Chapter 2

Supplier Management in Service Industry: What can be Learned from Automotive Manufacturing?

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Additional information is available at the end of the chapter

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Abstract

The objective of this chapter is to describe how many of the supplier management practices of the U.S. automotive industry can provide learning points for those who manage service organizations. After a review of the four service sectors (distributive, producer, social, and personal services), we define supplier management. The three main functions within supplier management—control, improvement, and planning—are illustrated and discussed. The suppliers for a specific service are even more diverse than those cited for an automotive OEM; many services use suppliers from each of the other service sectors. Consistent with automotive OEMs, service companies outsource all three categories of supplies—goods, services, and software—though the proportions and contribution of each supply category to operational excellence may differ. Service operations experience waste, and we review the accepted list of eight wastes for service operations, noting that each of these wastes could be caused by a supplier. Essential practices of supplier management for a service industry are organized around the concept of customer-supplier partnership, a six-step hierarchy first identified for automotive OEMs. With the addition of two more imperatives, assure service dependability and manage the service supply chain, we explain how these eight practices may be adapted to services.

Keywords: service sectors, supplier quality, supplier management, supplier planning, supplier improvement, supplier control, service supply chain

1. Introduction

Zhou et al. [1] state that in operations management, "the study of services has lagged the study of manufacturing," noting that "service firms also transact with their suppliers and service their downstream customers. This very much resembles the classic manufacturing supply chain structure." The purpose of their 2009 article was "to identify and discuss major

findings that contrast service and manufacturing supply chains as well as adding an operations management perspective to existing understandings." Their research can be viewed as a response to earlier articles in the *Journal of Operations Management* concerning the evolution of service operations management. The research presented here addresses supplier management in services and can be viewed as yet another step in that evolution, suggesting what a service industry might learn from world-class supplier management practices used in manufacturing supply chains.

Modern automotive original equipment manufacturers (OEMs) each employ a version of the Toyota Production System [2] and manage all facets of the relationship with their first tier external suppliers using a formal system of supplier management. Rather than focus on the "lean" practices for which these OEMs have become world-famous, the objective of this chapter is to describe how many of the supplier management practices of the U.S. automotive industry can provide learning points for those who manage service organizations. In particular, it will be useful to review the eight sources of waste (muda) in service systems to frame the beneficial role supplier management might play in improved efficiency of the service supply chain.

A simple definition of service is "work performed for someone else." Quinn and Gagnon's [3] definition is "Services are all those economic activities in which the primary output is neither a product nor a construction." Product-oriented sectors of the U.S. economy always produce a tangible product; a service may or may not terminate in a tangible product. Services are rendered on demand—either instant demand or scheduled demand—often with the customer present and involved in the service transaction. Therefore, the reliability characteristic "ready on demand" is critical for high-quality service. Once service begins, uninterrupted service (again, a reliability characteristic) is another customer expectation. As explained by Andres-Lopez et al. [4], there are five inherent characteristics of service found in the literature: Intangibility; Inseparability—the service's generation and consumption often occur simultaneously; Variability in response to specific customer requests may be intentional—information gets transformed into customized action in an attempt to satisfy the request; Perishability—services generally cannot be inventoried, though there are exceptions (consider college courses that are delivered asynchronously to distance education students); and Lack of Ownership. In contrast, a manufactured product is tangible, produced, and consumed at different locations at different times, expected to be of consistent quality, to be inventoried with like items, and to have clear ownership as it changes hands. These authors put forth a more detailed definition of service: "A set of one-time consumable and perishable benefits delivered by a service provider commissioned to the consumer needs, which are consumed and utilized by the triggering service customer."

It has been observed that when the totality of service sectors are considered, such as social, financial, and personal services, service quality depends as much on human reliability as equipment reliability. According to Zimmerman and Enell [5], service quality is "fitness for use as determined by those features of the service that the client recognizes as beneficial." A well-known summary list of service quality determinants was published by Ghobadian et al. [6]: Reliability, Responsiveness, Customization, Credibility, Competence, Access, Courtesy, Security, Communication, Tangibles, and Understanding the Customer. Consider how closely

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these characteristics parallel the expectations which U.S. consumers hold for the OEM that designs and manufactures their new automobile. Suitable modifications would of course apply, such as broadly interpreting service reliability—providing the pledged service on time, accurately, and dependably. Such parallels are the basis for this chapter.

"Service quality is the extent of alignment between customer expectations and their perceptions of provided service" [4]. Service quality matters a great deal to the economic prosperity of the U.S. In the microeconomic sense, Lewis [7] observed "service quality is considered a critical determinant of competiveness" because it:

- Sets expectations for the future.
- Affects repurchase intentions.
- Affects what customers say to other potential customers.
- Attracts new customers, if perceived to be high.

