

A CASE STUDY OF ADVANCED SUPPLY CHAIN STRATEGY:
THE EVOLVING ROLE OF THE TOTAL SERVICE PROVIDER
IN THE E-BUSINESS ERA

By

Dr. Richard L. Dawe
Director, E-Operations Center
The Edward S. Ageno School of Business, Golden Gate University,
and Executive Coordinator, Fritz Institute of Global Logistics
536 Mission Street, Suite #421
San Francisco, CA 94105
(415) 442-7883 / rdawe@ggu.edu

ABSTRACT

Experts predict the approaching e-business era will require massive changes in global supply chain operations, the activities in any organization that make and deliver goods and services to customers. Greatly increased customer expectations, coupled with enormous opportunities for performance improvement, will compel this redesign. For some industries such as music, software, and printing; the result will be an entirely new distribution method for their product as their supply chains replace physical delivery with electronic delivery. In most other industries, the redesign will employ reengineered processes, optimizing systems, and channel-linked organizations to produce improvements in order cycle time, total delivered cost, order fill rates and on-time performance that are multiple times better than today. Crafting today's supply chains into the advanced e-chains of the future will not be easy. It will require a rapid evolution of supply chain competence from functional focus through enterprise integration to channel collaboration to virtual connectivity.

One potential strategy for the rapid evolution in competence required for advanced supply chains is the use of total service providers (TSP), now arising from new e-business technology. In theory, the TSP would provide the competence of logistics service providers (LSP), application service providers (ASP), consulting, contract manufacturing, and procurement service providers through e-business utilities called portals. The TSPs would manage all of the operations centers, allowing users to simply choose and pay for what they need through a figurative "flip of a switch," like power and water utilities.

More than just a theory, TSPs are already beginning to form in the dawning e-business services industry. Early examples are the alliance of software providers and ASPs such as IBM, i2, Industri-Matematik, Arriba, and EXE to form a complete supply chain systems suite with e-business connectivity. Another example is the alliance of LSPs and ASPs such as Federal Express with SAP and Ryder Integrated Logistics with both i2 and IBM. It is becoming increasingly common for service providers to combine their offerings or merge their organizations because it is also becoming common for customers to demand all of their services from one provider, popularly known as 4th party logistics (4PL). The TSP model is simply an extension of this trend to offer a complete package of supply chain systems and worldwide operations capability, connected through e-business technology.

This case study examines the strategy of two significant TSPs that are taking completely different approaches to their development: 1) technology approach, represented by Electron Economy, a highly regarded start-up and 2) operations approach, represented by Ryder Integrated Logistics, the largest company in the LSP industry today. This case will profile their product development efforts and the value proposition they are attempting to create for their customers. The case should be useful for the strategic development of both users and providers. Users can study the value proposition of the service offerings against their future requirements and providers can study their potential product development to plan their position in the advanced e-business marketplace.

**A CASE STUDY OF ADVANCED SUPPLY CHAIN STRATGEGY:
THE EVOLVING ROLE OF THE TOTAL SERVICE PROVIDER
IN THE E-BUSINESS ERA**

COMPANY OVERVIEW

Overview of Electron Economy (EE)

EE, founded on April 1, 1999, by a web development executive and an international sales VP with a third party logistics company, proved it wasn't an April fool's joke when they received an initial \$16 million in venture capital funding to become a pioneering provider of e-logistics services. In March 2000, EE received a second round infusion of \$70 million from venture capitalists SOFBANK, Chase, Flatiron, and Crosspoint. By then, employment had grown to over 200, topping 250 by the end of that year. Included in this count were key executives from Andersen Consulting, Federal Express, Menlo Logistics, Ryder Systems, USCO Logistics, Sun Microsystems, Netscape, and Oracle. Analysts remarked how quickly this pre-IPO service provider had gone from idea to a powerful position in the emerging e-logistics services business.

EE defines its initial service offering as an e-fulfillment solution that provides a range of back-end logistics processes required to run any business more effectively and efficiently. EE's software platform solution integrates a web-enabled point of purchase, whether business-to-consumer (B2C) or business-to-business (B2B), with the entire back-end process including customer service, warehousing and fulfillment, delivery, and business reporting. As a privately held, pre-IPO company, there are no published financial reports of their progress to date.

