tries to have the new design incorporate materials and components already in satisfactory use on existing products. Program evaluation review technique (PERT) or similar tools are used to assemble all inputs for manufacturing the innovation (Schorr, 1998). Procurement urges departments to formulate new product specifications that will reduce future supply problems. It also assists in developing procedures to monitor the quality of incoming materials and components. In-house assembly of original designs occurs to prevent disclosure to competitors (Ballou, 2004). Policies and procedures for buying inputs, etc. for the innovation are formulated.

In cooperation with R&D, purchasing obtains small quantities of a wide variety of materials and components for testing purposes. It evaluates make-or-buy alternatives, conducts studies to determine short- and long-run supply and demand of commodities to be bought for producing the new product, and performs price-cost analyses of suppliers' inputs to ensure reasonableness of cost (Burt et al., 2007). Fur-

ther, procurement consults with the marketing department regarding sales expectations and long-run market plans for the novelty. It consults with traffic specialists on carrier designation, routing, etc. for materials and components (Bowersox et al., 2009).

Purchasing joins other departments in financial planning for the new item and in evaluating proposals for buying production and related equipment as well as tooling (Johnson et al., 2008). If toxic or dangerous materials must be used, it makes sure the organization has the necessary permits. Procurement cooperates in planning how the company will handle, store, and dispose of hazardous inputs. Also, it assists in the development and implementation of a risk management program, which includes information and training for employees in the proper handling, storage, and disposal of toxic items as well as worker safety. The innovation as well as materials and components are screened for compliance with government environmental and safety regulations (Christopher, 2011).

Potential vendors are informed by purchasing of the firm's product specifications and quality standards. It also asks these suppliers to identify their start-up and tooling costs for both small- and large-volume orders (Zenz, 1994). If dangerous items are involved, procurement evaluates prospective vendors in terms of whether they have the requisite experience, equipment, and permits for handling, storing, and disposing of such materials (Swink et al., 2010). Also, it conducts quality capability surveys of these suppliers' facilities to ensure they are capable of meeting the organization's materials specifications and quality standards (Benton, 2010).

After collecting and evaluating this information, purchasing develops a list of vendors who can meet the firm's product specifications, quality standards, and volume requirements. It assists selected suppliers in developing and implementing quality assurance programs for materials and components. If necessary, the company furnishes tooling to these vendors (Simchi-Levi et al., 2007). Prior to manufacturing custom-designed equipment, procurement asks suppliers to conduct a prepurchase survey of the firm's needs. It uses life-cycle costing to evaluate the "true" cost associated with vendors' proposals for capital equipment acquisitions (Jacobs et al., 2010).

Purchasing formulates joint plans with suppliers for handling the new product's sudden or erratic input needs. In cases where vendors are asked to develop new components, it asks the legal department to prepare contract language for protecting the company's trade secrets, preventing suppliers from selling surplus components as usable products, etc. If the innovation will supplant existing items, procurement pares materials commitments to present suppliers. Together with the accounting and receiving departments, it establishes policies and procedures for auditing and resolving vendors' invoices. Anticipating requirements will change over the PLC, purchasing insists on various options in early supply contracts (e.g., shipment acceleration or delay) (Johnson et al., 2008).

In combination with the information technology (IT) department, procurement creates a computerized Purchasing Information System (PIS) for the novelty to maintain comprehensive databases of supplier performance, prices of materials, scrap prices, etc. Finally, procurement develops criteria to evaluate performance of the department, prepares a set of written ethics and professional behavior standards, and trains its personnel with respect to these, if this has not already been done (Zenz, 1994).

5.2. Introduction stage. This period commences with full-scale marketing of the new product in its intended market. Purchasing seeks to balance the high likelihood of the innovation's failure with the urgency of adequate facilities and materials if the new item succeeds. In this phase, procurement works closely with suppliers to resolve input defects and servicing problems as well as implement engineering changes.

Along with various departments, purchasing formulates standards for cost, quality, and other factors relating to the novelty. It helps establish lead times, minimum stocks, and reorder points for materials and components. Procurement cooperates in developing a Total Quality Management (TQM) program and Materials Requirement Plan (MRP) as well as assists in formulating and implementing procedures to monitor quality, quantity, etc. of inputs. It also participates in planning how and when to implement a just-in-time (JIT) manufacturing system (Burt et al., 2007).