Drucker [8] convincingly argued that the macroeconomic competitiveness of postindustrial societies (such as the U.S.) depends on improving the productivity of knowledge workers, who for example make up 40% of the U.S. workforce. He notes that many knowledge workers depend on specialized information, facilities, and equipment to render their service, and that "productivity of the knowledge worker is not—at least primarily—a matter of quantity of output. Quality is at least as important." In this well-known article, Drucker clearly viewed the assembly worker at an automotive OEM to be a knowledge worker (using both his brain and hands), in addition to the more obvious engineers, accountants, purchasing agents, and other professional employees. Quality Management at the OEM has become systematized, with functions of quality planning, quality improvement, and quality control. Each automotive OEM has a quality management system (QMS), which may or may not be registered to the international QMS standard ISO 9000. Supplier quality is considered extraordinarily important, given the extensive content of modern vehicles purchased from suppliers and delivered just-in-time or just-in-sequence to the assembly plant. Quality planning addresses model year changes to "design in" quality to next-generation modules or parts and efficiency in the good's production and supply chain processes. Most OEMs practice continuous quality improvement inside their plants and employ supplier quality engineers to extend the QMS into supplier plants and the manufacturing supply chain that connects them to each other and the OEM. Quality control is exercised item-by-item and delivery-by-delivery, in an attempt to pass on the correct items, in the correct quantity, at the correct time, with correct packaging/identification, and to the next customer in the supply chain. Control implies that defects are detected quickly, removed from production flow, and replaced. The focus of the QMS is of course on prevention of defects, not detection and correction. In a real sense, supplier quality management as practiced at the modern automotive OEM is a well-developed practice of supply chain risk management.

The service sector of the economies of developed countries has exhibited steady growth over the past 60 years, in percent of employment and percent of gross national product (GNP). Even in 1950, 55% of U.S. workers were service workers (contrasted with 26% in France).

Today, over 75% of British and U.S. workers, 65% of French workers, and 60% of workers in Germany and Japan are service workers. A total of 70% of GNP is attributed to services in Belgium, France, the U.K., and the U.S.

Prior to 1975, the best-known explanation of national economic development was built into the Fisher-Clark three-sector scheme with 11 industry types, with Service listed last:

- Primary sector: Agriculture, Mining, Fishing, Forestry.
- Secondary sector: Manufacturing, Construction, Utilities.
- Tertiary sector: Transportation, Communication, Commerce, Service.

Over time, the percent of economic activity in a country's primary sector shifted first toward secondary and then toward tertiary due to productivity gains and the rising per capita income that stimulated the demand for a variety of services. As service industries expanded in the developed world, a new sectoral scheme was needed.

In 1975, Browning and Singlemann published a landmark study funded by the U.S. Department of Labor, *The Emergence of a Service Society* [9]. They proposed six sectors, four of which are services, to better capture the economic activity in the U.S.:

- Extractive (identical to primary).
- Transformative (identical to secondary).
- Distributive services (transportation, communication, wholesale and retail trade).
- Producer services (financial, insurance, engineering, law, business services).
- Social services (health, education, welfare, and government).
- Personal services (domestic, lodging, repair, entertainment).

They observed that the big shift over the decades of the 1930s–70s was not into services per se but very predominately a shift into producer and social services. For purposes of this chapter, the two "goods-oriented" service sectors, distributive and producer services, are most important because they include services that would most benefit from supplier management. They are situated between the first two "production" sectors and the last two "consumption" sectors. Although Browning and Singlemann placed utilities in the transformative sector, we are going to make a distinction between electric power generation (clearly transformative) and electric power distribution, which along with pipeline services (natural gas, water, etc.) shall be classified as a distributive service. Note also that distributive services, in turn, support all economic sectors. A failure in distributive service will affect direct customers in *all* economic sectors, including other distributive services. If the failure duration extends into minutes, hours, or even days, customers of the failed distributive services experience indirect or "cascading effects." This vulnerability of interconnected infrastructures has been recognized by Chiles [10], Little [11], and others.

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2. Background on supplier management

The Gartner Group defines supplier management to be "the process that enables organizations to control costs, drive service excellence, and mitigate risks to gain increased value from their vendors throughout the (procurement) deal's life cycle." In fact, it has been said that to limit financial, business, and reputational risk, it is crucial to properly manage suppliers. Supplier Management can be conceptualized as a part of (at the intersection of) purchasing management, quality management, and supply chain management as suggested in **Figure 1**. Supplier management begins with the establishment of performance expectations specific to the supplier's goods and services, with the understanding that each supplier put under contract will have its performance measured and tracked on an appropriate time basis, which could be minute-by-minute, hourly, daily, monthly, quarterly, etc. The three main functions within supplier management are control, improvement, and planning as illustrated in **Figure 2**. These three functions coincide with what Juran called the Quality Management "Trilogy" [12], adapted to Supplier Management. Supplier planning results in the performance expectations mentioned above, which may be written with a current supplier in mind or be put out for bid. If there is more than one candidate supplier (which may be preferable for competition and risk avoidance), another part of supplier planning would be "sourcing" carried out by purchasing professionals. Supplier improvement is another expectation built into any automotive OEM's contract with a supplier, where improvement could be expected in any performance criterion, especially those where chronic under-performance is detected. Supplier control (costs, quality, delivery performance, accuracy of billing, etc.) is a fundamental function of supplier management—repetitive measurement of supplier performance, identification and reaction to upsets and unexpected events, and assuring rapid restoration of the status quo by the supplier.

