

Tools, Joint Practices, and Performance Outcomes of Customer-Supplier Partnerships

Seungho Jung

Dept. of Information Systems, Pusan University of Foreign Studies

구매-공급사 간 협력관계에서 사용되는 상호작용(도구 및 관례)과 상호작용의 성취결과

정승호

The purpose of the study is to identify specific tools and joint practices used in customer-supplier partnerships and to investigate performance outcomes resulting from using the identified tools and joint practices. To achieve the purpose, related literatures in the area of marketing, purchasing, and management systems engineering are reviewed. Successful and world-class supply and/or supplier management cases are examined in-depth as well. Before addressing the purpose of this study, quality experts' assertions on and historical perspective of Supply Chain Management(SCM) and general issues on customer-supplier partnerships are also mentioned.

1. Introduction

Supply Chain Management(SCM) can be considered differently according to different perspectives such as marketing perspective, purchasing perspective, and management systems engineering perspective. However, some common foci of SCM can be found in all of the above three perspectives: the importance of and necessity for a closer relationship(or partnership) between customer and supplier organizations. This relationship has become a necessary condition for

today's business world in which many organizations try to remain competitive by identifying and measuring customer requirements, creating supplier partnerships, using cross-functional teams, cutting production costs, and increasing the quality of their products (Hackman and Wageman, 1995). See <Figure 1> for a graphical representation of major focus of this study: customer-supplier relationships, especially their partnerships.

The partnerships fundamentally possess the features of ongoing mutual inter-dependence and trust, a condition in which one party is vulnerable to another whose behavior is not under the control of the first.

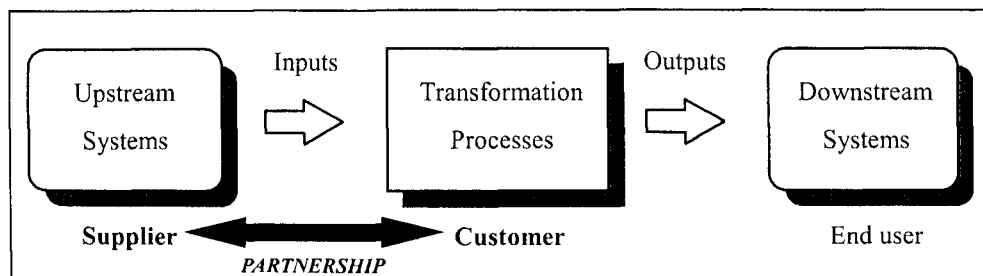


Figure 1. Organizational Systems.

What is implied here is that a customer-supplier partnership may not be possible unless the relationship is established in a favorable business environment with commitment to a long-term relationship, relationship-specific investments, trust, and two-way communication.

Much literature and research on organizational transformation processes has dealt with theories and practices that include brief introductions to SCM. This literature, however, does not identify the specific tools and joint practices that organizations use to develop world-class customer-supplier relationships. Leading edge customer-supplier partnerships are found only in many quality experts' theoretical assertions and a few internationally well-known companies. There is apparently no empirical research on the content of tools and joint practices used in a successful customer-supplier relationship (also called *partnership* in this study). The purposes of this study, thus, include:

- identification of specific tools and other joint practices used in customer-supplier partnerships, and
- investigation of performance outcomes resulting from using the identified tools and joint practices.

In this study, these two purposes are achieved by reviewing related literature and examining exemplary cases known to be successful and world class SCM practices. To study customer-supplier partnerships, this paper first addresses quality experts' assertions on and historical perspective of SCM. Then, general issues on customer-supplier partnerships such as definition, origin, etc. are examined, followed by specific tools and other joint practices used in customer-supplier partnerships and performance outcomes of the partnership.

2. Literature Review

2.1 Quality experts' key issues on SCM

Besides clear distinctions among experts' assertions on the quality dimension of performance measures of organizational SCM, each quality expert has their own philosophy on SCM. Even though experts' ultimate quality goals are centered on improving the quality of the process rather than product quality, and on emphasizing ongoing quality improvement efforts, each has a different SCM approach.