Purchasing girds itself to handle an avalanche of design modifications from engineering. It consults the marketing department regarding special orders and potential product changes. Procurement cooperates with other functions in the firm to plan the disposal of scrap materials as well as address changing government regulations based upon amounts of hazardous materials handled and stored (Coyle, 2008). Sales research reports are monitored for clues about eventual growth or discontinuance of the new product.

Until the innovation's market acceptance has been demonstrated, purchasing rents facilities and uses subcontractors. Subcontracting expands the organization's capacity without the resulting fixed expenditures and risks. Consignment buying is considered until demand for the new item increases. Where fea-

sible, procurement arranges for leases with options to buy manufacturing facilities and equipment (Zenz, 1994). A variety of special parts, tailor-made components, and technical services are bought, but only in small quantities. If possible, these small orders are consolidated with those of other inbound shipments (Bowersox et al., 2009).

When buying items for both original equipment use and resale, purchasing ensures lower-priced materials do not find their way into the replacement market. It cooperates in formulating and implementing a plan that makes sure proprietary subassemblies are distorted or dismantled before leaving the company's premises (Jacobs et al., 2010). Procurement asks the legal department to critically review its transactions to pinpoint potential problems.

A list of preferred and standby vendors is developed by purchasing based upon experience with new suppliers and their ability to deliver during the expected sales spurt. A senior procurement executive contacts these vendors and begins to establish long-run relationships with them (Sadler, 2007). Purchasing works with IT to develop a computerized communications system with suppliers in order to facilitate timely notification of changes, assure vendors' inventory and production goals are consistent with the firm's needs, etc. (Burt et al., 2007; Swink et al., 2010).

When signals of imminent sales growth have been confirmed, procurement plans an orderly shift from subcontractors to owned facilities. At the end of this period, it develops and implements a supplier certification program to improve the quality of inputs as well as reduce inventory, order processing, and inspection costs (Schorr, 1998).

5.3. Growth stage. This phase begins when unit sales start increasing at an increasing rate. Purchasing is plagued with temporary shortages, shipping delays, and similar rapid-growth problems. But, as a matter of policy, it maintains strict service and quality standards on incoming materials and components despite pressure from other departments for speedy deliveries.

Procurement managers use their high-level connections at vendors and shipping firms to obtain needed items quickly (Burt et al., 2007). Accounting is urged to pay suppliers' and transport carriers' invoices promptly to maintain the timely flow of shipments. Purchasing expands its departmental staff in order to handle an increasing volume of purchase requisitions and follow-up requests. If necessary, it uses brokers to find scarce items for immediate delivery (Zenz, 1994). Trade associations are also consulted as clearinghouses to procure needed materials.

In order to minimize repetitive ordering, procurement uses blanket purchase orders, traveling requisitions, and other methods. It assists in revising lead times, minimum stocks, and reorder points as well as participates in installing economic order quantities (EOQs) (Johnson et al., 2008). Purchasing also builds inventories of raw materials and goods-in-process. However, it avoids overbuying when some functions within the company extrapolate or exaggerate this period's steep sales increase (Swink et al., 2010).

Procurement cooperates with top management in determining whether to expand existing manufacturing facilities to accommodate increasing product demand. Some subcontractors are phased out in favor of in-house production. This action can contribute to the company's profitability in three ways. Purchasing saves "exchange" costs: its own buying and liaison efforts as well as subcontractors' selling and follow-through expenses. Most important, the firm benefits from operating leverage (Zenz, 1994). On the other hand, in-house production raises the buying department's transactions costs of contacting vendors, processing orders, coordinating inbound shipments, etc. (Williamson, 1996). Elimination of subcontractors also requires development of more basic sources.

A make-or-buy analysis for the existing product is performed by procurement as well as ABC analyses of inputs. A commodities study is conducted to determine short- and long-run supply, demand, and prices of major commodities to be bought for producing the product. In addition, purchasing executes price-cost analyses of vendors' materials, supplies, etc. to ensure reasonableness of costs given use, competitive situation, etc. (Coyle, 2008). It assists in implementing JIT manufacturing, TQM, and MRP.