Consider first the way in which parts suppliers are organized for an automotive OEM. There are tiers, and the first tier is considered most important—delivering subassemblies (modules) or individual items (body molding, paint) that are integrated directly into the vehicles

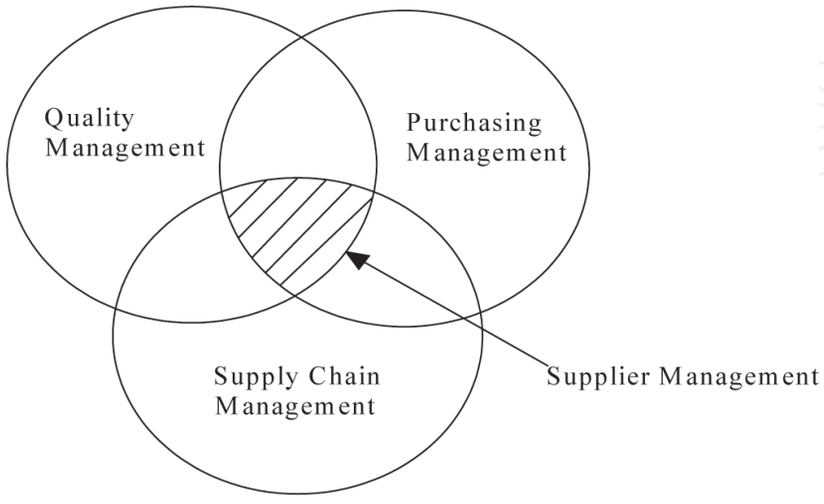

Figure 1. Supplier management in context.

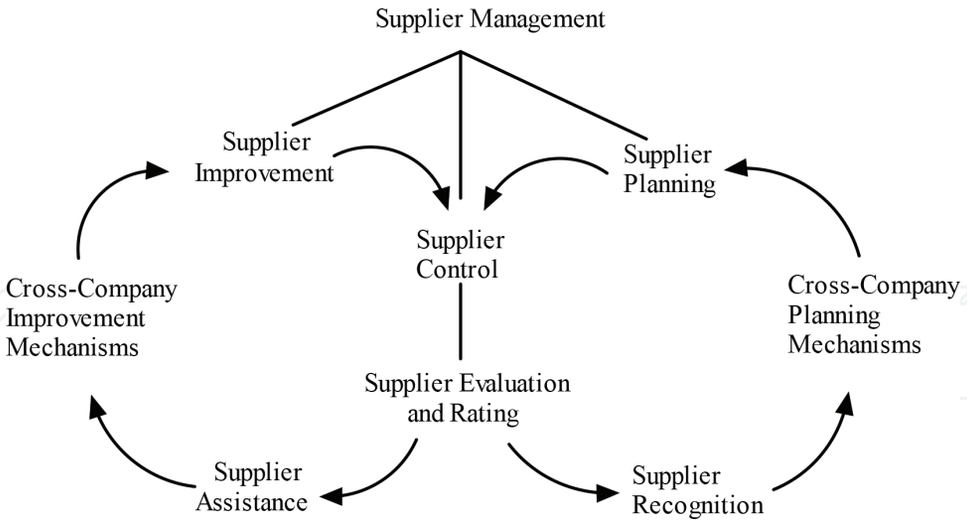

Figure 2. Supplier evaluation and rating originates in supplier control, and in mature applications leads to supplier improvement and planning functions.

under assembly. Second tier suppliers provide parts and services to the first tier, and of course, a failure of one of them can become a failure at the OEM, if the first tier passes it on. The Toyota Production System has a Maxim: Never pass on a known defective to the next work station or process in manufacturing or to the next tier in the automotive supply chain. Transportation suppliers include the companies whose trucks deliver subassemblies and parts to the assembly plant, and perhaps, different companies that load up the finished vehicles and deliver them to dealers. These are third-party logistics suppliers or 3PLs. In addition, OEMs will utilize temporary employee services, whenever there is a shortage of workers in a particular area of the plant. Of course, all the utilities used in the conduct of the OEMs business are key service providers—often taken for granted, until one of them fails. OEMs in the U.S. must of course comply with a large variety of U.S. government regulations concerning vehicles they produce (e.g., fuel efficiency, safety on the road), as well as worker safety and compensation. Some state governments provide the services of selection and training of entry-level hourly personnel; medical and child care on-sight are probably contracted out to qualified suppliers. Besides goods and services, OEMs typically purchase software from an external "business service" rather than write it themselves. All these supplier types—3PLs, utilities, federal and state government agencies, medical care providers, and software developers—would be typical of services as well.