Overview of Ryder Integrated Logistics (RIL)

RIL is one of two divisions of Ryder Systems, Inc.; the other being the well-known truck rental service, Ryder Transportation Services. The company began in 1933, when Jim Ryder moved quickly from truck driver to truck-leasing entrepreneur in his hometown of Miami. Through excellent management, Ryder Systems grew to be the leader in both truck leasing and logistics services with over \$5 billion in revenue, 14,000 customers, 30,000 employees, and operations in 66 countries. Ryder Systems has been honored as one of America's most admired companies and one of the 50 best companies for minorities by Fortune Magazine. The company's story is a classic American tale of regional success, national expansion, and constant renewal.

The RIL division, formed in the 1980s, provides cost savings and performance-enhancing logistics and supply chain services on a global basis. Their solutions integrate transportation, distribution, and information management; offering everything from operations to complete network design and consulting capabilities. With revenue growth of 20% per year, RIL is the fastest growing division. Its revenue of \$1.5 billion per year produces earnings of \$80 million. Key customers include HP, Daimler Chrysler, Ford, and SBC Communications. Their goals for 2000 are to capitalize on the growing trend for outsourced supply chain services, expansion into profitable opportunities in international logistics, and growing business in non-cyclical industries.

BUSINESS SITUATION

Product Development at Electron Economy (EE)

Vin Gulisano, co-founder, President and COO of newly founded EE, turned away from the white board in his well organized office in California's Silicon Valley, to address a question from his one-person audience, John Linney, the new Vice President of Product Management. Vin had just completed diagramming EE's product plan for maybe a thousandth time and, just like the previous times, it included new ideas for updated functionality. Ideas meant to keep EE among a very select group positioned to make a major break through in the burgeoning market for supply chain event management.

In the newly created Product Management Department, John will be responsible for transferring Vin's vision into marketable products that will reward the investor's bet on them. It's a big challenge, beginning with a description of what the company does. He is often asked, "Are you an LSP, an ASP, a freight broker, a software provider, or a hardware provider?" He knows this question well because it's the same one he asked when he was being recruited for this position. The answer speaks to a lofty goal.

EE is a software provider of real-time supply chain technology solutions that intelligently manage the flow of funds, goods and information across multiple partners in the supply chain. Their vision is to enable a frictionless economy by pioneering technology and solutions that increase intelligence and efficiency. EE is one of a select group of companies pioneering an approach to the exchange of logistics information through the use of advanced Internet-native technology in the same way that Federal Express pioneered small package delivery using airplanes. By start-up measures, they are succeeding and their progress has placed them with the front runners in this new industry. EE's success includes: obtaining a second round of venture capital funding, surviving for two years in a relatively hostile market, proving the initial feasibility of their advanced technology, and attracting real, paying customers. John considered the challenges of future product development as he settled into his office, barely conscious of the whir of construction outside the door that was quickly preparing space for his new department.

John was struck by a comment from the keynote speaker at the Council of Logistics Management's annual conference: "When a paradigm shift occurs in technology, everyone's experience is reset to zero." This shift seems to be exactly what created the opportunity for a start-up like EE to be a viable entry in the market for outsourced supply chain services and systems with established players like Federal Express, UPS, IBM, i2, Manugistics and many others. "EE is a breakthrough enterprise that was built from the ground up to leverage the Internet to meet the logistics, operations, and transaction management challenges facing companies today," claimed Vin. It has accomplished this feat by being one of the first to harness the power of the Internet to offer coordinated planning and execution across the entire global operations network; the advanced competency required of operations to support their enterprise's success in the future.

EE's products allow any businesses to tackle the challenges in their back-end operations that have often curtailed the success of their front-end customer relationship management

(CRM) systems. For example, how will a company connect thousands of suppliers, numerous distribution centers, hundreds of worldwide transportation companies, and thousands of customers with different languages and currencies so they can improve:

- customer's experience
- cost of supply chain transactions
- end-to-end visibility
- real time optimization
- return on technology investment
- capacity for growth and leverage of existing assets
- performance measurement
- anticipation and reaction to correct inevitable operations breakdowns before they negatively affect the customer's operations

To provide these improvements, EE introduced InternetTONE (transaction operations network for e-business) in January 2000, its core software platform. Partners include leading technology, logistics, and consulting firms such as Art Technology Group, Aztec Software, Corporate Express, CyberSource, Exodus Communications, SubmitOrder.com, USF eLogistics and USCO Logistics (**Figure #1**). The solution is an open software platform based on Extensible Markup Language (XML) and Java, providing a centralized, point-to-point messaging system that connects front end applications, such as MS Site Server, ATG, and BroadVision, with back-end manufacturers, distributors, and LSP. Although EE is a non-asset based LSP, it has links to 205 warehouses with a combined capacity of more than 36 million sq. ft., nearly 19,000 customer service representatives, and the global delivery capabilities of five transportation companies including Federal Express, UPS, and the US Postal Service.