Supply sources are selectively widened without disrupting desirable established relationships. Procurement shifts to suppliers with large capacity. However, some items are purchased from local and minority vendors. Suppliers are encouraged to develop new technologies, procedures, etc. for improving materials quality, speeding up production, etc. (Christopher, 2011). As a means to ensure long-run supply, purchasing investigates the feasibility of buying ownership interest in a major vendor or obtaining control of an essential input previously bought from a supplier (Ballou, 2004).

During this stage, much time and effort is devoted to accelerating vendors' shipments. Procurement coordinates efforts with transportation personnel in terms of expediting and tracing activities, filing loss and damage claims, etc. (Zenz, 1994). It also works with IT to make the interchange between the organization and vendors as well as among vendors more effective and efficient (e.g., purchasing's database is

tied to suppliers' databases via computer hookups). Vendor performance is monitored by means of computer-based systems and automated databases (Jacobs et al., 2010). If possible, procurement transfers liability for materials and components to suppliers. When extraordinary circumstances make concessions to vendors expedient (e.g., obtaining crucial inputs quickly), it consults the legal department to make sure the firm's future rights are not waived (Benton, 2010).

The director of purchasing monitors the ethical and professional behavior of personnel in the performance of their duties. He or she also evaluates the department's effectiveness and efficiency by reviewing and, if necessary, revising its policies, and procedures for buying materials (Johnson et al., 2008). At the end of this phase, procurement consults the marketing department concerning product modifications, line extensions, etc.

5.4. Maturity stage. In this period, unit sales continue increasing but at a decreasing rate, eventually plateau, and decrease slightly. Production equipment is in need of major repair or replacement. Many aggressive competitors exist. The company tries to fend them off by cultivating new markets, offering sales inducements to customers, increasing advertising, creating new product models, reducing price, providing special trade promotions to distributors, etc. (Kotler and Keller, 2009; Perreault, Jr. et al., 2009). However, the resulting cost-price squeeze causes the product's profits to dramatically decrease. As a result, purchasing seeks to improve the efficiency of department procedures and operations as well as individuals' routines. It also stabilizes materials commitments of the organization by designating regular and alternate sources, installing automated reordering of standard items, providing for product variants, and investigating the feasibility of long-run contracts with fewer suppliers.

Design engineers are urged to specify interchangeable parts on new models, sizes, and other modifications of the existing product as well as discover creative ways to use recycled materials. This is especially important in the maturity phase, because uncontrolled proliferation of product variants would fractionate procurement requirements (Jacobs et al., 2010). Vendors are encouraged to propose simplifications of component items and other cost-saving ideas for the product. However, purchasing insists suppliers adhere strictly to the firm's quality standards for inputs and services despite pressure for lower costs. Materials and component inventories are shifted to vendors, where possible (Benton, 2010). Procurement cancels overdue purchase orders. It also works with the transportation department to ascertain cost-reduction possibilities by consolidation of shipments and other special arrangements available from shippers (e.g., lower-cost freight class) (Bowersox et al., 2009).

Purchasing assists other departments in determining whether to repair or replace obsolete or worn-out manufacturing equipment, tooling, etc. If necessary, it replaces tooling at suppliers (Johnson et al., 2008). It participates in revising MRP, TQM, and JIT manufacturing. Procurement also adjusts the company's materials quality and service standards to conform with customers' preferences and needs. It performs make-or-buy analyses for the existing product, subcontracted jobs, new product extensions, etc. (Burt et al., 2007).

With demand leveling off, purchasing investigates the use of substitute materials and components as well as requires prospective vendors to identify their start-up and tooling costs for manufacturing these items. It performs price-cost analyses of suppliers' inputs, supplies, etc. to ensure reasonableness of costs given use, competitive situation, etc. (Simchi-Levi et al., 2007). Procurement conducts a commodities study to ascertain the short- and long-run supply, demand, and prices of raw materials bought to produce the product as well as substitute materials and components being considered (Schorr, 1998).

In cooperation with other functions, purchasing plans how the firm will handle, store, and dispose of substitute hazardous inputs. Also, it participates in a benchmarking study of the products, manufacturing processes, etc. of the organization's major competitors in order to identify ways to improve its existing product, operations, etc. (Burt et al., 2007). Along with design engineers and other personnel, procurement performs value analyses and a series of broad-scope efficiency studies. It explores the possibility of importing labor-intensive parts and/or acquiring vendors (Zenz, 1994).