The suppliers for a specific service are even more diverse than those cited for an automotive OEM. Many services use suppliers from each of the other service sectors. Reflecting back on the four service sectors of Browning and Singlemann, it is easy to confirm these potential customer-supplier relationships. For example, a parcel delivery company is considered to be in the transportation industry, but such a company (e.g., UPS) would use external insurance and law services, expect government agencies to provide clear explanation and fair enforcement of regulations, depend on health providers to keep employees well, and use external repair services for operations equipment it does not maintain itself (e.g., HVAC systems, elevators, perhaps even material handling equipment). In turn, each of these UPS service providers may

use UPS, or a competitor, for delivery of documents, certain equipment, and repair parts for its equipment. Consistent with automotive OEMs, service companies outsource all three categories of supplies—goods, services, and software—though the proportions and contribution of each supply category to operational excellence may differ.

To distinguish the supply chain in a service industry from the more familiar supply chain supporting a manufacturing industry, consider the following definitions of supply chain management (SCM):

- "SCM involves the management of flows between and among stages in a supply chain to maximize total productivity," from Chopra and Meindl [13].
- "SCM is a process-oriented, integrated approach to procuring, producing, and delivering end-products and services to customers … It covers the management of materials, information, and funds flows," from Metz [14].
- "The supply chain refers to all those activities associated with the transformation and flow of goods and services, including their attendant information flow, from the source of raw materials (and basic services) to the end users. SCM refers to the integration of all these activities, both internal and external to the firm," from Ballou et al. [15].

In a nutshell, the process of locating, obtaining, transforming, and transporting the inputs needed to satisfy the customer is the core function of SCM. By meeting this overriding quality goal, profitability is considered to follow. Taylor [16] noted that "service firms typically have little need for physical inputs other than office supplies," but this statement seems to be too narrow; one must consider that distributive services use fuels for transportation vehicles or electrical energy for communication networks. Social services such as health care and education are critically dependent on physical goods such as over-the-counter or prescription drugs, computer equipment and software, and textbooks. But, we agree with Taylor that:

- Both the service and manufacturing industries require an input of labor to complete the processing necessary to satisfy their promise to the end customer;
- Both industries require capital investment in equipment that allows their employees to do their work efficiently and safely;
- The primary difference is what gets manipulated by labor:
    - In manufacturing, labor costs arise from procuring, transporting, and manipulating physical material;
    - In service industry, the majority of labor is expended on manipulating information and developing relationships;
    - Capital investments in machinery and equipment are typically much higher in the manufacturing industry, though again there are exceptions such as distribution and computer networks associated with each of the four service sectors.

Another difference between manufacturing and service supply chains is logistics. Manufacturing supply chains focus on moving physical materials from one location to another, such as from second tier supplier, to first tier supplier, to the OEM or from OEM, to distributor, to the end customer. OEMs also must have in place an "After-Sale Service Supply Chain," which interestingly engages them in service delivery. Some features of this service that are different than delivery of the original product are: End customers have immediate needs for parts and repair service—response times are much tighter than the original sale; Thousands or even millions of part numbers may be involved in servicing decades of changing models; These products can be quite dispersed geographically—literally, all over the world; Personnel, for instance trained repairmen, are part of the service delivery and must be prepositioned or moved where needed; resources such as repair manuals and parts must be readily available; components or entire products which are returned to depots or the OEM's manufacturing facility engage the supplier in reverse logistics; the relationship with the customer extends far into the future, perhaps 20 years or more; software to support After-Sale Service Supply Chain Management may not be as well developed as enterprise software used to manage the manufacturing supply chain.

In some service organizations, physical materials arrive through a supply chain and are delivered to the customer as part of the service—in support of, rather than integrated into, the intangible service. In other service organizations, no physical product is moving except utility deliverables (electricity, water, gasoline, and natural gas) or perhaps a few sheets of paper in producer services such as law or engineering. In the producer service sector, improvements to speed the flow of communication—such as upgraded servers or new software—is the equivalent of OEMs negotiating faster transport or better shipping rates with their 3PLs. See Zhou et al. [1] for a comprehensive discussion of commonalities and differences between service and manufacturing supply chains.

Finally, service operations experience waste (muda, in the Toyota Production System [2]) just as Taiichi Ohno first described in manufacturing operations. Such waste in manufacturing systems is now referred to as the *original seven* wastes. Much more recently, Bicheno and Holweg [17] have developed an often-referenced listing of *eight wastes for service operations*:

1. *Delay* in the sense of customers waiting—for initial service, a delivery, a repair, a response that does not happen as promised to, or expected by, the customer.
2. *Duplication*—perhaps submitting data or information multiple times, either on forms or in response to queries from different parts of the service organization.
3. *Unnecessary movement* by the customer, such as standing in multiple physical queues, waiting on-line in multiple virtual queues, generally unable to complete a service transaction at one location or in one step.
4. *Unclear communication*, starting with the unclear directions on how to access the service or use service features, and continuing with time wasted seeking clarification.
5. *Incorrect inventory* for a wholesale or retail organization, so that both employees and customers are unsure of what is available now, or when it will be available; also, customer dissatisfaction with substitutes.