InternetTONE's phase I offering was the E-Fulfillment solution, designed to provide the entire suite of back-end processes integrated to the online storefront for the supply chains of emerging B2C "e-tailers," established brick-and-mortar retailers, and manufacturers going direct to customers. Based on the customers' needs, the service may be completely outsourced or it can be a hybrid of outsourcing and existing infrastructure. EE can deploy its E-Fulfillment solution in 90 days utilizing a plan-build-run methodology to assess the clients requirements, identify the appropriate service partners, customize the e-business rules and deploy the solution. Once the system is in place, EE's client operations team manages the client's day-to-day operations.

Phase II offerings will encompass the entire B2B supply chain. The Internet is promising to be the perfect medium for transferring information, assisting supply chain operations by speeding information flow and optimizing execution among all channel partners around the world in manufacturing, logistics, customer support, and product returns. Future capabilities will permit advanced best practices such as build-to-order, vendor managed inventory, and collaborative channel-wide planning for replenishment.

Phase II technology will replace the existing non-integrated systems, slow and expensive EDI communications and non-standard data bases with an XML architecture that can seamlessly transfer information among all supply channel participants via the Web. This

information includes messages and data shared between channel partners, but the real opportunity lies in the ability to transmit intelligence, provided by management systems, throughout the network. The intelligence comes from customized business rules, as well as optimization from advanced planning and scheduling (APS), transportation management systems (TMS), warehouse management systems (WMS), collaborative planning, forecasting, and replenishment (CPFR) residing in the control center. The combination of global, seamless information connectivity and real time optimization are the two key ingredients for future advanced B2B supply chain operations competency.

Product Development at Ryder Integrated Logistics (RIL)

As John pondered the value added potential of the InternetTONE product for future supply chain evolution; similar pondering was taking place some sixty miles to the north and 18 floors up in the downtown San Francisco office of Mark James, Product Manager for the high tech business group of RIL. Mark had just participated in a conference call with Jean Randal, the new corporate VP of Inter-Enterprise Product Development in the Miami headquarters. The call discussed how RIL will turn their established services into sleek new e-services as technology becomes viable and just before customers demand it.

Mark's responsibilities are for product development in the computer and consumer electronics industries, traditionally leading industries in the adoption of innovative practices and technology. Mark had also attended the CLM conference and heard the same comment from the keynote speaker; however, for RIL the news about discounting experience to zero was received with much less enthusiasm than at EE. It meant that much of their previous success in product development to support the high tech industry was threatened with instant obsolescence. The task ahead was to improve what can be salvaged and replace what will be obsolete. One advantage in this development is that RIL has a solid reputation with its Fortune 500 customers. This meant that future business would not have to be won, but defended against loss. Mark realized; however, that RIL's incumbent advantage might not last long in the approaching e-business era of heightened customer requirements, so these product decisions were critical.

RIL developed its leadership in the LSP industry by being an excellent supplier of logistics services to the high tech industry. When it appeared that they were slipping behind in systems technology in the 1990s, they developed an alliance with i2 Systems, IBM, and Andersen Consulting, all world leaders in information technology. RIL's product strategy for the high tech industry is to provide full service operations outsourcing. As an asset-based LSP, they have a core competence in controlling and managing their own operating logistics facilities such as consolidation/distribution centers and processing nodes. Even though their corporate division brother is a transportation company, RIL does not own any transportation equipment, choosing to partner with carriers who possess these assets.