Feigenbaum says, "Quality is expected, not desired." By this, he means quality begets quality. Therefore,

as one supplier becomes quality oriented, other suppliers must meet or exceed this new standard. Peters and Waterman(1982) highlight a customer-driven approach in their book *In Search of Excellence*. They advocate that excellent suppliers have an almost uncanny feel for what their customer wants. This is because they are customers of their own products. According to Deming(1985), inspection of incoming or outgoing goods is too late, ineffective, and costly. Inspection neither improves quality, nor guarantees it. And inspection usually allows a certain number of defects. Deming also emphasized sole sourcing because he believed multiple sourcing for protection is a costly practice. The advantages of sole sourcing include better supplier commitment, elimination of small differences between products from two suppliers, and simpler accounting and paperwork. Crosby and Juran recognize some of the advantages of single suppliers, but they take a more conservative view and simply advocate reducing the number of suppliers. Crosby and Juran consider it important to have different suppliers for the same product when the product is a critical one.

2.2 SCM from historical perspective

SCM for highly effective organizational inputs did not receive much attention until a systems approach to quality arrived in the 1970s. Of course, supply management for high quality organizational inputs existed in earlier organizational structures, but at a fairly low level on the organizational chart. Purchasing or supply managers' primary functions were regarded as strictly clerical and were limited to sourcing, pricing, and delivery (Ansari and Modarress, 1994). The responsibilities of supply managers' have changed since the early 1970s when U.S. firms started losing significant portions of the world market share and had to cope with new Asian and European competitors. Many experts now agree the scope of SCM should include selection of suppliers, acquisition, conversion, and distribution of the materials flow from suppliers to end users, including raw materials, work in process, and finished goods. <Table 1> shows historical data on the supply management and purchasing development evolution in the United States since the inception of SCM concept.

3. Customer-Supplier Partnerships

This section deals with general issues on customer-

Table 1. Historical Perspective on Supply Management and Purchasing Development

Time	Event
1832	• Charles Babbage develops the first materials management concept.
1915	• The magazine <i>The Purchasing Agent</i> (later, <i>Purchasing</i>) emerges. • National Association of Purchasing Agent (NAPA) (later the National Association of Purchasing Management - NAPM) is founded. • Top management begins making major decisions on SCM, and plant foremen are often involved in supply management activities.
1929	• NAPM develops a set of standard procedures for buying and selling.
1951	• Stuart Heinritz's <i>This Business of Buying</i> defines supply management as a critical function.
1960s	• Negotiation techniques, learning curves, cost/price analysis, inventory control, PERT/CPM, networks, buyer training, and supplier evaluation become tools increasingly used by personnel in organizational upstream systems. • Purchasing function is considered a profit center. • First MRP is developed at American Bosch Company; orders tend to be in large lot sizes.
1970s	• Oil embargo, material shortages, and escalating fuel and material costs contribute to an increased focus on the importance of SCM. • Purchasing as a specialized task has been pushed to the top level in organizational structures.
1980s	• Many Japanese approaches are implemented by many U.S. companies; orders tend to be in small lot sizes.
1990s	• JIT purchasing, sole-sourcing, quality audits, and other (quantitative and qualitative) measurement tools are widely used by many leading companies.

(Source: Ansari & Modarress, 1994)

supplier partnerships and related topics such as definition, origin, and reasons organizations should adopt SCM approach.

3.1 Definition and origin of customer-supplier partnerships

The customer-supplier partnership represents a transactional/relational philosophy. This philosophy expands the relationship between customer and supplier organizations beyond that typically found in traditional purchasing methodologies. A partnership involves long-term contracts, a reduced number of supplier sources, a high degree of intention, and sometimes, a changed paradigm.