6. *Opportunity lost* to retain current customers or win new customers, by failure to establish rapport, ignoring customers or treating them in an unfriendly or rude manner—a failure in relationship building and management.
7. *Errors in the physical part of the service transaction*, such as defective products in the product-service bundle (e.g., poorly cooked or cold main dishes in a restaurant; lost or damaged goods in home delivery from on-line shopping).
8. *Supplier quality errors*, a general lack of quality in service processes such as a supplier of school bus services to a school system that randomly fails to pick up some students in their neighborhood, fails to deliver them to the correct school, or cannot get them to their school before the school day begins.

It is easy to see how each of these wastes could be caused by a supplier, especially wastes numbered 1, 5, 7, and 8. Note that these four service wastes may relate back to a supplier's performance criteria: delivery schedule, delivery accuracy, supplier product quality errors, and supplier process quality errors. Avoiding the eight service wastes, therefore enhancing both quality and efficiency of service, should be part of supplier management in any service industry. For example, Swank [18] cited Jefferson Pilot Financial (JFP, a full-service life insurance and annuities company) for its application of lean principles to resolve waste in two of the categories above:

Delay: JFP "replaced one of its vendors with a company that not only provided faster turnaround times at a lower cost, but also was willing to commit to ongoing performance improvements."

Unnecessary Movement: For a JFP call center, "measure performance and productivity from the customers' perspective—the percentage of customers whose issues are addressed in a single call."

3. Essential practices for supplier management in a service industry

The relationship between buyer and supplier may progress from infancy to full maturity as follows: "one time only purchase," with no obligation from either side that a sale will occur in the future; "transactional," where the buyer and supplier have established an on-going "arms-length" relationship for repeat sales, with order-entry and tracking, subsequent delivery and billing, accepted disposition of product-service bundles that fail to meet quality or delivery expectations, etc.; a multifunctional customer-supplier relationship or "partnership"—also known as an "arms around" relationship"—where the supplier is considered an organizational extension of the buyer, with extensive information exchange (such as sharing of technological and/or customer information) and expectations on both sides that the supplier will be included in future business, perhaps even expected to provide R&D that helps with the buyer's product quality, cost competitiveness, and efficiency of operations. There is an extensive literature on supplier relationship management. For more on partnerships, see Batson [19].

Liker and Choi [20] reviewed how U.S. automotive OEMs build "deep supplier relationships" also known as "customer-supplier partnerships." The result of their review was the

supplier-partnering hierarchy, a six-step hierarchy with one step leading to the next. Liker and Choi state "Toyota and Honda have succeeded not because they use one or two of these elements but because they use all six together as a system." We believe that with proper interpretation, and augmented by human and equipment reliability (service dependability), this six-step hierarchy can be used as a guide for supplier management in any service industry, as explained below.

The supplier-partnering hierarchy of Liker and Choi [20] is described next, with steps numbered as suggested in the article, each followed by a few prescribed actions for the buyer.

3.1. Understand how your suppliers work

- Learn about supplier's business
- Go see how suppliers work
- Respect suppliers' capabilities
- Commit to co-prosperity

Under this set of prescriptions, one sees the buyer exhibiting willingness: to learn (perhaps from written, verbal, or audio-visual sources); to go observe actual operations and learn directly from the suppliers' managers, engineers, and workers; to develop and exhibit a respect for the suppliers' capabilities, some of which may exceed the buyer's capability in the same area; and to commit to long-term, shared prosperity on both sides of the partnership. Customer-supplier partnerships flourish when the supplier develops a respect for the OEM's customers and an intense interest in those customers' experience with the product-service bundle. The buyer, while showing humility and trustworthiness, and sharing customer information, is being proactive in building a foundation for the next five steps in the hierarchy. Liker and Choi [20] cite an OEM benchmark survey in which "suppliers said that Toyota and Honda were better communicators and were more trustworthy, and more concerned about suppliers' profitability, than other manufacturers were."

Adapting this practice to Service Industry: It is immediately obvious that if the supply is a good, the same four actions can be applied. If the supply is software, the buyer will depend on surveys and ratings of suppliers of such software, previous experience with this supplier, and/or exploratory visits with the vendor or trial utilizations of their software (limited implementation). References from other firms or agencies within the service industry are also important. If the supply is a service, sometimes there is only one supplier (e.g., water or electrical utility); when two or more suppliers of the service exist, visits to the supplier and unbiased assessment of their respective capabilities can be accomplished by a purchasing agent or a sourcing team. Service suppliers are motivated by potential long-term contracts with buyers who have long-term prospects for success, leading to co-prosperity.