A very popular product created by RIL for the high tech industry is their vendor managed inventory (VMI) service from Asia to North America, shown in **Figure 2**. This product has a discernible physical and information network. In the physical network, once a shipment from an Asian manufacturer reaches the RIL consolidation facility, they take

control over the remainder of the order fulfillment process. The consolidated shipments are dispatched to a distribution center in North America via air or water, depending on time sensitivity. At the DC, materials can be assembled or repackaged. Customers usually order materials in a JIT procedure that delivers small quantities frequently as needed via a carrier alliance partner. If there are shipments from other sources included in the order, RIL offers a merge-in-transit (MIT) service that will consolidate them into a single delivery to customers. The value-added is real time inventory control, proactive alerts of problems, zero latency, transportation management, and postponed assembly.

RIL's management information system is a combination of proprietary systems and partnerships with technology providers. Their strategy has been to leverage the use of alliance partners, rather than trying to stay competent in both operations and systems. Currently, the systems provide most transaction processing of orders, inventory balances, and cost. The second generation of systems capability is in work. It will apply optimization tools to the material flow to determine the best deployment alternatives: air versus water, order sizes, and merge-in-transit possibilities. It will also include a landed cost calculator to determine the total cost of ownership of distribution alternatives.

The plan for future systems technology will add a third layer for e-business connectivity. RIL may again turn to an alliance partner for this capability. This layer will have Internet connectivity to all RIL facilities and their alliance partners. This connectivity will complement the capability of the first two layers by providing global visibility over inventory and optimization of the entire vendor managed inventory transaction. This capability will allow them to offer additional best practices such as make-to-order and collaborative planning, forecasting and replenishment (CPFR).

Mark pondered how RIL's future product development could provide solutions that would enhance the value of RIL services to his customers. He found himself thinking how much easier it would be if, instead of being the largest LSP, they were a start-up with access to venture capital to build their new services. It's as if they were being penalized for successfully investing in previous technologies.

Market Information

The present market for outsourced logistics services demonstrates two strong trends: 1) the market for logistics services is growing at approximately 20% per year with 73% of global companies using one or more outsourced services and 2) the demand for systems and e-business services from LSP is the fastest growing feature with 90% of global companies indicating they expect future LSP to provide the key components for collaborated and optimized supply chains.ⁱ The downside to these trends are: 1) growth of logistics outsourcing has stalled at 73% over the last three years, with expansion coming from existing users who are buying more services and 2) only 27% of the companies in the LSP industry are felt to be capable of delivering advanced e-business solutions.ⁱⁱ Given this gap between supply and demand, LSPs have much to do.

The size of the 2000 logistics market was estimated at about \$800 billion in the US and \$3.5 trillion worldwide by the IMF. A macroeconomic breakout of global logistics cost

is shown in **Table 1** and the US in **Table 2**. Even though the logistics cost of an average value product (potato chips) is much lower per unit of weight and volume than for a high value product (microchips), the cost as a percentage of sales is higher for the low value product. For example, the logistics cost of a case of computer chips is ten times higher than the equivalent weight of potato chips; but while the logistics cost of potato chips is 8-12% of sales, the cost of computer chips is less than 1%.

While the use of LSP services has been growing steadily, past and future growth have come from very specific services as shown in **Table 3**. The industries using the most LSP services are consumer goods and the high tech industries, per **Table 4**. The current growth has been fueled by services for transportation, warehousing, and freight payment. The growth of these services is expected to continue, but the largest growth potential is in information technology, more than doubling the current rate of 9% with an expected increase of 12.5%. Even this dramatic increase in outsourcing still leaves 75% of users with no plan to outsource their IT. This finding was corroborated by a Northeastern University study, shown in **Table 5**, which found that 85% of LSP users do not expect to rely highly on LSP for the redesign of their IT systems. **Table 6** shows that LSP users outsource less than half of their IT systems requirements, except for freight payment. These findings indicate that users are unconvinced of the value-added by outsourcing their existing IT systems to LSPs, so they may resist outsourcing their e-business also.

There are hundreds of LSPs in the US and many more in Europe, where the major issue is the entrance of the German post office into the industry through the acquisition of several companies. An LSP industry is just beginning to form in Asia and countries like China and Korea may soon produce some very capable companies. In terms of revenue earned in the LSP industry, Ryder Integrated Logistics is clearly the largest by far as shown in **Table 7**. Future consolidation of the LSP industry is controversial because the opportunity for service improvement also carries a threat of decreased competition.