Ellram(1990) has defined a strategic partnership as "a mutual, ongoing relationship involving a commitment over an extended period, and a sharing of information and the risks and rewards of the relationship." Another team of researchers (Landeros and Monczka, 1989) found cooperative customer-supplier partnerships typically were characterized by five attributes:

- a supply pool consisting of one supplier or a preferred few,
- an alliance incorporating a credible commitment

- between the buying and selling firms,
- joint problem-solving activities,
- an extensive exchange of information between firms, and
- joint adjustment to marketplace conditions.

One of the critical success factors of a customer-supplier partnership implied by these attributes is that to be successful, the goals of the partnership must coincide with the strategic needs of both firms. How have customer-supplier partnerships evolved? Lamming(1993), based on his longitudinal data collection from interviews with managers of both customer and supplier organizations, has proposed three previous phases (see <Table 2>) that explain the necessity of partnerships.

The third phase was not sufficiently progressive for best practice relationships. For example, neither side liked the exchange of information, because the customers' tendency to use cost data against suppliers in negotiation was still apparent, while suppliers found their intention of and attitude toward building more credible relationships could still not be trusted. This is one of the reasons why the fourth phase was necessary as is explained in the next section.

Table 2. Timescale for the Four Models of Customer-Supplier Relationship

First phase	<ul style="list-style-type: none"> This period ended about 1975, before the impact of the oil shock and the resulting recession, and before the increase in international competition between world economic leaders and the rest. This period was relatively calm, with domestic demand and supply well balanced for mass producers.
Second phase	<ul style="list-style-type: none"> Between 1975 and 1980. This period was difficult for customer and supplier organizations because demand fell and became unstable.
Third phase	<ul style="list-style-type: none"> This phase began in 1980. There were noticeably better attitudes towards relationships, but they were still difficult and unstable.
Fourth phase	<ul style="list-style-type: none"> Customer-supplier partnership (since early 1990s).

(Source: Lamming, 1993)

3.2 Why customer-supplier partnerships?

Competition under the partnership is dynamic in the sense that every supplier firm knows it must work with customers and outperform other companies providing similar services. The methods of surviving this competition are different from those employed in the earlier phases of customer-supplier relationships as illuminated in <Table 2>. In the customer-supplier partnership, a preferred supplier should have a solid, long-term relationship with its customers and should know it must provide better service. The security of remaining a supplier to any customer is provided by fulfilling/exceeding customer expectations, not by maintaining the status quo.

Efficient information exchange is of fundamental importance to the success of the partnership. In Japanese customer-supplier relationships, the customer and supplier firms can monitor, predict, and influence the levels of the return of assets, by using a constant exchange of operating and financial data. The involvement of the customer (or supplier) organization in the process within the supplier (or customer) organization also provides the basis for a partnership

approach to price change. For example, Cusumano (1985) has noted the productivity of Japanese component supplier's rose as they received direct assistance from large auto-makers such as Nissan, Toyota, etc. The idea of reducing costs, and therefore prices, is the direct consequence of joint action between customer and supplier firms. Once the concept of the customer's (supplier's) involvement in improving the supplier's (customer's) processes is established, the joint approach to total quality and productivity improvement becomes natural.

In summary, a customer-supplier partnership is a strong inter-company dependency relationship with long-term planning horizons. <Table 3> shows the key contrasting elements between a traditional approach to the customer-supplier relationship and today's partnership.

4. Tools and Joint Practices Used in Customer-Supplier Partnerships

This section introduces tools and joint practices used

Table 3. Traditional vs. Today's Customer-Supplier Relationships

Traditional customer-supplier relationship	Customer-supplier partnership
<ul style="list-style-type: none"> Primary emphasis on price Short-term contracts Evaluation by bid Many suppliers Improvement benefits are shared based on relative power Improvement at discrete time intervals Problems are supplier's responsibility to correct Information is proprietary Clear delineation of business responsibility 	<ul style="list-style-type: none"> Multiple criteria including management philosophy Longer-term contracts Intensive and extensive evaluation Fewer preferred suppliers Improvement benefits are shared equitably Continuous improvement is sought Problems are jointly solved Information is shared Quasi-vertical integration

(Source: Stuart, 1993)

in customer-supplier partnerships. Tools and joint practices introduced in this section are summarized from practitioner-oriented literature that is based on real-world cases or examples.