3.2. Turn supplier rivalry into opportunity

- Source each component from two or three vendors.
- Create compatible production philosophies and systems.
- Set up joint ventures with existing suppliers to transfer knowledge and maintain control.

It appears Liker and Choi are prescribing that the buyer creates an environment where the potential suppliers "compete in a context of cooperation," as recommended by Deming [21]. Liker and Choi [20] in their first prescribed action contradict one of Deming's Fourteen Points [21], Point #4, wherein Deming says "move toward a single supplier for any one item, on a long-term relationship of loyalty and trust." Liker and Choi cites the Big Three U.S. OEMs, claiming they "set vendors against each other, and then do business with the last supplier standing…Neither Toyota nor Honda depends on a single source for anything; both develop two or three suppliers for every component or raw material they buy." This appears to be part of their practice of supply chain risk management, protecting against disruptions due to weather, labor strikes, etc. Action to "create compatible production philosophies and systems" suggests that suppliers to lean OEMs should be lean themselves, and that the philosophies and systems that govern production, inventory, and flow up and down the supply chain must be compatible. Joint ventures with existing suppliers might take the form of establishing R&D companies to address joint issues, funding or sharing of production facilities, and consolidation centers that keep complexity away from the OEM's production line; also, encouraging two suppliers—for example one from overseas and the other U.S. based—to form a joint venture to address a specific OEM need for the next model year.

Adapting this practice to Service Industry: Having a single supplier for each supply is actually typical of service industries. For instance, a government agency or a university will typically have a sole source for office supplies, for maintenance of copy machines, and for printing, cafeteria, and security services. However, such contract will periodically be rebid, and generally, there will be at least two qualified bidders for every supply (good, service, and software) the buyer is seeking. The quality of supply will often be identical, so such contracts may go to the lowest bidder. The production philosophies in the service may differ somewhat from the supplier (e.g., a university delivers courses in batches and schedules activities on a semester-by-semester basis; a textbook supplier may operate a pull system, only producing textbooks as orders are received; a supplier of copier paper may "produce to stock," using a push system to have inventory at the ready in the home or regional warehouse). Where such diverse systems must be compatible is in information exchange for inventory management: on the supplier end governed by meeting combined demands from many universities and on the buyer end governed by having the right books, at the right time, in the right quantity for the limited number of students enrolled in a particular course. Concerning student housing and cafeteria service in addition to the bookstore, one can envision how a university might encourage a joint venture between a private developer of student housing, a food service company, and a book seller to serve students where dorm space is unavailable or where a particular class of student (e.g., married) will be served.

3.3. Supervise your suppliers

- Send monthly report cards to core suppliers.
- Provide immediate and constant feedback.
- Get senior managers involved in solving problems.

Liker and Choi emphasize that instead of letting trusted suppliers "do their own thing," Toyota and Honda "do not take a hands-off approach; they believe suppliers' roles are far too vital for that." They use elaborate systems to measure the way their suppliers work, to set targets for them, and to monitor their performance at all times; this is the essence of supplier control in **Figure 2**. Controls are the flip side of the trust Toyota and Honda have in their suppliers. Honda sends reports to its suppliers' top management every month. A typical report has six sections: quality, delivery, quantity delivered, performance history, incident report, and comments. Honda expects its core suppliers to meet all their targets on metrics like quality and delivery. If a vendor misses a target, the company reacts immediately. Both Toyota and Honda teach suppliers to take every problem seriously and to use problem-solving methodologies that uncover root causes. If suppliers are not able to identify the causes, the manufacturers immediately send teams to help them." It is well known that when the OEM's senior managers get involved with a supplier issue and contact the senior managers at the supplier's plant or corporation, resources get directed to solve the problem to both managers' satisfaction.

Adapting this practice to service industry: Core suppliers are those whose supply impact customer satisfaction with service performance (timeliness, safety, and other quality indicators) and cost. The maxim "what gets measured, gets managed" applies here. First comes a commitment to measure supplier performance and then comes a commitment to confidentially report results of these measurements to the supplier, with an indication where performance is good-to-excellent and where improvement is needed. This approach could be new to both sides, because "service firms tend to rely on competitive pressure of market forces to drive supplier improvement" (Krause and Scannel [22]). Information exchanges need to result in action at the suppliers, and if feedback is ignored, then definitely senior managers should become involved.

3.4. Develop suppliers' technical capabilities

- Build suppliers' problem-solving skills.
- Develop common lexicon.
- Hone core suppliers' innovation capabilities.