During value analysis, purchasing screens substitute items and the redesigned product for compliance with government health and safety regulations. It also redirects value analysis to reduce the use of critical materials and to shift as much as possible from the use of non-renewable to renewable resources. With regard to substitute dangerous inputs, procurement ensures prospective suppliers have the necessary experience, equipment, permits, and insurance for handling, storage, and disposal as well as comply with government health, safety, and pollution standards. In addition, it acquires the necessary permits, insurance, etc. for the company to handle, store, and dispose of substitute hazardous items (Johnson et al., 2008). Purchasing consults with traffic specialists on carrier designation,

routing, etc. for substitute materials (Sadler, 2007). In disputes with vendors, it vigorously defends the firm's rights, and solicits assistance from the legal department, if necessary.

Procurement monitors possible supply disruptions among suppliers due to strikes, absorption by rivals, and other events. It arranges for a suitable mix of geographically dispersed vendors. In relations with suppliers, the emphasis on lowest total cost is stronger than ever. Negotiation techniques with vendors are improved so as to result in lower prices. Purchasing presses for systematic price reductions on materials and components based upon suppliers' experience. It also explores using vendors' discounts as a means of cutting costs. Preference is given to suppliers who are also customers. The elimination of single sources of supply is considered as a means to stimulate competition among vendors (Zenz, 1994). Procurement searches for ways to improve the effectiveness and efficiency of information exchange between the organization and suppliers as well as among vendors (e.g., purchasing's database is tied to suppliers' databases via computer hookups). It uses computer-based systems and automated databases to monitor vendor performance (Swink et al., 2010).

Cost-reduction efforts (e.g., "paperless" procurement) are implemented within the procurement department to increase efficiency. An internal suggestion system is developed to elicit ideas to make operations more productive. New buying techniques (e.g., prepaid purchase orders) reduce lead times or eliminate the need to stock maintenance items. Routine buying is delegated to junior buyers. If production activities are decentralized, purchasing may split up buying assignments the same way (Jacobs et al., 2010). However, some procurement (e.g., national contracts) remains centralized at headquarters. Purchasing executives evaluate buyers' negotiated contracts for compliance with standards established by the legal department (Benton, 2010).

The director of procurement assesses the usefulness of reports for controlling the department's actions and informing top management of its operations. He or she also evaluates the efficiency and effectiveness of the purchasing department by reviewing and, if necessary, revising its organization, policies, and procedures. In addition, the director monitors activities of personnel in terms of ethical and professional behavior (Zenz, 1994).

Trade associations are enlisted as clearinghouses for excess or needed inputs. These groups also compile and disseminate industry statistics (Benton, 2010). Along with the firm's own sales data and forecasts, this information alerts it to when the existing product's sales volume is likely to decrease.

5.5. Decline stage. When unit sales decrease at an increasing rate, the product has entered the decline phase. Both customers and distributors forsake it for newer, improved versions. Most of the aforementioned pressures intensify. Unless the firm can revitalize the existing product, it will eventually be dropped from the line. In which case, procurement significantly reduces services and inventories of materials and components for the product. It focuses on true cost eliminations (e.g., selling manufacturing equipment), not cost reassignments.

Accurate sales and production forecasts are especially important in this period, because excess specialized inputs and parts may lack alternative uses (Burt et al., 2007). Purchasing strictly enforces materials quality and service standards as cutthroat competition for declining sales volume makes some suppliers desperate. Also, EOQs are adjusted to reflect decreasing demand (Johnson et al., 2008). A controller-type procurement manager is assigned to screen requisitions and audit vendors' invoices for the faltering product (Simchi-Levi et al., 2009).

Purchasing reverts to subcontracting if the firm's manufacturing equipment can be converted to newer items. Specialized personnel are transferred to other duties or products. In addition, it makes sure that sources for spare parts are adequate to serve customers still using the old product (Benton, 2010). Procurement forewarns suppliers the existing product will be dropped from the line near the end of this stage. It assists vendors in changing over to newer items (e.g., buys and disposes of their inventories) (Zenz, 1994).

If the firm licenses another company to manufacture the existing product, purchasing asks the legal department to review and transfer buying commitments. It also participates in determining whether to sell raw materials, goods-in-process, and finished goods inventories to branch plants, suppliers, brokers, or competitors. Further, procurement considers using trade associations as clearinghouses for excess inputs, parts, and manufacturing equipment (Burt et al., 2007). It implements the company's plan for disposing of scrap materials, obsolete or worn-out equipment and tooling, and dangerous items (Schorr, 1998). Also, the director of purchasing monitors the ethical and professional behavior of personnel in the performance of their duties (Swink et al., 2010). After the product is dropped from the line, procurement stores associated buying records so these can be retrieved in case of litigation, etc.