4.1 Tools and joint practices identified in the literature

Currently, many books and papers relate the success stories of certain organizations' upstream management. These success stories and practices can serve as models for other organizations. A major American company estimates that 40% of its quality problems come from parts supplied by its suppliers. A Japanese firm had to recall 45,000 washing machines due to fires caused by a supplier's defective capacitors, and the investigations into the Challenger and Chernobyl accidents revealed procurement policies that often undermined quality (Pence and Saacke, 1988). Supply setbacks like these have severely hampered many companies' efforts to upgrade quality and become more competitive. So, why don't quality-conscious companies do a better job of selecting suppliers who share their ideas and are willing to commit to the quality of their customer organizations? The purpose of this section is to provide specific examples to demonstrate how some leading U.S. companies solve quality problems by effectively using certain joint practices. These companies have been successful in managing customer-supplier relationships as well as improving specific organizational performances.

JIT practices of members of the Association for Manufacturing Excellence, Inc.

Guinipero(1990) has examined how experienced Just-In-Time(JIT) managers and their JIT purchasing practices can track quality costs and their impact on scrap and rework, plant efficiency, and customer return costs, as well as on traditional incoming inspection costs. His research was based on questionnaire responses from 100 practitioners in organizations that were active in implementing JIT purchasing. Most of the practitioners are members of the Association for Manufacturing Excellence, Inc.

Under the JIT purchasing environment, buying organizations continuously need to motivate their suppliers to improve their performance. <Table 4> shows what other joint practices are used and how they are used in combination with JIT purchasing. These results show that to succeed in JIT purchasing practices, managers in the upstream system should

Table 4. Joint Practices Used to Motivate JIT Suppliers

Formal quantitative rating systems	n=43
Open & frequent communications	n=13
Supplier performance reviews	n= 9
Long-term relationships	n= 7
Stressing future benefits	n= 5
Competition	n= 4
No comment	n= 7
Miscellaneous	n= 5
Total respondents	n=93

(Source: Guinipero, 1990)

Table 5. Plans for Future Evaluation Systems for JIT Suppliers

Future evaluation system dimensions	Number of responses
Quality	21
Delivery	16
Price/cost reduction	6
Data processing/computer	6
Vendor certification/vendor qualification (on-site audits, supplier visits)	6
Communications	3
Line shutdowns/manufacturing integration	2
Percentage of Freight cost	1
Inventory	1
Technology	1
Total responses	104

consider both quantitative and qualitative joint practices to motivate suppliers. One of Guinipero's results shows how quality issues are important in evaluating JIT suppliers.

<Table 5> shows buying organizations' plans for refining and developing the future evaluation of their suppliers' performance. Quality is by far the most frequently mentioned performance factor. Results indicate JIT purchasers use a variety of tools to evaluate and motivate suppliers. The quality factor has assumed increasing importance in JIT operations. Consequently, most of the companies investigated in this research have adopted a broader view of quality because they realize that supplier quality impacts production efficiency, administrative costs, and ultimately the company's customers.

Caterpillars 'Quality Institute'

Caterpillar, Inc. has a unique approach to educating its suppliers in quality improvement techniques. It designs formal and teachable seminars built around what suppliers need to do to meet quality goals. The seminars are customized by including examples from Caterpillar's own manufacturing operations. These seminars are delivered to supplier representatives in a way that transforms them into trainers for their own company's personnel. This is why the Caterpillar's seminar course is called the 'train-the-trainer course.'

Through this seminar, the Caterpillar's Quality Institute has trained more than 1,000 suppliers who have already achieved Quality-Assured Certification. These certified suppliers are now on the preferred supplier list, and they are working for Caterpillar as its preferred suppliers. The purpose of Caterpillar's Quality Institute and its education program is to improve quality and reduce costs by showing the suppliers how better quality through upgrading their efficiency makes more money.