When a supplier evaluation points toward the need for "supplier assistance" as shown in **Figure 2**, such assistance may take the classic form of "supplier development" orchestrated by two departments at the OEM (purchasing and supplier quality)—OEMs maintain staff engineers to fulfill these needs at certain suppliers who appear, for whatever reason, do not have the ability to develop themselves: "Toyota and Honda have invested heavily in improving the ability of their first-tier vendors to develop products" [20]. Or, assistance may take the form of a "cross-company improvement team" focused on a specific item of supply that appears to have a chronic problem (quality, delivery, quantity, labeling, etc.) that cannot be solved by one staff member, or even a kaizen team, at the supplier. What is often the case is that the *symptoms* of the problem show up in the OEM inspection or assembly steps, but the *causes* are back at the supplier or perhaps in the suppliers supply chain. For more on best practices in automotive supplier development, see Batson [23]. Supplier development and supplier relationship management are intimately related. As the relationship progresses

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toward partnership, research has shown that the buying firm is more willing to engage in supplier development and in those forms of direct involvement that require commitment of time and resources.

Adapting this practice to service industry: On the surface, these three actions seems natural between an automotive OEM and each of their module or part suppliers; when the supplier is in a completely different industry than the buyer, which may be the case with service industries, such cooperation is possible so long as problem-solving skills are generic (Kaizen method and tools, reliability and maintainability improvement, safety analysis techniques) and innovation capabilities offered by the OEM actually apply to the supply.

3.5. Share information intensively but selectively

- Set specific times, places, and agendas for meetings.
- Use rigid formats for sharing information.
- Insist on accurate data collection.
- Share information in a structured fashion.

Liker and Choi [20] convincingly contrast the Chrysler information sharing philosophy with that of Toyota and Honda: Chrysler's philosophy seemed to be, "If we inundate vendors with information and keep talking to them intensely, they will feel like partners"… "Toyota and Honda, however, believe in communicating and sharing information with suppliers selectively and in a structured fashion" (as suggested in the prescribed actions above). Furthermore, "meetings have clear agendas and specific times and places…there are rigid formats for information sharing with each supplier." The Japanese OEMs believe that inundating people with data diminishes focus, while targeted information based on accurate data (facts) leads to results.

Adapting this practice to service industry: Should be no more easy or difficult than for manufacturing industry suppliers.

3.6. Conduct joint improvement efforts

- Exchange best practices with suppliers.
- Initiate kaizen projects at suppliers' facilities.
- Set up supplier study groups.

Liker and Choi [20] claim that "Because Toyota and Honda are models of lean management, they bring about all-around improvement in their suppliers…Honda, for example, has stationed a number of engineers in the United States, and they lead kaizen (continuous improvement) events at suppliers' facilities…Honda's engineers believe that the company's goals extend beyond technical consulting; the aim is to open communication channels and create relationships. Honda's Best Practices program has increased supplier's productivity by about

50%, improved quality by 30%, and reduced cost by 7%." Supplier's keep the cost savings and are better suppliers to other product lines for Honda and for other customers in general. Toyota is reported to set up "study group teams," where supplier and OEM personnel learn together how to improve operations. Mercedes-Benz has reported its use of cross-company improvement teams to improve M-class SUV supplier performance in Batson [24].

Adapting this practice to service industry: Should be no more easy or difficult than for manufacturing industry supplier, although one can argue that a service industry buyer may not be cognizant of best practices in the industry of his suppliers. Two approaches might be to require the supplier to identify and report best practices in his industry and to collaborate in a study group to jointly uncover these best practices.

As noted in the introduction, two reliability imperatives in service delivery are "Ready on Demand" and "Uninterrupted Service" once service begins. Neither of these was included in the supplier-partnering hierarchy, so below we add a seventh step to the Liker and Choi model. Finally, continuing this focus on timeliness of service from the customer perspective, we add an eighth step to manage the service supply chain in a manner that values your customers' time (minimizes delay is service waste #1 above). Both of these practices are added to the six-step supplier-partnering hierarchy and are described in the context of service industry, so no adaptation explanation is needed.

3.7. Assure service dependability via equipment and human reliability

Equipment reliability is highly valued in extractive and transformative industries (such as automotive OEMs) because of the direct impact of equipment on manufacturing productivity. Therefore, which services depend on equipment reliability? Almost any service uses the computer in some way. Service organizations often depend on heating, ventilation, and air conditioning (HVAC) to keep the service environment at a comfortable temperature. But these sorts of equipment dependency are not the kind of linkage between reliability and quality we seek to expose here. Computers that fail are often "backed-up" and interchangeable. A computer, or HVAC unit, that fails is often returned to service quickly, and the minor inconveniences to service customers are forgotten. A simple model proposed by Thomas [25] revealed more about "types" of service and their respective dependence on equipment for productivity and quality. Thomas [25] stated that to effectively manage a specific service business, it is necessary to answer two questions: (1) How is the service rendered? and (2) What type of equipment or people tenders the service? To answer Question 1, he posited two types of service: equipment-based service and people-based service. In equipment-based service, three implementation mechanisms were identified: automated; semi-automated (carried out by a relatively unskilled operator); or carried out by a skilled operator. Examples of such implementations for automated are telephone or computer network service; semi-automated might be the subway train or amusement park wheel one rides; and skilled might be the diamond cutter or lathe operator. In people-based service, again three implementation mechanisms were identified: unskilled labor, skilled labor, and professionals. Examples of such implementations for unskilled labor might be house-keepers, ditch-diggers, or stock boys; for skilled labor, examples might be automotive assembly or repair personnel, air-conditioner