Conclusion

By using the authors' PLC-purchasing activities model, procurement executives can determine the set of prescriptive purchasing actions they should consider implementing in each stage of a product's sales cycle. These lists, in turn, can serve as references for continuous reprogramming of procurement operations across the PLC. In planning and executing more timely and effective purchasing practices, at least two factors need to be considered – corporate objectives, and changing conditions in the marketplace. The actions of a firm are determined by its objectives. Direct linkage between corporate and procurement objectives gives meaning to the contributions from purchasing executives. Planners and doers both know what is expected of procurement as well as how these efforts relate to the broader objectives of purchasing and the organization. Flexibility is incorporated into the procurement plan by anticipating changes in market conditions. Using the PLC concept as a guideline, these basic changes can be anticipated as a product moves through the stages of its sales cycle. Purchasing planners knowing what they want to take place can gain this desired flexibility by fitting procurement actions to PLC phases. The emphasis in this type of planning is on timing the changes in purchasing activities to produce the best utilization of company resources. The contingency procurement plan says, in effect, "when this happens, purchasing will do this, or these alternatives are available." One purchasing manager, who previewed the authors' model, commented: "I've been buying raw materials for more than 30 years, but never understood the bigger picture. Now I do, thanks to your model."

Adoption of the authors' PLC-purchasing practices model can proceed piecemeal. Most urgent, however, is procurement management's attention to products in their early PLC phases (i.e., design, introduction, and growth). These are more volatile and often require radical departures from operational routines. During a stable maturity stage, seasonal patterns may be more decisive on purchasing operations. When sales decline, top management's attention shifts to successor products. After some trial adoptions, if results argue in favor of more extensive use of the authors' model, procurement executives can incorporate it into departmental objectives and policies. If other functions' activities follow these same guidelines, its effectiveness is maximized.

Finally, the authors' model, which depicts purchasing in a systems perspective, makes explicit procurement's relationship with other departments of the firm in the decision-making process. This is especially timely, because purchasing is assuming top-management status in many corporations. Procurement managers interact almost daily with executives from other functions either on an individual basis or as a part of cross-departmental teams. One of the major advantages of the PLC concept is it helps integrate thinking in all functional areas (Kotler and Keller, 2009). The authors' PLC-purchasing activities model can be invaluable, therefore, in illustrating the interrelationship of purchasing with other departments in the firm. This can assist executives of procurement and other functions to dovetail their operations. However, the overall approach and the constituent details are not universals, but a point of departure for custom tailoring to the macro-environmental conditions confronting the organization.

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Appendix

Table 1. Major characteristics of each product life cycle stage

Stage	Major characteristics
Design	Involves the development and test marketing of some product the company has never attempted to sell. The purchasing executive seeks flexibility, because the project is uncertain. Operating decisions should be tentative or reversible. Typical activities include: coordination of R&D with other functions, product design, process planning, preparation of a marketing plan, and recruitment and training of personnel.
Introduction	Commences with the full-scale marketing of the product in its intended market. Unit sales are low but rising. This stage is also characterized by losses or low profits, uncertainty of length, vulnerability of the product to competitors' attacks, relatively few distributors, and manufacturing of the product in pilot plants. The procurement manager seeks to balance the high likelihood of new product failure with the urgency of adequate facilities and materials if the innovation succeeds. Typical activities include: product "debugging", determination of ultimate scale of plant, and introductory promotions. Middlemen are buying base inventories. The new product has top management's attention. This phase ends when unit sales start rising rapidly, or management decides to drop the new item.
Growth	Begins when unit sales start increasing at an increasing rate. Trial sales have been largely completed. This phase is also epitomized by substantial profits, product being less vulnerable to competitors' attacks, and use or development of full-scale production lines. Operating decisions reflect rapid expansion in demand, not "buying" of market share. Typical activities include: heavy amount of manufacturing overtime incurred, new models being added to the product line, and an increased number of distributors handling the product.
Maturity	Occurs when sales volume continues increasing but at a decreasing rate, eventually levels off, and decreases slightly. This phase is also represented by profits reaching a plateau and declining rapidly; existence of many aggressive competitors; decreasing prices; production facilities, equipment, tooling, and processes in need of heavy repair or replacement; and a cost-price squeeze. The purchasing executive seeks to improve the efficiency of buying operations and routines. Typical activities include: development of new markets, short production runs, creation of new models or sizes, and special sales inducements or concessions being given to customers and distributors.
Decline	Occurs when unit sales decrease at an increasing rate. Other attributes of this stage are declining profits; customers and distributors forsaking the existing product for newer items; and, except in the short run, sales and profit declines cannot be curtailed by the firm. Top management tries to revitalize the product; if unsuccessful, the product is dropped. The procurement manager focuses on true cost eliminations (e.g., selling manufacturing equipment), not cost reassignments.