Bell and Howell DMPC's 'Strategic Supplier Partnership' through 'Supplier Certification Program'

One of the Bell & Howell DMPC's business strategies is to do more business with fewer suppliers. Naturally, certification becomes essential for suppliers who wish to continue doing business with Bell & Howell DMPC. This company has its own processes for granting certifications to superior suppliers. Suppliers that are rated high in a preliminary assessment are invited to submit a detailed, written quality plan. Then managers in purchasing and their staff look for supplier quality plans that complement Bell & Howell's own business plans. After this screening, the Bell & Howell team goes to the vendor for an on-site audit to determine whether the company is doing what its plan says it is doing. If the plan is accepted and the vendor is certified, it must be re-certified every year or two.

GTE's 'Partners in Quality' Program

GTE's example of involving suppliers in setting quality goals of supplied parts shows how quality problems can be solved by building quality in the early stage of business between buying and selling organizations. GTE's 'Partners in Quality' program works in this way: In December of each year, GTE sends a set of product-specific goals to each major supplier and asks that they be filled out and returned by January 31st. Historical data (benchmarks) for each goal must be given and a quarterly submission of progress is required. Benchmark data is entirely generated from the supplier's own product tracking system in order to encourage timely and accurate data recording and analysis. Initial goals are reviewed at a 1st quarter meeting between the supplier's quality manager and the GTE quality representatives assigned to that product type. Where the GTE manager feels that a goal is overly conservative, the supplier will be asked to review, and possibly elevate, the target. Where a goal seems excessively optimistic, the supplier will be asked to provide an analysis

showing the specific steps planned to accomplish the change. Stretch goals are encouraged, but must be attainable in order to prevent suppliers from ending the year with disappointing results. As a result of this program, GTE obtained about 20% quality improvement. This program can be applied to a wide range of products and by any company willing to do a little homework on its supplier's critical processes. Knowing what goals are mutually beneficial and presenting these in a positive way with a win-win example will usually get the cooperation necessary (Morgan and Zimmerman, 1990).

Other organizations

Organizations have different approaches to their superior SCM activities. One thing to note is that almost every company mentioned above is using at least two of the tool/joint practices. For example, member companies of the Association for Manufacturing Excellence, Inc. are using JIT purchasing practices and quantitative rating systems. Both Caterpillar and Bell & Howell DMPC are using supplier certification programs and their own education or stringent quality audit programs.

Many other examples of successful SCM practices are found in the literature. For example, Corning Inc. is using a strategic supplier partnership tool to select a few, preferred suppliers with whom it can do business. One of Corning's unique ways of selecting these superior suppliers is to go through its own quality audit processes using the Malcolm Baldrige National Quality Award Criteria (NIST, 1996). On the other hand, one Illinois-based company, Outbound Marine Corp. (OMC), is extensively using an objective, quantifiable supplier rating system that lets suppliers know where they stand against competitors in terms of delivery and quality. OMC has developed a rating system that accurately assesses supplier performance and quality. It provides a consistent measure that does not vary from buyer to buyer, or from day to day. For this rating system, the quality control department and purchasing department have input in developing the statistical reporting system. Purchasing coordinates its rating efforts with corporate and plant manufacturing, engineering, and quality staff.

4.2 Summary and review of examples from the literature

The examples introduced show different approaches across several industries. Even though the joint

practices are different from others, there are important similarities among these companies:

① Management commitment: In most of the companies, quality is not an imposed management policy, but rather a way of life. The drive to survive is creating a new generation of managers for whom quality is second nature. They may not know everything they need to do to achieve it, but they know that it must be done.

② Better supplier relationship: Companies described in this paper share the belief that better supplier relationships are the key to better quality, although they markedly differ on what those relationships can or should be. Effective buyer quality management activities seek to end adversarial buyer-supplier finger pointing, and point the way to mutual achievement of quality goals.

③ Supplier knowledge is power: The knowledge of suppliers' capability to produce or provide what they need is the baseline from which those companies begin to establish satisfactory supplier relationships. Effective buyer quality management activities are predominantly informational activities that improve their ability to influence the supplier's quality.