The emergence of B2C e-commerce caused a gold rush to be the market leader in LSP services. Many new online retailers had unrealistic expectations of order fulfillment that were then attempted by many new consumer delivery services. Despite the rush of newcomers, the largest LSP in this market is UPS with a market share of almost 80%.ⁱⁱⁱ While much of the early e-operations attention went to B2C commerce, the real growth and spending is now coming from B2B commerce. Here the need for supply chain connectivity, reduced total cost, and global visibility over transactions is expected to fuel a second gold rush for LSP services.^{iv}

Internet-based solutions currently abound and they will continue to proliferate; however, most of these are merely for transaction assistance to track shipments, automate payments and schedule logistics activities. The greatest value-added capabilities of e-business technology are still in their infancy. These include the optimization of demand and supply throughout the entire channel from customers to raw materials through the sharing of information and advanced planning systems.

PROBLEM DEFINITION

Every organization will eventually require e-business connectivity and optimization to coordinate planning and execution of their supply chains, whether they are a pure B2C e-business, a brick and mortar, or a hybrid. There is no clear best practice for the establishment of this e-chain capability. The issues in creating this capability are: 1) which e-business technology will be viable and which is needed first, 2) should the technology be purchased in a suite or in modules, 3) what sources are best for e-business technology and operations and 4) should the source be a single TSP or a best of breed? The analysis is a traditional outsourcing analysis with the addition of e-business technology. This issue has tremendous implications on both the users and providers. Jim Kelly, CEO of UPS, calls the approaching era of e-business, the last competitive frontier.

The User's Perspective

User choices include: 1) whether or not to outsource some or all of their e-chain operations to a service provider, 2) what to outsource, if they do, and 3) whether to outsource both operations and systems to a single TSP or to select best of breed providers for both and attempt to integrate them. The alternatives produce a dizzying array of possible combinations. A methodology for selection and operations strategy needs to be created to analyze quantitative information and qualitative factors and this analysis needs to begin soon. At stake is the competence in order fulfillment that might be the difference between being a future market leader or a market follower.

The Provider's Perspective

Provider choices include: 1) what services to offer, 2) whether to create services themselves or find complimentary alliance partners, 3) how to create an integrated, seamless, global solution for customer's needs, and 4) how to demonstrate the value added by these solutions in each industry. The possibilities for products and market are overwhelming so a valid methodology for evaluation of features and market value needs to be created that includes quantitative market data and customer factors. The analysis needs to begin soon. At stake is the competence in advanced order fulfillment services that will create a viable provider with huge potential or an industry laggard.

ANALYSIS & ALTERNATIVES

As both John at Electron Economy and Mark at Ryder Integrated Logistics understood, the injection of e-business technology into an already complex arena of supply chain management will create a fire storm of hope, confusion and panic. Many companies will be like deer caught in the headlights, unsure which way to go. Providers will also share that feeling as users turn to them to be lifesavers. Those currently using or considering outsourcing their e-operations are faced with many alternatives as they look for assistance to redesign their supply chains from emerging TSPs. Meanwhile, TSPs are asking themselves these questions: 1) do customers really know what they need? 2) do they know the value this service is worth and what they should be willing to pay for a TSP to

be successful? The stakes are high and no one can afford to make a mistake by selecting the wrong technology or the wrong service provider. The challenge for both users and providers is how to thrive in an e-business era by answering these questions:

Key User Questions:

1. What level of operations competence will be required in the next five years?
2. What is the potential economic value added (EVA) of outsourcing?
3. What is the best short-term solution for potential outsourced services?
4. What is the best long-term solution?
5. How do we analyze this decision and how long do we have to decide?

Key Provider Questions:

1. What supply chain services will be required by users next year? In five years?
2. What is the economic value added (EVA) of these services?
3. Which services can be provided profitably?
4. How will these services be created and deployed?
5. How will users be sold on these services and when will they buy?

When time permitted, both John and Mark attended the Northern California Council of Logistics Management roundtable meetings. At one meeting, they learned of a local university with an E-Operations Competency Center for the research of best practices. They each approached the Center with requests for information and research that might help them answer their questions. The Center responded with two models for e-operations design shown in **Figures 3-4**. The model in **Figure 3** shows the relationship between the front-end customer facing activities and the back-end order fulfillment operations, coordinated by the business strategy. Operations competence, it was explained, existed on four levels: I = functional excellence, II = internally optimized supply chains, III = externally collaborated supply channels and IV = virtually connected portals. Competency levels I and II are below the "e-line" as they focus on internal processes and transaction execution. Competency levels III and IV are above the "e-line" as they will utilize advanced e-business technology for seamless, virtual connectivity.