installers or maintainers; for professionals, consider teachers, lawyers, and medical personnel. These examples answer Question 2, "What type of equipment or people tenders the service?" Obviously under this scheme, the automated equipment-based service would have the strongest dependence on equipment reliability. It also appears that people-based service would have the strongest dependence on human reliability, such as skilled labors using best practices of their trade, and professionals using their career training and norms of their profession in a consistent, timely manner.

McDermott et al. [26] argued that when considering the role of technology in services, a two-dimensional classification scheme worked best. They posited two types of service: substantial product component and pure (or strong) service. On another dimension, they classified services into either knowledge-based service or knowledge-embedded service.

For example, a pure service that is knowledge-embedded could be package delivery company like UPS or FedEx. Yes, physical packages are being delivered, but the timing and programming of the delivery path from sender to receiver are knowledge based, depending on data bases, bar codes, and other "embedded" information technology. The delivery of college course content, in-person, is a pure service that is knowledge based; delivery of that same content via Internet would be a knowledge-embedded pure service. Knowledge-based services are those where most of the customer value is provided by the person providing the service hence depend more on human reliability. Knowledge-embedded services are those which embed the customer value in a system that provides the service, and so human-machine system reliability is the key. This framework focuses on where the "valued added" comes from, rather than what the process "looks like" [26]. Their second dimension depends on classifying services by the extent to which physical product is incorporated within the output. These authors state that "a service which has a significant product component may, in many ways, behave like a production environment… the nature of the environments in each of these quadrants differ significantly with respect to technology management in service."

3.8. Manage the service supply chain to minimize customer delay

From the customer perspective, minimizing delay in the service experience depends on the service provider managing physical and virtual queues in the supply chain in a manner that values customer time. The quality and concern with which this queue management is carried out are observed by the customer, who should be kept informed of service time remaining, and it significantly impacts their perception of the services rendered—essentially the quality, cost, and time expense of the service are weighed to determine the value rating the customer assigns to the service experience. Time delays are just another form of cost.

4. Conclusions

The objective of this chapter was to identify supplier management practices of the US automotive industry and demonstrate how these practices can each be adapted to manage the diverse suppliers found in a service industry. We began by defining services and identifying

five inherent characteristics of services that distinguish it from manufacturing and construction: Intangibility; Inseparability; Variability; Perishability; and Lack of Ownership. Next, we defined service quality and its determinants, and how automotive OEMs employ a standardized Quality Management System. To establish the context and diversity of service industry, the Browning-Singlemann [9] six-sector model was reviewed.

In the next section, an extensive background on supplier management was provided, again focused on the world-class practices of automotive OEMs and how they utilize the three functions of supplier control, supplier improvement, and supplier planning. Supply chain management was then defined, and the similarities and differences between a manufacturing supply chain and a service supply chain were identified. Both supply chains require input of labor to complete the process of locating, obtaining, transforming, and transporting the inputs needed to satisfy the customer. Also, both supply chains depend on capital equipment, which must be reliable, maintainable, and safe to operate. The primary difference between the two is what gets manipulated by the labor: physical material (goods) in the manufacturing supply chain; information and relationships in the service supply chain—though in some services, physical items may be delivered simultaneously in a product-service bundle.

We identified the accepted list of eight wastes for service operations: Delay (effects on the customer); Duplication; Unnecessary Movement (by the customer); Unclear Communication; Incorrect Inventory; Opportunities Lost (to retain a customer or to win a new customer—a failure in relationship building and management); Error in the physical part of the service transaction; and Supplier Quality Error. An example of an insurance company whose customers were experiencing undue delay and unnecessary movement, prior to improvement projects, was reported.

Adapting the supplier-partnering hierarchy of Liker and Choi [20]—a hierarchy of six steps identified from extensive research on supplier management at US automotive OEMs—to services was the basis for the final section which identified eight "Essential Practices for Supplier Management in a Service Industry":

- Understand how your suppliers work.
- Turn supplier rivalry into opportunity.
- Supervise your suppliers.
- Develop suppliers' technical capabilities.
- Share information intensively, but selectively.
- Conduct joint improvement efforts.
- Assure service dependability via equipment and human reliability.
- Manage the service supply chain to minimize customer delay.

The last two imperatives (added by the author) are strongly related to the service customer's expectations for "Ready on Demand," "Uninterrupted Service" once it begins, and in general "Respect for (valuation of) Customer's Time" spent engaging with your service. These in turn

relate back to how the service provider hires and trains those who maintain his equipment, those who interface directly with the customer, and those suppliers who are included in or provide logistics within his supply chain.

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