④ Supplier certification: One step on the way to zero-defect suppliers is to determine their capability to perform to a quality standard and to periodically verify that they are doing so. This supplier certification is found to be a key facet of most of the companies' quality programs, although there are considerable differences in what supplier certification is called, how it is used, and which standards are employed.

⑤ Quality improvement: To bring suppliers into the quality fold, these companies lead by example, deploying extensively quality improvement programs in their own operations and providing training and consultation to help their suppliers do the same.

5. Selected Performance Results of Customer-Supplier Partnerships

In this section, actual and exemplary customer-supplier joint action practices are reviewed for two purposes: (1) to identify tools and joint practices that are actually used in real customer-supplier partnerships and (2) to categorize them in a meaningful way. To achieve these purposes, all materials used here are the results of case studies, surveys, and other research activities based on actual customer-supplier joint

action, not including theoretical assertions and arguments. <Table 6> shows the summary results of the literature review on various tools and joint practices with respect to the type of industry, specific performance results, and so on. To derive meaningful information about tools and joint practices in the context of three industry types (manufacturing, service, and overall), the tools and joint practices identified in <Table 6> are analyzed and categorized under the three industry types, and <Table 7> shows the result.

Some conclusions from <Table 7> are (manufacturing: M, service: S):

- Tools/joint practices frequently used, regardless of industry types, are: QFD (M:3 and S:2), JIT purchasing (M:3 and S:1), supplier performance evaluation (M:2 and S:1), joint problem-solving activities (M:2 and S:3), and education and training programs (M:1 and S:1).
- Based on the first finding, the manufacturing industry seems to rely on QFD, JIT, and supplier evaluation programs more than the service industry does, whereas two service industry uses form of joint action committee or team more frequently than the manufacturing industry does.
- One unique approach is used in the service industry: a team of multiple suppliers.

Based on <Tables 6 and 7>, three general trends have been derived. First, the manufacturing industry is more likely to use specific tools in terms of steps and procedures associated with their usage such as QFD, JIT, and supplier evaluation programs. To use QFD, the user is required to follow steps and procedures already identified and suggested by experts. In the case of JIT and supplier evaluation programs, the user in the manufacturing industry usually uses specific technologies and performance measures. This specificity provides the user with (semi-) standardized ways to apply the tools to their customer-supplier relationships. On the other hand, the service industry is likely to use other practices that do not provide standardized or fixed ways to use, such as the joint action committee. Unlike the three tools mentioned above, a form of joint action committee involves not only the technical aspects of interactions, but also social, cultural, and any other human related aspects.

Second, based partly on the first trend, the performance results achieved from tools used by manufacturing industries are different from those of the service industry. That is, performance measures

and results used and obtained in the manufacturing industry are more specific and concrete than those used in the service industry. This may be explained by the different natures of the joint action used by the two industries. The tools more likely used in the manufacturing industry usually provide performance measures and subsequent results that can be easily quantified, such as increase/decrease in production cost/selling price, gains and losses expressed in percentages and rates, and so on. On the other hand, the service industry uses performance measures such as an increased ability to meet the customers expectations, a prolonged contract period, a multiyear partnership, and so on.

Third, three specific performance dimensions are identified as the most-widely used indicators of

measuring the impact of tools and joint practices: quality, cost, and cycle time. <Table 8> shows these three performance dimensions and others used at least ones.

6. Conclusions

Some conclusions can be drawn from findings in Section 5. Quality audits may be used to evaluate suppliers. Today, many customer organizations not only ask or require their suppliers to be certified by ISO 9000, for example, but also maintain a list of preferred suppliers. In fact, Jung(1997) identified in his research that quality audits have been used as one

Table 6. Tools/Joint Practices Across Manufacturing and Service Industries (cont.)