Unfortunately, most of the technology required for levels III and IV is not yet available; however, it is coming soon from many Northern California companies including Oracle, Ariba, Commerce One, Peoplesoft, Broadband, SAP (North American region), and eBreviate (EDS). The model in **Figure 4** shows a methodology for the design of operations competence, based on the concepts of a leading business strategy book.^v The design begins with the business plan to provide solutions to meet perceived customer needs. This leads to a market plan that defines target customer groups. The relative need for order fulfillment capabilities will establish the core competency requirement for operations. If the strategy is to invent unique products that will have virtual monopolies in their categories, order fulfillment may need only a level I competency. If, however, the strategy is to produce a commodity product and distinguish it by being uniquely fast to fulfill customer orders at low prices, operations will need to have a level III competence. Once the appropriate competence is determined to support the business strategy, the elements of process, technology, and organization are designed to deliver the desired

performance. The Center's models help users analyze their business needs and help providers identify services offerings.

Next the center responded to the question of the sources of operations competence. The product of this research was a positioning matrix and a provider-services matrix shown in **Figure 5**. The positioning matrix defined two approaches for providers to become TSPs: operations-based or systems-based. RIL represents the operations-based approach and EE the technology-based approach. The desired end-state of both approaches is to be a provider with global capability in both dimensions. Several examples were plotted to show the relative position of companies in this market space. One conclusion drawn from the Center's research is that there currently are no providers with TSP capabilities.

Table 8 details the eight segments of the TSP industry that were vying for pieces of the order fulfillment market and the 4 service categories they provide. For example, IBM and its partners have established an early lead in breadth of services, missing only the operations execution role. A partnership with a company such as RIL would give them TSP status. Likewise, EE's services include operations connectivity and operations execution through partners such as Federal Express and Usco. A partnership with a systems provider such as i2 or Manugistics would complete their suite of TSP capability. Providers and users can adapt the Center's positioning model to analyze their respective positions.

The last question posed to the Center was the thorny issue of quantifying the value-added proposition for the TSP services. The Center suggested using the economic value added (EVA) model, shown in **Figure 6**, which combines the impact of profit margins and the cost of capital of different scenarios. This model is the tool of choice by financial analysts. Using this model, a company can judge the value created or destroyed by proposed design changes in their supply change services. A sample problem and data is provided in the appendix to demonstrate how this analysis works. Users and candidate TSPs can apply this tool to analyze the implications of various outsourcing scenarios such as the single provider TSP scenario versus a best of breed approach. Other quantitative methods that have application would be ROI, break even and make versus buy analysis.

REFERENCES

-
- ⁱ "Third Party Logistics Study" Caps Gemni/Ernst & Young, University of Tennessee, and Exel; July 2000
- ⁱⁱ "Growth Spurt" a report on the survey of the 3PL industry by Northeastern University, Logistics Magazine, November 2000, p. 77
- ⁱⁱⁱ "Logistics Gets a Little Respect" Business Week Online, November 20, 2000.
- ^{iv} "Demystifying B2B Integration" Forrester research report, November 2000.
- ^v The Profit Zone, Slywotzky & Morrison, Random House 1997

ABOUT THE AUTHOR

Richard Dawe, Ph.D., is Director of the E-Operations Center in the Edward S. Ageno School of Business at Golden Gate University, which joins academics and industry for the joint study of E-business development. Dr. Dawe also serves as the Executive Coordinator of the Fritz Institute of Global Logistics, a non-profit partnership of academics and practitioners for research and education on best practices in global supply chain management.. Dr. Dawe is an advisor to the Center of Logistics Management at the University of Nevada (Reno) and the Global Logistics Center of the California Maritime Academy. He is past president of the CLM San Francisco Roundtable and has presented at four CLM annual conferences. His numerous articles have appeared in such publications as the Journal of Business Logistics, Transportation and Distribution magazine, and the Journal of Purchasing and Supply Chain Management, a European publication. His book, The Impact of Information Technology on Materials Logistics, has been used extensively to understand the application of evolving technology in operations management.