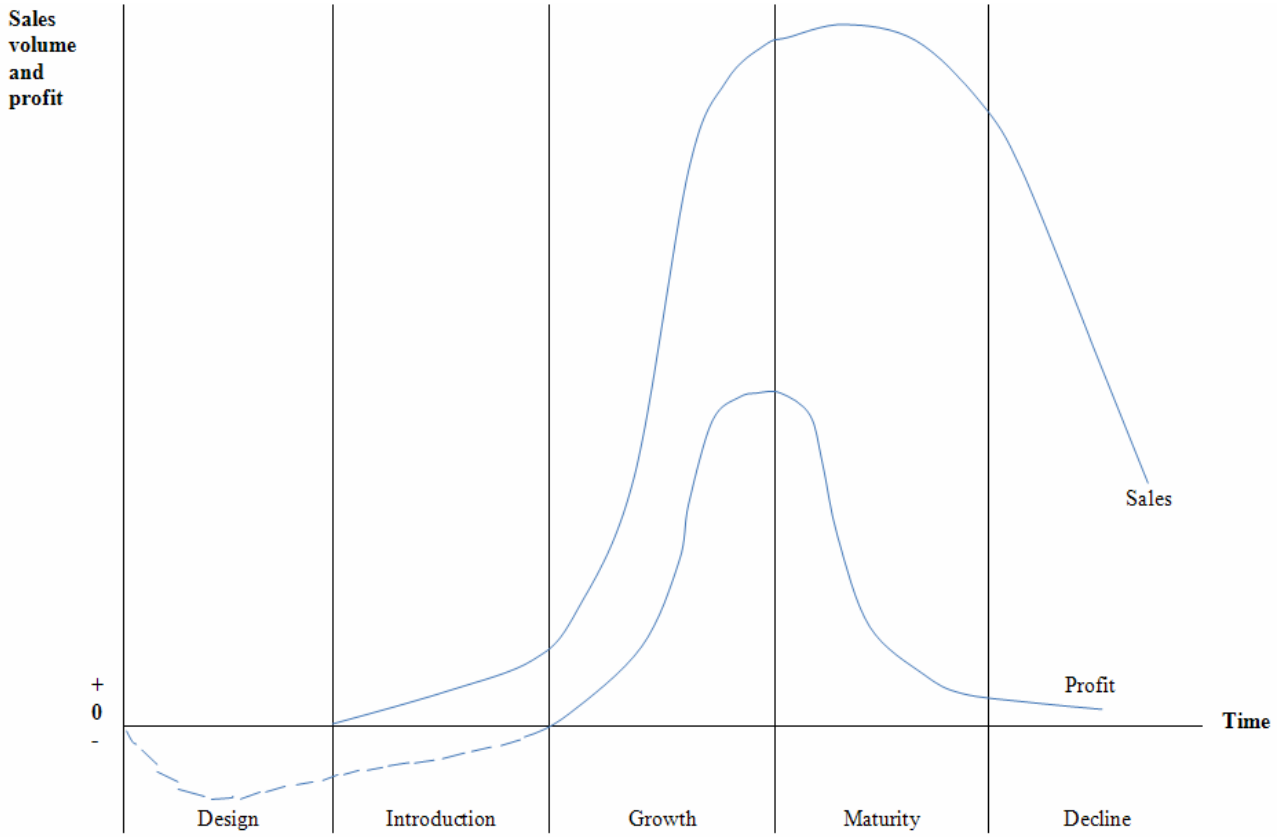

Fig. 1. A generalized product life cycle curve