Source and type of research design	Type of industry	Tools/joint practices used	Performance results (shared results) or significant outcomes
Schonberger, R.J. and A. Ansari (1984). IJPM; Case study	Overall	JIT purchasing	Frequent deliveries of smaller lot sizes, supplier evaluation based on product quality, single sourcing in closer geographical area, long-term relationship with fewer suppliers, supplier's improved quality
Stuart, F.I. and P. Mueller, Jr. (1994). IJPM; Case study	Service	Joint problem-solving team and partnering	Increased customer's productivity by about 7.5%
Sullivan, L.P. (1988). Quality Progress; Case study	Within organization (Overall)	QFD	Identification of better means (tools) to ensure desirable results, policy management
Morgan, J.P. and S. Zimmerman (1990). Purchasing; Survey	Service (Document management)	Supplier certification program (by their own standards)	Multiyear partnership, sharing of responsibility on specific commodity
	Manufacturing	Supplier qualification (MBNQA)	Establishment of exemplary benchmarks and measures
	Manufacturing	Supplier performance evaluation program	Provision of guidelines for other companies
	Manufacturing	Partnership with a few preferred suppliers and certified supplier award system	Reduced lead-time, better forecasting, open communication Increased scrap savings, reduced repair cost, supplier involvement in new product design
	Service	customer's education/ training program of quality for its supplier, joint quality and productivity team, quantitative supplier evaluation program	Reduced number of suppliers
Vera, D.D. et al(1988). Quality Progress; Case study	Manufacturing	QFD	Reduced final product price by 50%, reduced engineering expense by 50%, reduced drafting expense by 20%

Table 6. Tools / Joint Practices Across Manufacturing and Service Industries

Source and type of research design	Type of industry	Tools/joint practices used	Performance results (shared results) or significant outcomes
Ansari A. and B. Modarress (1994). IJPM; Literature research	Manufacturing	supplier's involvement in customer's QFD	Supplier's provision of expertise in analyzing customer requirements, close working relationship to resolve any inconsistency in the process
Chen, B.A. and Batson, R.G. (1996). 50th ASQ Annual Quality Congress Proceedings; Case study	Manufacturing	Joint problem-solving team	Supplier's gain: improved quality, customer service, new technology development, reduced defect rate, more and better use of SPC tools, development of partner relationship customer's gain: improved documentation on supplier's delivery, improved quality of final product, reduced inspection cost of outgoing products
Cayer, S. (1990). Purchasing; Case study	Manufacturing	customer's quality education/training program for supplier	Not specified
Cross, J. (1995). Harvard Business Review; Case study	Service	A team of multiple suppliers	Prolonged contract period (initiation of partner relationship), sharing of cost savings, greater flexibility and higher quality of supplier's service, supplier's technical competency and provision of skills and ideas
Gunipero, L.C. (1990). IJPM; Literature research	Manufacturing	JIT performance measurement	Less use of cost/price measures, more use of number of suppliers/supplier lead time/supplier quality and delivery/inventory turnover/inventory reduction in total dollar volume
Graham, T. Scott, P.D. Daugherty, and W.N. Dudley (1994). IJPM; Case study	Manufacturing	Long-term commitment	Decreased average lot size/number of suppliers/number of source per item Increased average contract agreement length/frequency of delivery to plant/supplier involvement in quality certification program Improved quality of supplier's operations (processes), improved quality of incoming purchased items, decreased supplier's/customer's total cost, improved supplier's (customer's) ability to handle customer-(supplier-) initiated delivery schedule change
Hauser, J.R. (1993). Sloan Management Review; Case study	Service	QFD	Reduced product price, more effective R & D activities in meeting customer's needs
Johnson, S.G. (1989). ASQC Quality Congress Transactions; Case study	Manufacturing	Supplier evaluation program and joint goal setting (planning)	Average gain: overall field return rate (17%), re-return rate (14%), no trouble found rate (19%), computerized tracking (16%), process SPC (11%), product SPC (13%), design SPC (33%)
McMillan, John (1990) California Management Review; Case study	U.S. and Japan auto industry (Manufacturing)	Incentive systems (customer's specific investment, risk sharing, multi sourcing)	Fewer suppliers, supplier's earlier involvement in customer's product design, more monitoring of supplier's quality
Raja, Ernest (1990). Purchasing; Survey	Manufacturing	JIT purchasing and delivery	Customer's rework reduced by 24%, scrap rate reduced by 21%, WIP inventory reduced by 31%, manufacturing cycle time reduced by 50%, supplier's quality improved by 26%, costs reduced by 11%, lead-time reduced by 29%

Table 7. Proposed Tools/Joint Practice-Industry Type Combinations

Industry type	Tools/joint practices used
Manufacturing (12)	QFD (2), JIT delivery and purchasing (2), Supplier evaluation (2) and qualification (1), Long-term commitment to partner relationship (2), Joint problem-solving (1) and goal-setting (1), Quality education and training (1), Incentive system (1)
Service (5)	Joint action team or committee (3), QFD (1), Education and training (1), Supplier certification (1) and evaluation (1), A team of multiple suppliers (1)
Overall (Manufacturing + Service)	QFD (1), JIT (1)

(Numbers in parentheses in the first and second columns indicate the number of the same industry type and frequency of joint practices identified in Table 6 respectively.)

Table 8. Frequently Used Performance Dimensions

Performance dimensions	Specific performance results used in Table 6
Quality	supplier's improved quality and reduced defect rate; customer's improved quality of final product (Chen & Batson) Higher quality of supplier's service (Cross) Improved quality of supplier's operations (processes), improved quality of incoming purchased items (Graham et al.) Overall field return rate (17%), re-return rate (14%), no trouble found rate (19%) (Johnson) customer's rework reduced by 24%, scrap rate reduced by 21%, supplier's quality improved by 26% (Raia) Supplier's improved quality (Schonberger & Ansari)
Cost	customer's reduced inspection cost of outgoing products (Chen & Batson) Sharing of cost savings (Cross) Decreased supplier's/customer's total cost (Graham et al.) WIP inventory reduced by 31%, costs reduced by 11% (Raia) Reduced repair cost (Morgan and Zimmelman) Reduced engineering expense by 50% and reduced drafting expense by 20% (Vera et al.)
Cycle time	Lead-time reduced by 29% (Raia) Reduced lead-time cost (Morgan and Zimmelman)
Others	Reduced product price (Hauser, Vera et al.) Use of SPC tools (Chen & Batson) Increased productivity by 7.5% (Stuart and Muller, Vera et al.)

of the most common mechanisms to certify suppliers or to recognize supplier's performance. Joint problem-solving activities used in customer-supplier relationships may be on reviewing and preparing corrective action procedures or documents, including warranty failure, not on actually designing corrective actions. Although it was not specifically addressed nor discovered in this study who actually designs corrective actions, it is assumed that corrective actions are actually designed and implemented by managers and engineers in either R & D or operations / production, while corrective action procedures are reviewed, documented, and modified by managers responsible for the buying and selling functions of the organization. JIT purchasing appears to be used frequently not only to streamline both delivery (from suppliers to customer) and production (in customer

organizations) systems, but also to automate several related operations such as ordering and scheduling by using EDI or paperless business operations. Frequent delivery of defect-free materials is one important objective of JIT purchasing. One way to meet this objective is to eliminate the receiving inspection of incoming materials. The elimination of the receiving inspection can be done by supplier certification in conjunction with a quality audit. When suppliers consistently meet the quality standard set by both the customer and supplier, the customer organization does not need to conduct a traditional receiving inspection.

One of the future research directions could be formative evaluation of customer-supplier relationships in which the results of this study have been applied. By gathering data on performance outcomes,

formative evaluation research will allow a researcher to evaluate the strengths and weaknesses of tools and joint practices identified in this study. In this way, the validity of findings and conclusions made here can also be evaluated.

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정승호

경희대학교 산업공학과 학사

University of Delaware-Operations Research 석사

Virginia Tech Industrial & Systems Engineering 박사

현재: 부산외국어대학교 정보경영과학부

전임강사

관심분야: Customer-supplier partnership, Development of a procurement contract mechanism, 중소기업 경쟁력 강화를 위한 정보기술의 역할